

A-17 Thematic Poster - Acute Exercise

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM
Room: CC-102A

60 Chair: Juan Murias. *University of Calgary, AB, Canada.*
(No relevant relationships reported)

61 Board #1 May 29 9:30 AM - 11:30 AM
Upper- and Lower-body Resistance Exercise With and Without Blood Flow Restriction on Autonomic Modulation
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(No relevant relationships reported)

While data have demonstrated that resistance exercise without blood flow restriction (BFR) decreases vagal tone up to 30 minutes, the effects of upper- versus lower-body resistance exercise with BFR on autonomic modulation are unknown. **PURPOSE:** To evaluate autonomic modulation in response to upper- and lower-body resistance exercise with BFR. **METHODS:** Autonomic modulation was assessed in twenty resistance-trained individuals at rest, 30 (R30), and 60 (R60) minutes after either upper- or lower-body resistance exercise with or without BFR. The upper- and lower-body resistance exercise consisted of the lat pulldown and chest press, and knee extension and knee flexion, respectively. The BFR (40% of arterial occlusion pressure) and without BFR conditions consisted of 4 sets of 30, 15, 15, and 15 repetitions at 30% 1-repetition maximum (1RM), and 4 sets of 8 repetitions at 70% 1RM, respectively. Autonomic modulation was expressed as natural logarithm (Ln), and included total power (LnTP), high frequency power (LnHF), and sympathovagal balance (LnLF/LnHF ratio). An ANOVA was used to evaluate groups (upper- or lower-body) across conditions (BFR or without BFR) across time (Rest, R30, and R60) on autonomic modulation. **RESULTS:** There were no significant 3-way interactions for any variables. There were no changes for LnTP. There were significant main effects of time for LnHF (Upper-body with BFR (UBFR): Rest: $7.3 \pm 1.6 \text{ ms}^2$, R30: $6.3 \pm 1.6 \text{ ms}^2$, R60: $6.7 \pm 1.5 \text{ ms}^2$; Upper-body without BFR (UW): Rest: $7.1 \pm 1.4 \text{ ms}^2$, R30: $6.1 \pm 1.5 \text{ ms}^2$, R60: $6.5 \pm 1.3 \text{ ms}^2$; Lower-body with BFR (LBFR): Rest: $6.9 \pm 1.3 \text{ ms}^2$, R30: $6.2 \pm 1.6 \text{ ms}^2$, R60: $7.1 \pm 1.4 \text{ ms}^2$; Lower-body without BFR (LW): Rest: $7.3 \pm 1.5 \text{ ms}^2$, R30: $6.3 \pm 1.8 \text{ ms}^2$, R60: $7.1 \pm 1.4 \text{ ms}^2$) and the LnLF/LnHF ratio (UBFR: Rest: $3.9 \pm 0.9 \text{ ms}^2$, R30: $5.1 \pm 10.9 \text{ ms}^2$, R60: $4.8 \pm 1.0 \text{ ms}^2$; UW: Rest: $3.7 \pm 1.0 \text{ ms}^2$, R30: $4.9 \pm 0.8 \text{ ms}^2$, R60: $4.8 \pm 0.7 \text{ ms}^2$; LBFR: Rest: $4.0 \pm 1.0 \text{ ms}^2$, R30: $4.8 \pm 1.1 \text{ ms}^2$, R60: $4.5 \pm 1.0 \text{ ms}^2$; LW: Rest: $3.9 \pm 1.0 \text{ ms}^2$, R30: $5.0 \pm 0.9 \text{ ms}^2$, R60: $4.65 \pm 0.84 \text{ ms}^2$) such that LnHF and LnLF/HF ratio were significantly reduced, and augmented, after upper- and lower-body resistance exercise with and without BFR. **CONCLUSIONS:** These data suggest that either upper- or lower-body resistance exercise with or without BFR significantly alters autonomic modulation up to 60 minutes after an acute bout of resistance exercise.

62 Board #2 May 29 9:30 AM - 11:30 AM
Cardiovascular Disease Risk Influences Cerebrovascular Regulation in Older Adults
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(No relevant relationships reported)

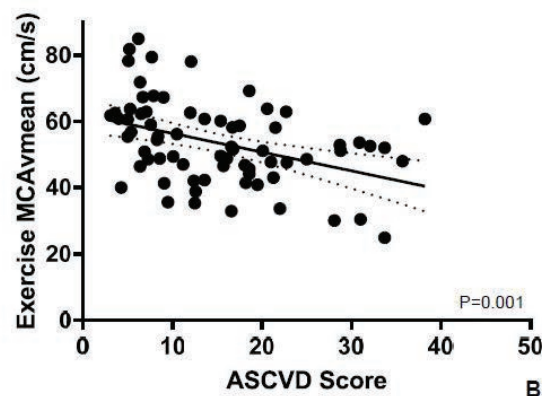
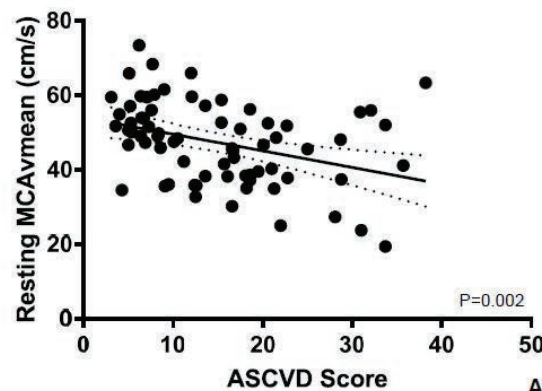
Purpose: The aim of this study was to evaluate the influence of CVD on cerebrovascular regulation at rest and during exercise. A secondary aim was to explore the relationship between cerebrovascular regulation and 1) the presence of white matter lesions and 2) cognitive function.

Methods: We recruited individuals who were cognitively normal older adults. CVD risk was assessed by the Pooled Cohort atherosclerotic cardiovascular disease (ASCVD) risk score. Transcranial Doppler ultrasound measured middle cerebral artery at rest and during a bout of moderate intensity exercise. We quantified white matter lesions from MRI and cognitive function outcomes included executive function, language, processing speed, and attention.

Summary of Results: Seventy-two participants 70.1 ± 4.7 years of age completed the study protocol. ASCVD risk score was significantly associated with both resting and exercise

cerebral blood flow velocity ($p < 0.01$). Cerebrovascular regulation parameters were not associated with white matter lesions ($p > 0.468$). We observed a significant association between cerebrovascular regulation parameters and language processing ($p = 0.010$) but not other cognitive domains.

Conclusion: In cognitively normal older adults, higher ASCVD risk score was associated with blunted cerebrovascular regulation and with lower language processing performance. These results highlight the need for CVD risk management to maintain optimal brain health.



63 Board #3 May 29 9:30 AM - 11:30 AM
Looking Beyond A-vo₂ Difference: Peripheral Adaptations And Vo₂Max In Trained And Untrained Adults

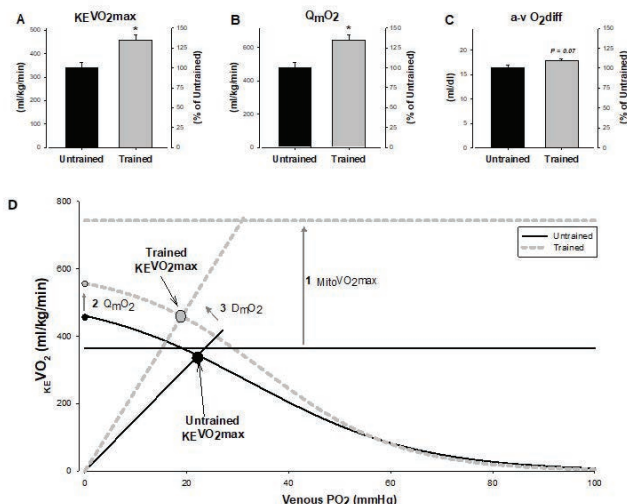
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PURPOSE: Observing little-to-no increase in arterial-venous oxygen difference (a-vo₂diff) following endurance training, some previous investigations have attributed little importance to factors peripheral to the heart, such as maximal mitochondrial oxygen consumption (\dot{V}_{Mito} VO₂max) and convective (\dot{Q}_{M} O₂) and diffusive (\dot{D}_{M} O₂) muscle oxygen delivery in the training-induced increase in VO₂max. As lack of change in a-vo₂diff does not necessarily indicate a lack of change in peripheral function, the purpose of this study was to determine the combined influences of adaptations peripheral to the heart in the endurance-training-associated increase in VO₂max.

METHODS: Arterial-venous blood draws and Doppler ultrasound during maximal single leg knee extension (KE) exercise were used to quantify \dot{Q}_{M} O₂, \dot{D}_{M} O₂, a-vo₂diff and \dot{V}_{KE} VO₂max when free of upstream limitations from the heart in 10 untrained and 10 trained young males. Mitochondrial respiration of muscle biopsied from the vastus lateralis was used to quantify \dot{V}_{Mito} VO₂max when free from upstream oxygen supply limitations.

RESULTS: In agreement with previous investigations, \dot{Q}_{M} O₂ and \dot{V}_{KE} VO₂max were 20-35% greater in the trained ($P < 0.05$), while a-vo₂diff was not markedly different ($P > 0.05$, See Figures A-C). Nevertheless, training was associated with a 50-100%

increases in $\dot{V}_{O_2\max}$ and $\dot{V}_{O_2\max}/\dot{V}_{O_2}$ ($P<0.05$). When plotted as a Wagner diagram (Figure D), it becomes clear that the greater $\dot{V}_{O_2\max}$ in the trained is the result of 3 synergistic adaptations (1. increased $\dot{V}_{O_2\max}$, 2. increased \dot{Q}_{mO_2} and 3. enhanced D_{mO_2}), which, together, raise $\dot{V}_{O_2\max}$ more than each adaptation would alone. **CONCLUSIONS:** Despite minimal changes in $a-vO_2$ diff, the training-associated increase in $\dot{V}_{O_2\max}$ is dependent upon specific peripheral factors within the muscle exhibiting a greater capacity, including mitochondrial respiratory capacity, as well as convective and diffusive muscle oxygen delivery.



64 Board #4 May 29 9:30 AM - 11:30 AM

Autonomic Modulation After High-Intensity Heavy Rope Exercise in Resistance-trained Individuals

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(No relevant relationships reported)

The changes in autonomic modulation after high-intensity heavy rope exercise (HI-HRE) are unknown. **PURPOSE:** To examine the effects of HI-HRE on autonomic modulation in resistance-trained (RT) individuals. **METHODS:** Twenty-two young, RT individuals (mean±SD: age 23±3 yrs; height 1.7±0.1m; weight: 74.3±14.9kg) had their heart rate (HR), mean arterial pressure (MAP), and measures of autonomic modulation collected at rest, and 15 (Rec1), 30 (Rec2) and 60 (Rec3) minutes following HI-HRE. Heart rate variability measurements included the root mean square of successive differences between normal heartbeats (RMSSD) in the time domain, high-frequency power (lnHF) and the ratio of low-frequency to high-frequency power (lnLF/lnHF ratio) in the frequency domain. RMSSD and lnHF are indicative of vagal modulation while the lnLF/lnHF ratio is a measure of sympathovagal balance. The HI-HRE consisted of six, 15-second exercise bouts, using a double wave pattern, separated by 30-seconds of passive recovery; the pace of the exercise was set at 180bpm. A one-way repeated measures analysis of variance was used to analyze the effects of HI-HRE across time (rest, Rec1, Rec2, and Rec3). Significant main effects were analyzed using pairwise comparisons with a Bonferroni correction. **RESULTS:** There was a significant main effect of time ($p\leq 0.001$) for HR (rest: 63±10bpm; Rec1: 84±10bpm; Rec2: 76±9bpm; Rec3: 70±8bpm), such that it was augmented during all recoveries compared to rest. There was a significant main effect of time ($p=0.04$) for MAP (rest: 82.3±4.5mmHg; Rec1: 81.2±4.9mmHg; Rec2: 83.1±114.5mmHg; Rec3: 70±7mmHg), such that it was attenuated during all recoveries compared to rest. There were significant main effects of time ($p\leq 0.001$) for the RMSSD (rest: 4.2±0.69ms; Rec1: 2.8±0.6ms; Rec2: 3.1±0.63ms; Rec3: 3.6±0.5ms) and the lnHF (rest: 7.4±1ms²; Rec1: 4.7±1.2ms²; Rec2: 5.5±1.1ms²; Rec3: 6.3±0.91ms²), such that they were decreased during all recoveries compared to rest. There was a significant ($p\leq 0.001$) main effect of time for the lnLF/lnHF ratio (rest: 0.9±0.1; Rec1: 1.2±0.2; Rec2: 1.1±0.2; Rec3: 1±0.1), such that it was augmented during all recoveries compared to rest. **CONCLUSION:** These data demonstrate that high-intensity heavy rope exercise results in significant decreases in vagal modulation for at least 60 minutes.

65 Board #5 May 29 9:30 AM - 11:30 AM

Effects Of Matched Intermittent Versus Continuous Exercises On The Changes Of Cardiac Biomarkers

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(No relevant relationships reported)

PURPOSE: Endurance runners training with high-intensity intermittent exercise might experience damage to cardiac muscle. We have therefore compared the changes of cardiac biomarkers after workload-matched intermittent and continuous exercise in such runners.

METHODS: Twelve endurance runners (11 males, 1 female; age, 23.5±5.5 y; $\dot{V}_{O_{2\max}}$, 62.4±5.4 ml.kg⁻¹.min⁻¹; velocity of $\dot{V}_{O_{2\max}}$ [$v\dot{V}_{O_{2\max}}$], 17.1±1.4 km.h⁻¹; training volume, 44 ± 25 km.wk⁻¹) completed intermittent and continuous exercise trials in random order. Intermittent exercise consisted of hard running at 90% $v\dot{V}_{O_{2\max}}$ for 2 min followed by easy running at 50% $v\dot{V}_{O_{2\max}}$ for 2 min, repeated for 92 min in total. The continuous run was performed at 70% $v\dot{V}_{O_{2\max}}$ for 92 min. Blood samples were drawn before exercise and at 0, 2, 4, 24 and 48 h after the completion of exercise for assay of various cardiac biomarkers. Changes in concentration of each biomarker were averaged over 0-24 h for comparison of intermittent with continuous exercise after adjustment for baseline concentration and exercise intensity expressed as percent of heart-rate reserve (%HRR).

RESULTS: There were trivial differences between the changes in concentration adjusted to the mean intensity of 78%HRR for all biomarkers investigated, but at 85%HRR high-sensitivity cardiac troponin-I and high-sensitivity cardiac troponin-T were moderately higher following intermittent exercise (factor mean change \times/\div 90% confidence limits: 3.4 \times/\div 1.9 and 2.1 \times/\div 1.8 respectively). Changes in other cardiac biomarkers at 85%HRR were trivial.

CONCLUSIONS: Prolonged intermittent exercise is potentially more damaging to heart muscle than continuous exercise of the same average running speed at higher average heart rates.

66 Board #6 May 29 9:30 AM - 11:30 AM

Exercise Tolerance: New Insights From Single-leg Cycling Exercise

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(No relevant relationships reported)

The biological factors determining the maximal exercise capacity are typically assessed during whole-body exercise (e.g. double-leg cycling), implicitly assuming that limbs contribute homogeneously to exercise tolerance. However, given the presence of limb dominance, it is possible that the dominant leg may achieve greater peak \dot{V}_{O_2} uptake ($\dot{V}_{O_{2peak}}$) and be able to sustain greater power outputs during prolonged dynamic exercise compared to the non-dominant leg.

PURPOSE: To investigate peak power output (PPO), $\dot{V}_{O_{2peak}}$, and maximal lactate steady-state (MLSS) during double-leg as well as during dominant and non-dominant and counter-weighted single-leg cycling exercise performed with the dominant and non-dominant legs. **METHODS:** Twelve men (30 ± 5 yrs) during 12 to 14 lab visits performed: (i) a ramp-incremental test to determine PPO, $\dot{V}_{O_{2peak}}$, and maximal \dot{V}_{O_2} extraction; and (ii) 30-min constant-load tests to determine MLSS. These tests were performed using both legs (DBL), the dominant leg only (SLd), and the non-dominant leg only (SLnd). Gas exchange variables were measured with a metabolic cart; local de-oxygenation ([HHb]) of the vastus lateralis (VL) was measured using a frequency-domain NIRS; capillary blood samples were analysed for lactate concentration ([Lac]_b). **RESULTS:** PPO for DBL, SLd, and SLnd was different in each condition: 329 ± 38, 181 ± 30, 168 ± 27 W, respectively ($p < 0.05$). $\dot{V}_{O_{2peak}}$ for DBL, SLd, and SLnd was different in each condition: 3.43 ± 0.34, 2.92 ± 0.42, 2.74 ± 0.38 L·min⁻¹, respectively ($p < 0.05$). The [HHb] amplitude of the VL was greater in the dominant compared to the non-dominant leg during both DBL (18.6 ± 8.5 vs 15.4 ± 9.5 mMol) and SL (15.4 ± 9.5 vs 11.6 ± 7.7 mMol) ramp-exercise ($p < 0.05$). These amplitudes were highly correlated with the $\dot{V}_{O_{2peak}}$ values observed during DBL dominant and non-dominant ($r = 0.86$ and $r = 0.91$, respectively), SLd ($r = 0.79$), and SLnd ($r = 0.71$) RI tests ($p < 0.05$). The PO at MLSS for DBL, SLd, and SLnd was different in each condition: 183 ± 32, 119 ± 25, and 111 ± 24 W, respectively ($p < 0.05$). The \dot{V}_{O_2} , [Lac]_b, and RPE values during SLnd and SLd were similar ($p > 0.05$) despite this lower PO. **CONCLUSIONS:** These data indicate a heterogeneous exercise capacity of the exercising limbs that should be considered when evaluating exercise tolerance during double-leg exercise.

67 Board #7 May 29 9:30 AM - 11:30 AM

Despite Menstrual Phase Differences in Respiration, Blood Lactate, and Muscle Deoxygenation, Exercise Performance is UnchangedJordyn Smith, Glen R. Belfry. *Western University, London, ON, Canada.*

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(No relevant relationships reported)

PURPOSE: Fluctuations of ovarian hormones over the menstrual cycle result in changes in cardiorespiratory and metabolic responses that may affect exercise performance. The purpose of this study is to evaluate respiration, muscle deoxygenation ($\Delta\text{[HHb]}$) and arterialised blood lactate $[\text{La}^-]$ throughout incremental (RAMP) and constant load exercise performance (EP) during follicular (FOL) and luteal (LUT) phases.

METHODS: Ten eumenorrheic females (22 yrs \pm 1.4; 167 \pm 7 cm; 64 \pm 8 kg) completed RAMP (20 W/min) and EP (@ 101% $\text{VO}_{2\text{max}}$) to limit of tolerance during both FOL and LUT phases. Breath-by-breath measures of gas exchange and vastus lateralis muscle deoxygenation were recorded throughout.

RESULTS: RAMP: FOL and LUT maximal oxygen uptake ($\text{VO}_{2\text{max}}$) (FOL: $2.36 \pm 0.4 \text{ L}\cdot\text{min}^{-1}$; LUT: $2.36 \pm 0.4 \text{ L}\cdot\text{min}^{-1}$), ventilation (V_E) (FOL: $53.2 \pm 25 \text{ L}\cdot\text{min}^{-1}$; LUT: $55.1 \pm 25 \text{ L}\cdot\text{min}^{-1}$), and $\%\Delta\text{HHb}$ (FOL: $60 \pm 3\%$; LUT: $57 \pm 3\%$) were unchanged ($p > 0.05$).

However, $\%\Delta\text{HHb}/\%\Delta\text{VO}_2$ was 65% lower in LUT compared to FOL below lactate threshold (GET) ($p < 0.05$). $\text{P}_{\text{ET}}\text{CO}_2$ values were lower in LUT compared to FOL (FOL: $37 \pm 2 \text{ mmHg}$; LUT: $36 \pm 3 \text{ mmHg}$) ($p < 0.01$), whereas $\text{P}_{\text{ET}}\text{O}_2$ values remained unchanged (FOL: $105 \pm 6 \text{ mmHg}$; LUT: $107 \pm 6 \text{ mmHg}$) ($p > 0.05$). **EP:** V_E (FOL: $83 \pm 19 \text{ L}\cdot\text{min}^{-1}$; LUT: $89 \pm 17 \text{ L}\cdot\text{min}^{-1}$) and $\text{P}_{\text{ET}}\text{O}_2$ (FOL: $115 \pm 4 \text{ mmHg}$; LUT: $118 \pm 4 \text{ mmHg}$) were greater in LUT compared to FOL ($p < 0.05$), without changes in breathing frequency (FOL: $32 \pm 4 \text{ L}\cdot\text{min}^{-1}$; LUT: $35 \pm 5 \text{ L}\cdot\text{min}^{-1}$) ($p > 0.05$). No differences in $\%\text{HHb}$ were observed between LUT and FOL (FOL: $83 \pm 21\%$; LUT: $85 \pm 21\%$); however, $\%\Delta\text{HHb}/\%\Delta\text{VO}_2$ was 18% lower during the kinetic phase of the EP in LUT compared to FOL ($p < 0.05$). Post-EP $[\text{La}^-]$ were lower in LUT compared to FOL (FOL: $12.9 \pm 2.5 \text{ mmol}\cdot\text{L}^{-1}$; LUT: $11.7 \pm 1.7 \text{ mmol}\cdot\text{L}^{-1}$) ($p < 0.05$). No performance differences were

observed between FOL and LUT for RAMP peak power (FOL: $218 \pm 35 \text{ W}$; LUT: $221 \pm 29 \text{ W}$) or EP endurance (FOL: $99 \pm 20 \text{ s}$; LUT: $96 \pm 15 \text{ s}$) ($p > 0.05$).

CONCLUSION: During RAMP exercise, there was a greater reliance on muscle deoxygenation at sub-GET work rates in FOL compared to LUT. During EP, the LUT phase showed higher V_E , lower Post-EP $[\text{La}^-]$, and lower muscle deoxygenation during the kinetic portion of the step exercise, suggesting increased ventilatory buffering compared to FOL. Despite the different physiological responses between menstrual phases, short duration exercise performance is preserved.

68 Board #8 May 29 9:30 AM - 11:30 AM

Effect Of Ultra-endurance Exercise On Alveolar-Capillary Recruitment And Lung DiffusionGlenn Stewart¹, Caitlin Jorgenson¹, Courtney Wheatley¹, Paul Robach², Alice Gavel², Briana Ziegler¹, Jesse Schwartz¹, Bryan Taylor³, Loïc Chabridon², Pierre Bouzat⁴, Bruce Johnson¹. ¹Mayo Clinic, Rochester, MN. ²Ecole Nationale de Sports de Montagne, Chamonix, France. ³University of Leeds, Leeds, United Kingdom. ⁴Grenoble University Hospital, Grenoble, France.

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(No relevant relationships reported)

Purpose—Prolonged vigorous exercise increases cardiac output and pulmonary arterial and capillary pressures to levels that may exceed a tolerable right ventricular and alveolar-capillary load. Accordingly, this study examined the effect of an ultramarathon on resting and exertional measures of alveolar-capillary recruitment & lung diffusion. **Methods**—Cardiac and lung function were examined at rest & during 3 stages of low-intensity exercise in 44 runners (Age: 41 ± 9 yr BMI: $23 \pm 2 \text{ kg}/\text{m}^2$) before, and 1-4-h and 24-h after the Hong Kong 100 and Ultra Trail Mont Blanc ultramarathons. Cardiac biomarkers (cTnI, BNP) were assessed from whole blood (I-stat), while stroke volume (SV) & cardiac output (Q) were quantified via echocardiography. Lung diffusing capacity for carbon monoxide and nitric oxide (DLco & DLno) and its components, alveolar membrane conductance (Dm) and capillary blood volume (Vc), were determined via a single-breath DLco/DLno method.

Results—Participants finished the ultramarathons in 22 ± 11 h with an average heart rate of 130 ± 14 bpm. Cardiac biomarkers increased after the race (cTnI: 0.03 ± 0.01 vs $0.09 \pm 0.02 \text{ ng/ml}$; BNP: 18 ± 2 vs $129 \pm 14 \text{ pg/ml}$, $p < 0.01$). Stroke volume decreased post-race at rest (86 ± 2 vs $74 \pm 2 \text{ ml}$, $p < 0.01$) & during exercise (Stage3: 99 ± 2 vs $92 \pm 3 \text{ ml}$, $p < 0.01$), while cardiac output was similar pre and post-race (Rest: 4.6 ± 0.1 vs 4.9 ± 0.2 , $p = 0.20$; Stage3: 8.7 ± 0.3 vs 8.8 ± 0.3 , $p = 0.61$). Resting DLco , DLno & Vc decreased post-race, while Dm was unchanged. On the contrary, DLco , DLno and Dm were reduced during low intensity exercise post-race, while Vc normalized to pre-race values. When corrected for Q, DLco was lower at rest (DLco/Q : 7.1 ± 0.2

vs 5.7 ± 0.2 , $p < 0.01$), but normalized to pre-race values during exertion (stage3 DLco/Q : 4.0 ± 0.1 vs 3.8 ± 0.2 , $p = 0.31$). All values returned to baseline after 24-h of recovery. **Conclusions**—The data suggests a transient decrease in lung diffusion at rest following ultra-endurance exercise is related to a reduced capillary blood volume and potential pulmonary de-recruitment; however, pulmonary capillary recruitment during low-intensity exercise remains mostly preserved. On the contrary, alveolar membrane conductance was preserved at rest but reduced during light exercise and may contribute to the exertional decrease in lung diffusion after an ultramarathon.

A-18 Thematic Poster - Exercise and Cancer

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM

Room: CC-101A

69 Chair: Claudio Battaglini, FACSM. University of North Carolina at Chapel Hill, Chapel Hill, NC.

(No relevant relationships reported)

70 Board #1 May 29 9:30 AM - 11:30 AM

Effects Of A 16-week Aerobic And Resistance Exercise Intervention On Leptin/adiponectin Ratio In Overweight And Obese Breast Cancer SurvivorsKaylie Zapanta, Kyuwan Lee, Nathalie Sami, Christina M. Dieli-Conwright, FACSM. *University of Southern California, Los Angeles, CA.*

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(No relevant relationships reported)

INTRODUCTION: Overweight and obese breast cancer survivors (BCS) are at greater risk of developing type II diabetes (T2D) than non-cancer populations due, in part, from adipose tissue-induced modulations to the adipokines, leptin and adiponectin. Leptin upregulates inflammatory cytokines associated with insulin resistance (IR) while adiponectin inhibits inflammation and regulates glucose uptake. The Leptin/Adiponectin Ratio (LAR) has been used as an indicator for the diagnosis of T2D, due to its ability to measure both inflammatory and glucose abnormalities. In overweight and obese BCS, an elevated LAR induces IR, which contributes to the development of T2D. Exercise may be an effective strategy to reduce the LAR to target the risk of T2D in BCS. **OBJECTIVES:** The purpose of this study was to determine whether a 16-week aerobic and resistance exercise intervention reduces the LAR in overweight and obese BCS. **METHODS:** Sedentary, overweight/obese (BMI $\geq 25 \text{ kg}/\text{m}^2$) BCS (Stage I-III) were randomized to the Exercise (EX; $n = 50$) or Control (CON; $n = 50$) groups. The EX group underwent supervised moderate-vigorous intensity aerobic and resistance exercise sessions 3 times per week for 16 weeks. Leptin and adiponectin were measured from fasting blood samples using enzyme-linked immunosorbent assays. Paired t-tests and mixed-model repeated measures ANOVA were used to examine the within and between group differences in mean changes in LAR. **RESULTS:** On average, women were 53.5 ± 10.4 years old, postmenopausal (60%), Hispanic (55%) with a BMI $33.5 \pm 5.5 \text{ kg}/\text{m}^2$. Post-intervention, leptin was significantly reduced ($-8.0 \text{ ng}/\text{mL} \pm 0.3$) in the EX group compared to CON group ($+4.8 \text{ ng}/\text{mL} \pm 0.5$; $p = 0.001$). Adiponectin was significantly increased ($+7.5 \mu\text{g}/\text{dL} \pm 1.0$) in EX group compared to CON group ($-1 \text{ ng}/\text{mL} \pm 0.3$; $p = 0.001$). Post-intervention, LAR was significantly reduced (-1.23 ± 0.21) in the EX group compared to CON (0.66 ± 0.11 ; $p < 0.01$). There was a significant increase in LAR in the CON group ($P < 0.01$). **CONCLUSION:** A 16-week aerobic and resistance exercise intervention is an effective approach to reduce the LAR in overweight and obese BCS. This finding supports the utilization of exercise to reduce the risk of T2D following the completion of cancer treatment in overweight and obese BCS.

- 71 Board #2 May 29 9:30 AM - 11:30 AM
Effect of Exercise During Versus After Chemotherapy for Breast Cancer on Fatigue and Quality of Life
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Chemotherapy for breast cancer may result in fatigue and reduced quality of life (QOL). While exercise can attenuate adverse chemotherapy effects, improvements relative to baseline may be more likely with exercise performed post-treatment. **PURPOSE:** To compare the effect of exercise during versus after taxane chemotherapy for breast cancer on fatigue and QOL. **METHODS:** Women were randomized to supervised aerobic and resistance exercise 3x/wk for 8-12 wk starting pre-chemotherapy (Immediate Exercise=IE) or 2-3 wk post-chemotherapy (Delayed Exercise=DE). Fatigue and overall QOL/functional subscales were evaluated using the Piper Fatigue Scale (0=none, 10=severe) and European Organization for Research and Treatment of Cancer Quality of Life Questionnaire (scored: 0-100), respectively, at: 1) baseline; 2) 2-3 wk post-chemotherapy (post-chemo); and 3) 10-15 wk post-chemotherapy (follow-up). **RESULTS:** Overall, n=27 women enrolled and n=26 (IE n=12, DE n=14) completed the intervention (attended >1 session). Attendance was 79±23% for IE and 81±20% for DE. Fatigue did not differ between groups across time, so change within groups was assessed individually. Fatigue increased in DE from baseline to post-chemo (mean diff: +1.7±0.47, p=0.01) and did not decrease with exercise between post-chemo and follow-up (mean diff: -1.1±0.65, p=0.13). Fatigue did not change over time in IE. Overall QOL differed between groups over time (p<0.01), where it was higher in IE versus DE post-chemo (mean diff: +6.2±3.0, p<0.05). No other group differences were found for QOL/functional subscales. The overall deterioration in QOL in DE during chemotherapy was a result of reductions in physical function (mean diff: -16.4±5.6, p<0.01), role function (mean diff: -20.0±6.3; p<0.05), cognitive function (mean diff: -16.0±5.8, p=0.01) and social function (mean diff: -17.4±7.4, p=0.04). Relative to post-chemo, the DE intervention significantly improved QOL by follow-up (mean diff: +20.2±5.4, p<0.01), such that DE and IE QOL did not differ at follow-up (mean diff: 4.6±3.7, p=0.22). **CONCLUSIONS:** Exercise during taxane chemotherapy may mitigate treatment-related fatigue and reductions in QOL in women with breast cancer. While exercise after chemotherapy increased overall QOL, fatigue experienced during chemotherapy persisted.

- 72 Board #3 May 29 9:30 AM - 11:30 AM
Heavy-load Resistance Exercise In Women At Risk Of Breast Cancer-related Lymphedema During Chemotherapy: Randomized Trial
 Kira B.N. Bloomquist¹, Lis Adamsen¹, Sandra C. Hayes², Christian Lillelund¹, Christina Andersen¹, Karl Bang Christensen³, Peter Oturai¹, Bent Ejlersen¹, Malgorzata K. Tuxen⁴, Tom Møller¹. ¹Copenhagen University Hospital, Rigshospitalet, Copenhagen, Denmark. ²Queensland University of Technology, Brisbane, Australia. ³The University of Copenhagen, Copenhagen, Denmark. ⁴Copenhagen University Hospital, Herlev-Gentofte Hospital, Herlev, Denmark.
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It is unclear whether women at risk of breast cancer-related lymphoedema can safely participate in heavy-load resistance exercise.

PURPOSE

To evaluate the effect of heavy-load resistance exercise on lymphedema outcomes in pre-diagnosis physically inactive women at risk of breast cancer-related lymphedema during adjuvant chemotherapy.

METHODS

Physically inactive women receiving anthracycline and taxane-based chemotherapy for breast cancer (n=153) were randomized to a HIGH (supervised multimodal exercise including heavy-load resistance exercise: 85-90% 1 repetition maximum [RM], three sets of 5-8 repetitions) versus LOW (walking supported by pedometer and one-on-one consultations) 12-week exercise intervention.

Outcomes (assessed at baseline, 12- and 39-weeks follow-up) included lymphedema status [extracellular fluid [L-Dex, bioimpedance spectroscopy] and inter-arm volume % difference [dual energy X-ray absorptiometry], lymphedema symptoms [numeric rating scale 0-10]), upper-extremity strength (1 RM), and quality of life domains (EORTC breast cancer specific questionnaire). Linear mixed models were used

to evaluate equivalence between groups for lymphedema outcomes (equivalence margins for L-Dex, % difference and symptoms scale: ±5, ±3% and ±1, respectively). Superiority analysis was conducted for muscle strength and quality of life domains.

RESULTS

Post-intervention equivalence between groups was found for extracellular fluid (0.4; 90% CI -2.5 to 3.2) and symptoms of heaviness (-0.2; -0.6 to 0.2), tightness (-0.1; -0.8 to 0.6) and swelling (0.2; -0.4 to 0.8). Non-equivalence was found for inter-arm volume % difference (-3.5%; -17.3 to 10.3) and pain (-0.7; -1.3 to 0), favoring the HIGH group. Strength gains were superior in the HIGH versus LOW group (3 kg; 1 to 5, p<0.05). Further, clinically relevant reductions in breast (-11; -15 to -7) and arm (-6; -10 to -1) symptoms were found in the HIGH group.

CONCLUSION

Findings suggest that pre-diagnosis physically inactive women can benefit from supervised heavy-load resistance exercise during adjuvant chemotherapy for breast cancer without increasing lymphedema risk.

Supported by funding from the Danish Cancer Society, the Novo Nordic Foundation and Trygfonden (7-12-0401)

- 73 Board #4 May 29 9:30 AM - 11:30 AM
A Randomised Clinical Trial Of 'Prehabilitation' High Intensity Interval Training (HIIT) Before Urological Cancer Surgery
 James EM Blackwell, Matthew S. Brook, Brett Doleman, Alistair Morton, John P. Williams, Jonathan N. Lund, Bethan E. Phillips. University of Nottingham, Nottingham, United Kingdom. (Sponsor: Professor Craig Sale, FACSM)
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PURPOSE: Operations for urological malignancy are increasing in number and complexity due to the advancing age of patients with multiple comorbidities. Low pre-operative cardiorespiratory fitness (CRF) and muscle mass, are both associated with increased peri-operative morbidity and mortality, as well as poorer post-operative outcomes and delayed return normal activities. High intensity interval training (HIIT) may represent an efficacious training modality to rapidly improve CRF and body composition in the short clinically-dictated time-frame between diagnosis and surgery. **METHODS:** Forty patients (mean: 71 years, 98% male) were recruited at diagnosis of urological cancer. Patients providing written informed consent were to randomisation to either HIIT prehabilitation ((HIIT): 12 sessions of 5 x 1-min exertions, 3 sessions/week) or usual care (control (CON)). Patients underwent cardiopulmonary exercise testing (CPET), dual-energy X-ray absorptiometry (DXA) scans and muscle architecture assessments using B-mode ultrasonography before and after a 28-day intervention period. *Vastus lateralis* (VL) muscle biopsies were also taken at both time-points. Statistical analysis, using ANCOVA, compared the effects of HIIT versus CON. **RESULTS:** HIIT elicited a clinically significant improvement in CPET-derived measures of anaerobic threshold (2.16 ml/kg/min (95% CI: 0.24 to 4.08), $\dot{V}O_{2PEAK}$ (2.26 ml/kg/min (95% CI: 1.25 to 3.26) and wattage at failure (12.86 W (95% CI: 5.52 to 20.19) vs. CON. Resting blood pressure (BP) decreased (vs. CON) with HIIT (systolic: -8.2 mmHg (95% CI -16.1 to -0.3), diastolic: -6.5 mmHg (95% CI -12 to -0.4)). There were no differences in whole-body composition changes between the groups, despite HIIT eliciting preferential gains in VL muscle thickness 0.22 mm (95% CI 0.02 to 0.41) and pennation angle 2.49 degrees (95% CI 0.42 to 4.55). HIIT was well-tolerated and safely delivered within this cohort.

CONCLUSIONS: CRF, BP and muscle architecture parameters can be significantly improved with 4 weeks low-volume HIIT in urological cancer patients awaiting surgery. Mass-spectrometry analysis of muscle biopsies from this patient cohort will help elucidate the relative contribution of changes in mitochondrial and/or myofibrillar muscle protein metabolism in achieving these gains.

- 74 Board #5 May 29 9:30 AM - 11:30 AM
High Adherence To Home-Based Exercise Improves Muscle Strength And Cardiorespiratory Fitness With Advanced Prostate Cancer
 Erik D. Hanson¹, Jackson L. Carver¹, Alexander Lucas², Michael Bass¹, Mohammod Alzer¹, Young Whang¹, Michael Harrison³, Matthew I. Milowsky¹, Rhonda L. Bitting², Claudio L. Battaglini, FACSM¹. ¹University of North Carolina at Chapel Hill, Chapel Hill, NC. ²Wake Forest University, Winston-Salem, NC. ³Duke University, Durham, NC. (Sponsor: Claudio Battaglini, FACSM)
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Exercise is a potential mechanism for mitigating some side effects caused by androgen deprivation therapy (ADT) for metastatic castration-resistant prostate cancer (mCRPC)

and home-based interventions may help eliminate barriers to physical activity. **PURPOSE:** To assess feasibility, adherence, and physiological changes following a home-based exercise intervention in men with mCRPC receiving ADT and androgen receptor targeting agents. **METHODS:** Men with mCRPC (age=71y \pm 10, BMI=29.64 kg/m² \pm 3.4) completed body composition (DXA), muscular strength, physical function, and cardiopulmonary exercise testing (CPET) before and after a 12-week home-based exercise intervention (with weekly phone contact) using resistance band and wearable technology for tracking walking. Patient reported outcomes were used for the assessment of fatigue (FACIT-Fatigue), quality of life (FACT-P) and depression (Hospital Anxiety and Depression Scale). Feasibility (target: 67%) was determined as the % of patients who completed the intervention. Adherence (target: 75%) to the overall program and specific activities was determined as the number completed relative to prescribed. Physiological changes were assessed using paired samples t-tests and adherence rates with a single sample t-test. **RESULTS:** Fourteen men completed baseline testing and eight completed the intervention (57%), which was lower than the target value. Adherence was reached but did not statistically exceed the target value of 75% for overall (82.7% \pm 9.5; $p=0.076$), walking (80.7% \pm 14.2; $p=0.326$), or resistance training (85.3% \pm 12.5; $p=0.072$). Core focused exercises had significantly lower adherence (58% \pm 35.7; $p<0.001$). Training significantly increased leg press maximal strength (10.7% \pm 6.7, $p=0.023$) and peak oxygen consumption (9.7% \pm 22.4%, $p=0.013$). No significant difference occurred in any other variable tested. **CONCLUSIONS:** Feasibility estimates were lower than expected but the high adherence promoted improvements in strength and cardiorespiratory function during mCRPC treatment but did not translate into functional improvements. These preliminary findings suggest home-based interventions are promising, but limited supervision or advanced disease may limit completion of training protocol.

75 Board #6 May 29 9:30 AM - 11:30 AM

Pre-surgical Exercise In Men With Prostate Cancer Undergoing Prostatectomy.

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(No relevant relationships reported)

Traditionally, exercise interventions to improve recovery in prostate cancer patients following prostatectomy were limited to the post-surgical period with exercise protocols focusing on the pelvic floor muscles. However, emerging evidence indicates that a more opportune time to intervene to reduce the adverse effects of surgery and length of hospitalisation is the pre-operative period. **PURPOSE:** To evaluate the efficacy of exercise undertaken before surgery to enhance pre-surgical physical function and body composition, and improve recovery from surgery. **METHODS:** Twenty-two men with localised prostate cancer aged 50-73 years scheduled for surgery were randomised to exercise (EX = 12) or usual care (UC = 10). EX underwent a supervised 6-week progressive resistance and aerobic exercise program 3 times per week prior to surgery. Outcome measures included muscle strength and endurance, physical performance by a battery of tests, body composition by dual x-ray absorptiometry, and urinary incontinence. Measures were undertaken at baseline, pre-surgery, and 6 weeks post-surgery, with incontinence assessed following catheter removal and 6 weeks post-surgery. Data were checked for normality and analysed using two-way repeated-measures ANOVA. **RESULTS:** There were no differences between groups at baseline. Following exercise, there was a significant interaction ($p < 0.05$) for chest press, leg press and leg extension strength with strength increasing in EX prior to surgery and returning to pre-training values post-surgery. There was a significant time effect ($p < 0.05$) for 6 m fast walk, 6 m backwards walk, and 400 m walk with performance generally improving over the study period. Following surgery, lean mass was reduced (time, $p < 0.001$) by ~1.9 kg and ~1.4 kg in EX and UC, respectively. Urinary incontinence was significantly reduced at 6 weeks post-surgery in EX and UC (time, $p < 0.001$). There was no difference in length of hospital stay (3 \pm 1 days for EX and UC) and there were no exercise-related adverse effects. **CONCLUSIONS:** A pre-surgical exercise program improves components of physical function prior to surgery which may enhance the patient's fitness for surgery. Given the loss of lean mass following surgery, a longer period of anabolic exercise prior to surgery may prove useful in buffering post-surgical loss.

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Board #7

May 29 9:30 AM - 11:30 AM

Responders Versus Non-responders To Resistance-based Multimodal Exercise In Men With Prostate Cancer Undertaking ADT

Dennis R. Taaffe, FACSM¹, Robert U. Newton¹, Nigel Spry¹, David Joseph², Daniel A. Galvao, FACSM¹. ¹Edith Cowan University, Perth, Australia. ²Genesis Cancer Care, Perth, Australia.

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(No relevant relationships reported)

In the management of prostate cancer androgen deprivation therapy (ADT) is effective in delaying disease progression and enhancing survival, although it is associated with an array of adverse effects including reduced muscle mass, strength and physical function, and an increase in body fat. Exercise is one strategy to counter these musculoskeletal treatment-related toxicities resulting from ADT. However, to recommend and prescribe exercise, clinicians need to know the likelihood of a positive response. **PURPOSE:** To assess the prevalence of exercise responsiveness in men with prostate cancer undergoing ADT on body composition, muscle strength, and physical function. **METHODS:** Prospective analyses were undertaken in 152 men (43-90 years) with prostate cancer on ADT undertaking resistance exercise combined with aerobic and/or impact training for 3-6 months. Whole body lean mass (LM) and fat mass (FM), trunk fat mass, and appendicular skeletal muscle (ASM) were assessed by dual x-ray absorptiometry, upper and lower body muscle strength by 1-RM, and physical function by a battery of tests (6-m usual, fast, and backwards walk, 400-m walk, repeated chair rise, stair climb). **RESULTS:** There were significant improvements ($P<0.01$) in LM (0.4 \pm 1.4 kg, range -2.8 to +4.1 kg) and ASM (0.2 \pm 0.8, range -1.9 to +1.9 kg), and all measures of muscle strength (chest press: 2.9 \pm 5.8 kg, range -12.5 to +37.5 kg; leg press: 29.2 \pm 27.6 kg, range -50.0 to +140.0 kg) and physical function (from -0.1 \pm 0.5 s, range +1.3 to -2.1 s for the 6-m usual walk, to -8.6 \pm 15.2 s, range +25.2 to -69.7 s for the 400-m walk). In addition, FM (0.6 \pm 1.8 kg, range -3.6 to +7.3 kg) increased ($P<0.01$). Twenty one men did not have a favourable response in at least one body composition component, 10 did not improve muscle strength, and 2 men did not improve physical function. However, all patients responded in at least one of the areas and 120 (79%) favourably responded in all three areas. For all 12 outcome measures, improvement was observed in 8 \pm 2 (range 2 to 12) measures. **CONCLUSION:** There were no non-responders to resistance-based multimodal exercise in men with prostate cancer undergoing ADT, and this form of exercise can be confidently prescribed to derive beneficial effects during active treatment.

A-19 Thematic Poster - UCL Injuries in Overhead Athletes

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM

Room: CC-102B

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Chair: Jason L. Zaremski, FACSM. University of Florida, Gainesville, FL.

(No relevant relationships reported)

78

Board #1

May 29 9:30 AM - 11:30 AM

Is Shoulder Joint Rom Or Ucl Thickness A Predictor Of Medial Elbow Joint Space?

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UCL injuries among baseball athletes are an extremely common pathology. It is well documented that baseball athletes typically exhibit an increase in shoulder external rotation range of motion (ERRM) and a decrease in internal rotation range of motion (IRRM) while maintaining total rotational range of motion (TROM). Loss of TROM and ERRM may be associated with increased risk for UCL injury. Ultrasound imaging allows clinicians to evaluate UCL thickness and medial joint space (MJS) opening non-invasively. **PURPOSE:** To examine if shoulder joint motion (ERRM, IRRM, TROM), or the thickness of the UCL at the mid substance and apex of trochlea predicts medial elbow joint space (MJS) in asymptomatic collegiate baseball pitchers. **METHODS:** Twenty-nine NCAA Division I pitchers participated in this follow-up study. Ultrasound images were obtained of the MJS and UCL on the participant's

throwing arm using a GE LOGIQ e ultrasound unit. Participants were placed supine with a wedge placed underneath their pitching hand to maintain elbow position at 30 degrees. A 3 kg valgus force, as measured by a hand-held dynamometer, was applied 20 cm distal to the medial epicondyle. Ligament thickness measurements were performed at the mid-substance of UCL and at the apex of the trochlea. Imaging measurements to evaluate MJS opening were performed from the apex of the trochlea to the apex of the ulna. Standard goniometric procedures were performed with the athlete in a supine position to obtain ERRM, IRRM, and TROM values. Three stepwise linear multiple regression analyses were performed to determine if shoulder ROM or UCL thickness measures of the mid-substance and apex of the trochlea could predict MJS. **RESULTS:** Shoulder joint range of motion were not able to significantly predict MJS [$R^2 = .05$, $F(2,25) = 0.58$, $p = 0.56$]. UCL thickness at the mid-substance [$R^2 = .04$, $F(1,25) = 0.10$, $p = 0.76$], and at apex of the trochlea [$R^2 = .00$, $F(1,25) = 0.03$, $p = 0.95$] were not able to significantly predict MJS. **CONCLUSIONS:** Results further supported prior research that shoulder ROM did not predict MJS, and new to this study, UCL thickness measured at two points were unable to predict MJS in asymptomatic baseball pitchers. Further research is recommended to perform multiple imaging sessions throughout the competitive season to further determine predictors of UCL injuries.

79 Board #2 May 29 9:30 AM - 11:30 AM
Do Outcomes or Subsequent Injuries Differ Following Ulnar Collateral Ligament Reconstruction Using Palmaris vs. Hamstring Autograft?

Joshua Dines¹, Brandon Erickson², Peter Chalmers³, John D'Angelo⁴, Kevin Ma⁴, Anthony Romeo². ¹HSS, New York, NY. ²Rothman Orthopaedic Institute, Tarrytown, NY. ³University of Utah, Salt Lake City, UT. ⁴MLB, New York, NY.
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 (No relevant relationships reported)

Purpose: Ulnar collateral ligament reconstruction (UCLR) is a successful procedure in professional baseball players. It is unclear if results differ based on graft choice. The purpose was to determine the performance and return to sport (RTS) rate in professional baseball players following UCLR and compare performance and RTS rate, as well as injury rates, between players who underwent UCLR with hamstring vs. palmaris autograft. The authors hypothesize that there is a high RTS rate in professional baseball players following UCLR with no significant difference in injury rates, RTS rate, or performance, specifically related to primary outcome performance variables: WHIP ((walks + hits)/innings pitched), fielding independent pitching (FIP), and wins above replacement (WAR)) between those who had UCLR with a palmaris vs. hamstring autograft. **Methods:** All professional baseball players between 2010-2015 who underwent UCLR using hamstring autograft were included. Surgical details of their procedure were recorded using operative reports. Players with a hamstring UCLR were compared to a matched control group of players who underwent UCLR with palmaris autograft. **Results:** Overall, 191 players underwent UCLR using hamstring autograft. No differences in RTS rates or timing to RTS existed between the hamstring vs. palmaris groups. Significantly more subsequent lower extremity injuries were seen in the hamstring group ($p = 0.040$). More subsequent upper extremity injuries existed in the palmaris group, although this difference was not significant ($p = 0.052$). No consistent differences in performance metrics upon RTS existed between hamstring and palmaris groups, although both groups significantly declined in many performance metrics following surgery. Both groups showed a decline in post-operatively in WAR and WHIP; FIP did not decline. No significant difference in WAR, WHIP, or FIP existed between groups post-operatively. **Conclusion:** Baseball players who undergo UCLR with hamstring autograft are more likely to sustain a subsequent lower extremity injury while those who undergo UCLR with a palmaris are more likely to sustain an upper extremity injury. No difference in performance or RTS rates existed between groups. Both groups significantly declined in WAR and WHIP after UCLR.

80 Board #3 May 29 9:30 AM - 11:30 AM
Quantity Time: Identifying The Benefit Of Ulnar Collateral Ligament Reconstruction In Major League Baseball

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 (No relevant relationships reported)

Reconstruction of the ulnar collateral ligament (UCL), known colloquially as Tommy John surgery, was first performed in 1974. Today, approximately 30 Major League Baseball (MLB) players undergo this procedure annually; however, 57% of recipients are youth, age 15-19. Despite the abundance of subjects and accessibility of statistics, few investigations have studied its long-term effects on performance. **PURPOSE:** To evaluate changes in pitching performance following UCL reconstruction. **METHODS:** We compared 3 samples of MLB pitchers: 1) Underwent UCL reconstruction (REC), 2) Sustained an injury without surgical care (INJ), and 3) Never injured (NON). The REC sample was selected at random from a list of players who had pitched at least 2

seasons prior to the operation and at least 2 seasons post-surgery. Matched samples of INJ and NON were created; there were 50 subjects in each group. Mixed ANOVA with repeated measures compared first season statistics to final season statistics, and means of the first 2 seasons to the last 2. Linear regressions tested the effect of UCL reconstruction on changes in performance across those periods, holding all potential confounders constant. **RESULTS:** Among all 150 pitchers, during the first 2 seasons, they won 53.6% of games, struck out 0.88 ± 0.23 batters per inning, and had an earned run average (ERA) of 4.01 ± 1.14 . Between the first 2 and last 2 seasons, REC subjects experienced a 5.7% decrease in win percentage ($p = 0.063$) but struck out 4.7% more batters per inning ($p = 0.015$). Linear regression, evaluating the change from first to last season, found UCL reconstruction to improve winning percentage by 14.4 percentage points ($p = 0.026$); there was no effect on strikeouts per inning ($p = 0.339$) or ERA ($p = 0.892$). UCL reconstruction failed to elicit significance on the change in performance between the first 2 and last 2 seasons in any variable. The ANOVA models found no group effect between first and last season with win percentage ($p = 0.190$), strikeouts per inning ($p = 0.428$), or ERA ($p = 0.600$). Similarly, there was no group effect between the first 2 and last 2 seasons in win percentage ($p = 0.454$), strikeouts per inning ($p = 0.961$), or ERA ($p = 0.496$). **CONCLUSION:** UCL reconstruction does not appear to compromise the quality of pitching performance, but does prolong the quantity of pitches in a player's career.

81 Board #4 May 29 9:30 AM - 11:30 AM
Open Reduction Internal Fixation of Medial Epicondyle Fractures After Ulnar Collateral Ligament Reconstruction in Professional Baseball Pitchers

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 (No relevant relationships reported)

Purpose: Determine the rate of return to sport (RTS) and performance upon RTS in professional baseball pitchers following ORIF of the medial epicondyle, and see if there is a difference in RTS rate and performance between players who underwent ORIF and matched controls. The authors hypothesize that there is a high rate of RTS in professional baseball pitchers following medial epicondyle ORIF with no significant difference in rate of RTS or performance, specifically related to the primary outcome performance variables of win-loss percentage (W-L%), WHIP ((walks + hits)/innings pitched), fielding independent pitching (FIP), and wins above replacement (WAR)) between cases and controls.

Methods: All professional baseball pitchers who underwent medial epicondyle ORIF between 2010-2016 were included. Demographic and performance data (pre and post surgery) for each player was recorded. Performance metrics were then compared between cases and matched controls (no history of UCLR or ORIF). **Results:** Overall, 15 pitchers (80% starters, 73.3% right-handed) underwent ORIF of a medial epicondyle fracture. All underwent a prior UCLR using either the American Sports Medicine Institute (n=9, 60%) or docking (n=6, 40%) technique. ORIF techniques included fixation with one screw (n=13, 86.7%) and fixation with suture anchors (n=2, 13.3%). Eleven (73.3%) pitchers were able to RTS (which did not differ from controls $p = 0.537$). No significant differences existed in the primary performance outcome variables when comparing pre-operative to post-operative performance. No significant differences in the primary performance outcome measures were seen between cases and controls following surgery although cases pitched fewer innings than controls following surgery ($p = 0.003$). **Conclusion:** Following medial epicondyle ORIF of professional pitchers with a history of UCLR, 73.3% were able to RTS without a significant decline in most performance variables when compared to their pre-operative performance levels, or when compared to matched controls. Number of innings pitched declined following surgery.

82 Board #5 May 29 9:30 AM - 11:30 AM
Performance and Return to Sport Following Ulnar Nerve Decompression/Transposition in Professional Baseball Players

John D'Angelo¹, Brandon Erickson², Peter Chalmers³, Kevin Ma¹, Anthony Romeo². ¹MLB, New York, NY. ²Rothman Orthopaedic Institute, Tarrytown, NY. ³University of Utah, Salt Lake City, UT.
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 (No relevant relationships reported)

Purpose: Determine performance and return to sport (RTS) rate in professional baseball players following isolated ulnar nerve decompression/transposition, including those who required an ulnar nerve transposition/decompression following ulnar collateral ligament reconstruction (UCLR), and compare outcomes between cases and matched controls.

Methods: All professional baseball players who underwent isolated ulnar nerve decompression/transposition between 2010-2016 were included. Demographic and performance data (pre and post surgery) for each player was recorded. Performance metrics were then compared between cases and a group of matched controls. **Results:** Overall 52 players, 83% pitchers (14 underwent prior UCLR) were included. Most surgeries (92%) were anterior subcutaneous transpositions. Overall, 62% of players were able to successfully RTS and 56% returned to the same or a higher level. There was no significant difference between cases and controls in the majority of performance metrics pre-operative or post-operatively, specifically ERA, WHIP, WAR, and OPS. When players who had a UCLR prior to their ulnar nerve transposition/decompression were compared to controls with a history of a UCLR but who did not go on to have an ulnar nerve transposition/decompression, the only performance difference of all the recorded metrics was cases allowed more walks per 9 innings (4.4 vs. 2.8; $p=0.011$). **Conclusion:** Anterior subcutaneous transposition is the most common surgery in professional baseball players to address ulnar neuropathy at the elbow. Players have a 62% rate of RTS, which is lower than expected for this non-reconstruction or repair procedure. For players who successfully RTS, performance compared to matched controls remained the same in most performance metrics. Post-operatively, pitchers with a UCLR prior to ulnar nerve transposition/decompression that had a successful RTS performed the same as matched controls with prior UCLR.

83 Board #6 May 29 9:30 AM - 11:30 AM
Land leg vs. Drive Leg Hamstring Graft Harvest Side Does Not Affect Performance or RTS Rates and Does Not Increase Risk for Future Hamstring Injuries Following UCLR in Professional Baseball Pitchers

Peter Chalmers¹, Brandon Erickson², John D'Angelo³, Kevin Ma³, Christopher Ahmad⁴, Joshua Dines⁵, Anthony Romeo².
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Purpose: To compare, performance, return to sport (RTS) rate, and injury rates between professional baseball players with a history of UCLR using an ipsilateral (drive leg) hamstring autograft to those with UCLR using contralateral (landing leg) hamstring autograft.

Methods: All players between 2010-2015 who underwent UCLR using hamstring autograft were included. Surgical details of their procedure were recorded using operative reports. Players with a hamstring UCLR were compared within group to compare grafts taken from the drive leg vs. landing leg. **Results:** Overall, 191 players underwent UCLR using hamstring autograft (58 [30%] landing/contralateral and 133 [70%] ipsilateral/drive leg). The docking technique was more common in the contralateral/landing leg group while the figure-of-8 technique was more common in the ipsilateral/drive leg group ($p>0.001$). More patients in the ipsilateral/drive leg group underwent concomitant treatment of the ulnar nerve than the contralateral/landing leg group ($p<0.001$). No difference existed in return to sport (RTS) rates, or timing of RTS between groups. No differences in subsequent ipsilateral or contralateral hamstring injuries between players who underwent UCLR using hamstring from the ipsilateral/drive leg or contralateral/landing leg was seen ($p=1.000$; $p=0.460$ respectively). No difference in overall upper or lower extremity injury rates existed between groups. **Conclusion:** No difference in RTS rate, performance upon RTS, or subsequent hamstring, lower extremity, or upper extremity injury rates existed between players who underwent UCLR using hamstring autograft from the ipsilateral/drive or contralateral/landing leg.

A-20 Thematic Poster - Walking Biomechanics

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM
 Room: CC-101B

84 Chair: Julia Freedman Silvernail. University of Nevada, Las Vegas, Las Vegas, NV.
 (No relevant relationships reported)

85 Board #1 May 29 9:30 AM - 11:30 AM
Pelvis and Trunk Motion Comparisons Between Male and Female Soldiers While Walking With Heavy Loads

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 (No relevant relationships reported)

With the recent decision permitting female soldiers to enter Combat Arms roles, knowledge of sex differences in military load carriage is more operationally relevant. Limited work comparing the effect of heavy carried loads (> 30 kg) in men and women has attributed differences in gait mechanics to sex without matching for anthropometrics that may contribute to differences. **PURPOSE:** To examine the effect of carrying light to heavy loads on pelvis and trunk range of motion (ROM) between anthropometrically matched male and female soldiers. **METHODS:** Four male and 4 female Soldiers were matched on height and body weight (differences < 2.54 cm and 4.54 kg). All participants walked unloaded (BW), and with vest-borne loads of 15, 35 and 55 kg. Each load was carried for 10 min while walking on a level treadmill at 1.3 m·s⁻¹, with pelvis and trunk segmental angles collected after 5 min. Four mixed model ANOVAs (sex x load) compared trunk and pelvis frontal and transverse plane ROM. **RESULTS:** There were sex x load interactions for trunk transverse and frontal plane motion (Table 1). Specifically, as load increased: (A) trunk axial rotation decreased more in females than males ($p=0.037$), and (B) trunk frontal plane motion increased for males and remained relatively constant for females ($p=0.034$). Pelvis frontal plane ROM also increased at 55 kg in both sexes relative to carrying no additional load. **CONCLUSIONS:** Despite anthropometric matching, preliminary results suggest sex-related differences in trunk frontal plane motion while carrying loads ≥ 35 kg and no sex-related differences in pelvis motion. **DISCLAIMER:** The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

Table 1. Pelvis and Trunk Frontal (Y) and Transverse (Z) plane ranges of motion for different loads among male and female Soldiers.

		Sex	BW	15 kg	35 kg	55 kg
Pelvis	Frontal	M	6.9 ± 0.3	8.4 ± 0.2	8.7 ± 1.5	9.3 ± 0.7
		F	8.8 ± 2.2	9.7 ± 3.0	10.5 ± 3.1	11.1 ± 1.9 *
	Transverse	M	6.3 ± 2.1	6.5 ± 2.2	7.3 ± 2.8	6.3 ± 1.8
		F	10.8 ± 2.8	8.8 ± 1.6	8.0 ± 1.8	8.1 ± 1.8
Trunk	Frontal	M	4.9 ± 1.4	5.3 ± 0.5	6.7 ± 1.0	6.2 ± 0.6
		F #	4.9 ± 1.7	4.6 ± 1.7	4.2 ± 2.2 ^	4.1 ± 1.1 *
	Transverse	M	8.4 ± 2.1	6.2 ± 0.9	7.9 ± 2.7	6.1 ± 1.4
		F #	9.0 ± 1.4	6.6 ± 1.1	5.0 ± 0.8 *	4.4 ± 0.7 *

BW = Bodyweight only; # = sig sex x load interaction

* Sig different from BW; ^ sig different from male

86 Board #2 May 29 9:30 AM - 11:30 AM
Logistic Regression Analyses Regarding Patient Dissatisfaction with Total Knee Replacement Outcomes

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 (No relevant relationships reported)

Current research on patient satisfaction after a total knee replacement (TKR) lacks an examination of objective assessments with respect to gait biomechanics, strength, and balance abilities.

PURPOSE: To examine associations between patient satisfaction and the gait biomechanics, strength, balance, functional capacities, and survey data.

METHODS: Twenty four TKR patients participated in overground walking, stair ascent and descent, isokinetic strength, static and dynamic balance, and functional tests. Nine patients were in the dissatisfied group and fifteen in the satisfied group. Four models of logistic regression analyses were performed to predict patient satisfaction: one for walking, stair ascent, stair descent, and functional/strength/survey data. If high correlations ($r \geq 0.7$) existed, variables were selected based on biomechanical and functional importance identified through review of literature concerning TKR patients. Selected kinematic, kinetic, strength, and balance variables along with functional test and survey data scores were input into a logistic regression analysis using SAS (Version 9.4, Cary, NC, USA). Models were evaluated using Akaike's Information Criterion.

RESULTS: The walking model included 1st and 2nd peak vertical ground reaction force (VGRF), knee extension moment, and forgotten joint score ($R^2=0.69$, AIC=22.73, $p=0.0026$). The stair ascent model included 2nd peak VGRF, knee extension moment, preferred gait speed, and peak isokinetic knee extension torque ($R^2=0.72$, AIC=23.85, $p=0.0013$). The stair descent model included knee extension moment, preferred gait speed, peak isokinetic knee extension torque, and forgotten joint score ($R^2=0.80$, AIC=20.47, $p=0.0003$). The functional model was inclusive of WOMAC total scores, stair ascent and chair rise times, and peak isokinetic knee extension torque ($R^2=0.87$, AIC=19.51, $p=0.0002$).

CONCLUSIONS: The biomechanical models included both VGRF and knee extension moments, indicating their relevance to patient satisfaction. Additionally, preferred gait speed was significant to both stair ascent and descent models. Pain was not included in any models due to a complete separation of data points.

Acknowledgements Supported by Matching Dissertation Grant of International Society of Biomechanics.

87 Board #3 May 29 9:30 AM - 11:30 AM Quadriceps Strength and Knee Mechanics in Adults with Prader-Willi Syndrome

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(No relevant relationships reported)

Prader-Willi syndrome (PWS) is a form of congenital obesity that occurs 1 in 25,000 births. Progressive obesity and reduced lean mass contribute to muscle weakness, which may alter knee mechanics during gait. **PURPOSE:** To compare quadriceps strength between individuals with and without PWS, and to examine the relationship between quadriceps strength and knee mechanics during gait in adults with PWS.

METHODS: 10 individuals with PWS participated in this study (1.70 ± 0.09 m, 71.9 ± 16.1 kg), and were matched on sex to 10 obese controls (1.74 ± 0.08 m, 108.0 ± 13.2 kg) and 10 lean controls (1.67 ± 0.06 m, 65.3 ± 7.16 kg). Participants completed three maximal isometric knee extensor contractions using a dynamometer set at 60° of knee flexion. Early (0-100 ms) and late (100-200 ms) rate of torque development (RTD₁₀₀, RTD₂₀₀), and peak torque were extracted. Gait biomechanics were collected as participants completed 5 walking trials over 2 force plates on a 10-m runway at self-selected speed. Peak knee flexion angle (KFA), excursion (KFE), and knee flexion moment (KFM) were extracted from the first 50% of stance. Strength and joint moments were normalized to lean mass and a product of body weight and height, respectively. One-way MANOVA was used to compare strength variables between groups. Partial correlation controlling for gait speed was used to determine the relationship between strength and gait variables. **RESULTS:** There were group differences in peak torque ($p=.001$), RTD₁₀₀ ($p=.010$), and RTD₂₀₀ ($p=.002$). Post hoc analyses showed that individuals with PWS had lower peak torque ($p=.006$, $p=.001$), RTD₁₀₀ ($p=.038$, $p=.015$), and RTD₂₀₀ ($p=.003$, $p=.016$) than obese and lean controls. There were no significant correlations in control groups ($p>.05$). Greater KFE was related to greater peak torque ($r=-0.71$, $p=.016$), greater RTD₁₀₀ ($r=-0.59$, $p=.049$) KFA ($r=0.69$, $p=.019$). **CONCLUSIONS:** Strength variables were associated with knee mechanics in the PWS group, indicating that aberrant gait in PWS may relate to muscle weakness. Adults with knee osteoarthritis (KOA) have a quadriceps avoidance gait pattern indicated by lower KFE. Individuals with PWS had lower quadriceps strength compared to controls, which was associated with lower KFE. Lower quadriceps strength and altered knee mechanics in individuals with PWS may contribute to KOA.

88 Board #4 May 29 9:30 AM - 11:30 AM

Recovery of Joint Function During Sit to Walk Following Periacetabular Osteotomy: A Case Study

Cailyn Schroeder¹, Linnea Zavala¹, Laura Opstedal², James Becker¹. ¹Montana State University, Bozeman, MT. ²Build Physio and Performance, PLLC, Bozeman, MT.

(No relevant relationships reported)

To date, biomechanical analyses of outcomes after periacetabular osteotomy (PAO) have not evaluated short term recovery or assessed activities other than walking or running. **PURPOSE:** Evaluate changes in joint moments and moment distributions during a sit to walk (STW) task before (PRE) and 6 weeks (6WK), 12 weeks (12WK), and 6 months (6MO) following PAO surgery. **METHODS:** A 22 year old female who underwent PAO due to a history of failed hip surgeries participated. She was non-weight bearing for 6 weeks following PAO, with physical therapy initiated in the first week. At each time point STW trials were performed under motion capture while ground reaction forces were recorded using force plates. Peak extensor moments at the hip (HEM), knee, and ankle, peak support moment (Ms), and distribution of peak Ms among joints were calculated. Differences between nonsurgical (NS) and surgical (S) limbs and times were evaluated using single subject analysis techniques. **RESULTS:** At PRE, peak Ms and HEM were higher on the NS side (both $p<.01$). However, the distribution of peak Ms among joints was not different between limbs (all $p>.05$). By 6WK after surgery peak Ms and HEM on the NS limb increased by 35.6% ($p<.01$) and 40% ($p<.01$), while decreasing by 49.6% ($p<.01$) and 67% ($p<.01$) on the S limb. Additionally, within the S limb there was a redistribution of load bearing, with the hip carrying a smaller percentage of peak Ms and the knee a larger percent (both $p<.01$). While deficits were still present at 12WK, the magnitude of differences decreased (all $p<.01$). By 6MO Ms, HEM, and distribution of Ms across joints had returned to pre-surgery values (all $p<.01$). However, moments were still larger on the NS limb compared to S limb (all $p<.01$). **CONCLUSION:** During recovery from PAO there is a shift in loading from the S limb to the NS limb and a redistribution of load carriage within the S limb which gradually dissipates over 6 months. Rehabilitation programs should include methods cope with this altered loading.

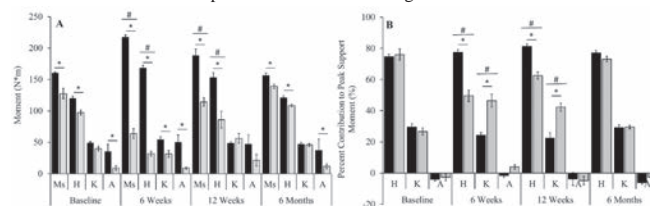


Figure 1. Peak support moment (Ms), hip (H), knee (K), and ankle (A) extensor moments at instance of peak support moment (A), and distributions of the support moment across the hip, knee, and ankle joints (B). Black bars are the nonsurgical limb and grey bars are the surgical limb. * and # indicate statistically significant differences between limbs and time points, respectively. All differences are at the $p < .01$ level.

89 Board #5 May 29 9:30 AM - 11:30 AM

Recovery of Hip Biomechanics During Walking After Periacetabular Osteotomy

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(No relevant relationships reported)

To date, studies on biomechanical outcomes following periacetabular osteotomy (PAO) have focused on gait adaptations 6 months or 1 year post-surgery. There are no reports in the literature on how biomechanics recover during the initial months following surgery. **PURPOSE:** To assess changes in hip angles and moments during walking between pre-PAO-surgery (PRE), and 6 weeks (6WK), 12 weeks (12WK), and 6 months (6MO) post-operation. **METHODS:** One female collegiate athlete (age: 22 yrs; mass: 85 kg; height: 181 cm) with a history of failed hip surgeries participated. At each time point hip kinematics and kinetics in the surgical limb were assessed during walking using motion capture and force plates. Variables of interest included peak hip extension (HE), adduction (HAD), and internal rotation (HIR) angles, hip extensor moment (HEM) at the initial vertical ground reaction force peak, and peak hip abductor (HABM) and internal rotator (HIRM) moments. Differences between time points were evaluated using ANCOVA with walking velocity as a covariate. **RESULTS:** Compared to PRE, HE was reduced at 6WK ($p<.0001$). While HE increased back towards PRE values at each time point ($p<.0001$), it was still reduced at 6MO. By 12W, HEM increased from B ($p<.0001$), which was still true at 6M ($p=.012$). HAD decreased after 12W post-surgery ($p<.0001$). The same pattern was seen for HABM ($p<.0001$). HIR decreased from B to 6M ($p<.0001$) and HIRM decreased after surgery ($p=.031$) but at 6M was not different than B. **CONCLUSIONS:** Overall, hip angles and moments during walking decreased in the involved limb immediately following PAO but began to return towards baseline by 12WK to 6MO. Increased HEM beyond

baseline was also observed, indicating more use of the surgical leg to move the body through stance than prior to surgery. Understanding these initial recovery patterns may help improve PAO-specific rehabilitation programs.

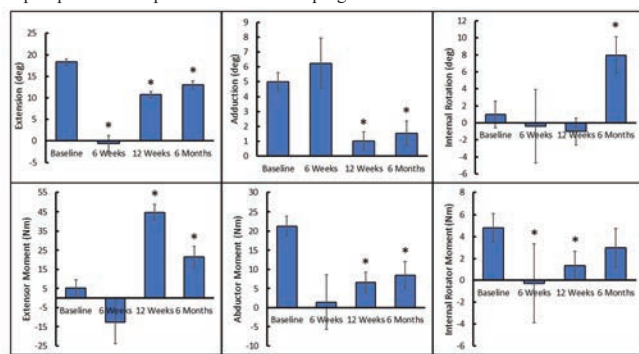


Figure 1. Average hip angles and hip moments for involved leg. Error bars are standard error. The asterisks indicate differences from baseline for p-value < 0.05.

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Board #6

May 29 9:30 AM - 11:30 AM

Increased Dynamic Knee Joint Load at the Non-Modified Limb during Medial Knee Thrust Gait Modification

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(No relevant relationships reported)

Medial contact force (MCF) is a measure of the internal loads contributing to knee cartilage loss. Including both knee adductor moment (KAM) and knee flexor moment (KFM) peaks in regression equations significantly improves the prediction of MCF. The objective of gait modification is to reduce KAM by lateralizing the resultant vector of the ground reaction force of the targeted limb. Yet, scant research currently exists investigating consequential changes in MCF of the non-modified limb. **PURPOSE:** To compare changes in MCF of the non-modified limb as a result of implementing medial knee thrust (MKT) strategy. **METHODS:** 19 healthy participants (age 26.74.8 years; height 1.690.17 m; mass 72.311.8 kg) volunteered for this study. All analyses were completed on the non-modified limb. Participants completed 10 trials each walking with normal gait and MKT. The prescribed change in knee angle during the MKT trials was participant specific, using the mean and standard deviation (SD) from baseline trials. During MKT trials, visual real-time feedback was provided to ensure joint angles fell within 1-3 SD (1st 5 trials) and 3-5 SD (last 5 trials) from baseline average. KAM and KFM were computed on Visual 3D. To assess MCF, a linear regression equation was used: . Coefficient values (c1, c2, and c3) were attained from prior studies that quantified MCF using instrumented knee implants. Changes in MCF during the 1st and 2nd half of stance were assessed using an ANOVA ($P < 0.05$). **RESULTS:** MCF of the non-modified limb for the 1st half of stance was significantly greater during the MKT trials ($F_{2,36} = 6.747$, $P = 0.003$). Participants had greater MCF during the 1-3 SD ($d = 0.36$) and the 3-5 SD ($d = 0.44$) compared to the baseline trials. No other statistically significant difference was found ($P < 0.05$). **CONCLUSION:** Increased MCF in the non-modified knee is possibly explained by the lateralization of the force vector from the modified limb. As a result of the repetitive nature of gait, small increases in MCF over each step may instigate significant ramifications over time. Our results suggest that for individuals with bilateral knee osteoarthritis MKT may be contraindicated. Future studies implementing gait retraining within pathological populations should consider investigating biomechanical changes in the non-modified knee.

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Board #7

May 29 9:30 AM - 11:30 AM

Diabetes is Associated with Slow Walking Speed in People with Knee Osteoarthritis

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Walking speed is often considered a sixth vital sign and an important predictor for disability and mortality in older adults. Previous research has shown that a decline in

walking speed is associated with diabetes (DM) or osteoarthritis (OA), independently. Slow walking speed may interfere with daily living and basic mobility needs.

Purpose: The aim of this study was to investigate the impact of diabetes on walking speed in people with knee OA. **Methods:** A cross sectional analysis of Osteoarthritis Initiative (OAI) data at 96 months follow up was performed for 2122 individuals aged between 53-87 years with knee pain over 30 days. Participants were grouped into knee OA+diabetes or knee OA only. Walking speed was measured using the average speed of two trials of 20 meter walk test. Diabetes and knee pain over 30 days were assessed via a self-reported questionnaire. Walking speed was categorized as either slow walking speed (< 1.0 m/s) or normal walking speed (≥ 1.0 m/s). Knee pain while walking was assessed immediately after each walk test using a numeric rating scale from 0 to 10. Knee pain while walking was categorized as follows: no pain (0), mild pain (1-3), moderate pain (4-6) and severe pain (7-10). Logistic regression analyses were performed at 0.05 alpha level. **Results:** A total of 1848 participants had knee OA only and 274 had knee OA+diabetes. A total of 245 individuals had a walking speed < 1.0 m/s with 26.5% of these individuals having diabetes. A total of 1877 participants had a walking speed ≥ 1.0 m/s with 11.1% of these individuals having diabetes. Logistic regression analyses showed that diabetes was significantly associated with slow walking speed (< 1.0 m/s), (odds ratio 1.62; 95% confidence interval [1.11, 2.36], $p = 0.013$) after controlling for age, sex, race, body mass index, depression and pain while walking. **Conclusion:** This study found an association between diabetes and slow walking speed in people with knee OA, independent of knee pain. People with diabetes and knee OA are about 1.6 times more likely to have a slow walking speed (< 1.0 m/s) than those with OA alone. Previous research has linked slow walking speed to adverse health outcomes. Further research should explore the complex relationships between walking speed, functional ability, and health outcomes in this population.

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Board #8

May 29 9:30 AM - 11:30 AM

Obesity Moderates the Association Between Knee Adduction During Gait and Femoral Cartilage Thickness

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(No relevant relationships reported)

Mechanical stimuli are necessary for the maintenance of articular cartilage. Individuals with obesity have large joint loads during gait yet are at high risk for knee osteoarthritis. As such, the association between joint loading and cartilage thickness in individuals with obesity is unclear. **PURPOSE:** To examine the moderating effect of obesity on the association between knee adduction characteristics during gait and femoral cartilage thickness.

METHODS: 48 young adults with and 48 without obesity matched on age and sex completed assessments of gait biomechanics and ultrasound imaging. Ultrasound imaging was completed in 140° of knee flexion, and outcome variables included cartilage thickness of the medial and lateral femoral condyles, and the medial to lateral (M:L) thickness ratio. 3-dimensional gait analyses were conducted over 5 trials on a 10m runway at a self-selected speed. Biomechanical outcomes included the peak knee adduction angle (KAA), first (KAM₁) and second (KAM₂) peaks of the knee adduction moment, and the knee adduction angular impulse (KAI). Kinetics were normalized to a product of height and weight. Multiple linear regression was used to examine the association between biomechanical and cartilage outcomes after accounting for sex, gait speed, and step width. The moderating effect of body mass index (BMI) on the association between biomechanical and cartilage outcomes was assessed via the addition of the interaction term (BMI x biomechanical variable). Significant interactions were assessed via post hoc probing of the conditional slopes at each level of BMI group ($\alpha = 0.05$). **RESULTS:** There was a significant interaction between BMI group and KAA ($\beta = -0.029$, $p = 0.03$), KAM₁ ($\beta = -15.70$, $p < 0.01$), and KAI ($\beta = -34.50$, $p = 0.04$) on the M:L ratio. Post hoc probing indicated that KAA (Effect = 0.02, $p = 0.05$), KAM₁ (Effect = 12.63, $p < 0.01$), and KAI (Effect = 29.40, $p = 0.02$) were only associated with M:L ratio in individuals without obesity. No associations were found between biomechanical outcomes and medial or lateral femoral condyle cartilage thickness. **CONCLUSIONS:** Results suggest that obesity influences the ability of cartilage to positively adapt to ambulatory joint loads. Obesity is associated with proinflammatory cytokines, which may impair cartilage remodeling in response to mechanical stimuli.

A-21 Free Communication/Slide - Factors Influencing Work Capacity in the Heat

Wednesday, May 29, 2019, 9:30 AM - 11:00 AM
Room: CC-202C

93 **Chair:** Ollie Jay, FACSM. *University of Sydney, Lidcombe, Sydney, Australia.*

(No relevant relationships reported)

94 May 29 9:30 AM - 9:45 AM Relationship Between Muscle Oxygenation and Oxygen Uptake During Exercise in the Heat

Margaret C. Morrissey, Luke N. Belval, Gabrielle E. W. Giersch, Rachel K. Katch, Brad D. Endres, Taylor A. Duhart, Douglas J. Casa, FACSM. *Korey Stringer Institute, University of Connecticut, Storrs, CT.* (Sponsor: Douglas Casa, FACSM)
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(No relevant relationships reported)

Exercising in the warm environments increases thermoregulatory demand for skin blood flow, influencing oxygen delivery and oxygen consumption (VO_2) systemically and to active muscle. Near infrared spectroscopy (NIRS) is a non-invasive technique that indirectly assesses local tissue oxygen delivery and VO_2 and accounts for systemic oxygen uptake. Limited evidence exists on the relationship between muscle oxygenation and systemic oxygen uptake during combined heat stress and exercise. **PURPOSE:** To examine the relationship between muscle oxygenation and VO_2 at different exercise intensities in the heat. **METHODS:** Six participants (4 males, 2 females, age: 21 ± 1.0 years, height: 173.41 ± 15.84 cm, weight: 73.14 ± 17.28 kg, $\text{VO}_{2\text{max}}$: 46.41 ± 3.53 ml·kg⁻¹·min⁻¹) performed a treadmill exercise protocol (30°C, 60% relative humidity) with 10 minutes each at 30%, 40%, 60%, 70%, and 80% of velocity at $\text{VO}_{2\text{max}}$. NIRS (Moxly, Fortiori Design LLC, Minnesota, USA) was used to assess muscle oxygen saturation (SmO_2) of the vastus lateralis muscle and systemic VO_2 was measured using expiratory gas analysis. Pearson correlations coefficients were calculated to evaluate the relationship between average SmO_2 , relative changes from baseline (Δ) in SmO_2 , mean VO_2 at percent of peak velocity, and percent of $\text{VO}_{2\text{max}}$. **RESULTS:** There was a positive correlation between ΔSmO_2 and VO_2 at 80% of peak velocity ($r=0.857$, $p=0.029$). There were no significant correlations between ΔSmO_2 and VO_2 at 30%, 40%, 60%, or 70% of peak velocity (30%: $r=0.483$, $p=0.332$; 40%: $r=0.554$, $p=0.254$; 60%: $r=0.653$, $p=0.160$; 70%: $r=0.620$, $p=0.189$). There were no significant correlations between mean SmO_2 , VO_2 at percent of peak velocity, or percent $\text{VO}_{2\text{max}}$. **CONCLUSION:** At 80% of peak velocity, ΔSmO_2 and VO_2 are positively correlated and may suggest this relationship exists while running at high intensities. Therefore, the relationship between NIRS measured SmO_2 and oxygen uptake during exercise in the heat must be further explored in order to use NIRS as an assessment for energy efficiency and substrate utilization.

95 May 29 9:45 AM - 10:00 AM Application of the Thermal-Circulatory Ratio to Individuals Without History of Exertional Heat Illness

Brad D. Endres, Luke N. Belval, Gabrielle E. W. Giersch, Rachel K. Katch, Margaret C. Morrissey, Rebecca L. Stearns, Douglas J. Casa, FACSM. *Korey Stringer Institute, Storrs, CT.* (Sponsor: Douglas J. Casa, FACSM)
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(No relevant relationships reported)

The thermal-circulatory ratio (TCR) is a supportive measure for the assessment of heat tolerance (HT) that was developed for use in military-age males with a history of exertional heat illness (EHI). Examining the heat tolerance test (HTT) and the TCR in a healthy population would give evidence for the application of these as functional measures of heat tolerance in this population. **PURPOSE:** To assess the sensitivity and specificity of the TCR threshold value during a HTT in a subset of individuals without a history of EHI. **METHODS:** 12 participants (8 males, 4 females; age: 20 ± 2 years; height: 171 ± 11 cm; weight: 68.7 ± 12.97 kg; $\text{VO}_{2\text{max}}$: 46.83 ± 4.59 ml·kg⁻¹·min⁻¹) completed a HTT composed of two hours of treadmill walking at a speed of 5 km·hour⁻¹ at a 2% grade in 40°C and 40% relative humidity. Rectal temperature (T_{re}) was assessed and heart rate (HR) was assessed. The Israeli Defense Force (IDF) criteria for heat intolerance was utilized and determined when T_{re} exceeded 38.5°C, HR exceeded 150 bpm, or when either did not reach a plateau. The TCR was calculated by dividing T_{re} by HR. The TCR threshold value to determine heat tolerance at the end of the HTT (TCR_{HTT}) was 0.279°C/bpm. Independent t-tests were performed to compare ending T_{re} and HR between HT and heat intolerant (HI) groups. Data are presented as mean \pm SD and significance level ($p < 0.05$) was set a priori. Diagnostic accuracy of the

TCR criterion in comparison to IDF HTT criterion was assessed using sensitivity and specificity. **RESULTS:** The mean T_{re} , HR, and TCR_{HTT} were $38.02 \pm 0.79^\circ\text{C}$, 119 ± 19 bpm, and $0.327 \pm 0.04^\circ\text{C}/\text{bpm}$, respectively. There were no differences in T_{re} at the end of the HTT between HT and HI, though HR was observed to be lower in HT versus HI ($p=0.006$). Sensitivity and specificity of the TCR in healthy individuals was 50% and 100%, respectively. The positive likelihood ratio was unable to be calculated due to a lack of false positives. The negative likelihood ratio ($-LR$) was 0.5. **CONCLUSIONS:** The specificity of the TCR in this study is similar to findings in previous research. The TCR threshold identified all healthy participants who were HT ($n=8$) based on IDF criteria but lacked the ability to determine HI participants. Further research is needed to determine the application of the TCR to varying groups of individuals and if it may be a potential predictor for future EHI risk.

96 May 29 10:00 AM - 10:15 AM Sex Differences in Internal Temperature Responses to Prolonged Exercise in the Heat

Gabrielle E. W. Giersch, Luke N. Belval, Margaret C. Morrissey, Rachel K. Katch, Brad D. Endres, Douglas J. Casa, FACSM. *University of Connecticut, Storrs, CT.* (Sponsor: Douglas Casa, FACSM)
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(No relevant relationships reported)

Given the increased female presence in military populations and the extreme environmental stress of many military operations, it is important to fully elucidate possible differences in response to environmental stresses between the sexes. **PURPOSE:** To investigate the sex differences in temperature responses to prolonged, dynamic exercise in the heat. **METHODS:** Six individuals (3 males, 3 females, age: 20 ± 2 y height: 166 ± 9.5 cm weight: 69.58 ± 13.6 kg $\text{VO}_{2\text{max}}$: 43.2 ± 2.1 ml/min/kg) completed nine-hour trials with three 80-minute blocks of exercise that consisted of bouts of walking at 30% and 40% $\text{VO}_{2\text{max}}$ and running at 70% and 80% of velocity at $\text{VO}_{2\text{max}}$, followed by 50 minutes of rest. Exercise was completed in two hot environmental conditions (dry: 35°C, 30% relative humidity (RH); and humid 30°C, 60% RH) and two clothing conditions (t-shirt and shorts, and Army Combat Uniform). Internal temperature (T_{int}) was assessed continuously via rectal probe. Independent samples t-tests were utilized to assess differences between the sexes. Data are presented as mean \pm SD, significance was set a priori at $p < 0.05$. **RESULTS:** The only differences in this data set were present in the maximum T_{int} in the third block of exercise (male: $39.23 \pm .40$, female: $38.82 \pm .15^\circ\text{C}$, $p=0.028$). Environmental and clothing condition data was pooled for this preliminary analysis. No differences were observed in mean temperatures for any blocks of exercise (Block 1 – male: $38.06 \pm 0.30^\circ\text{C}$, female: $38.08 \pm 0.39^\circ\text{C}$, $p=0.542$; Block 2 – male: $38.46 \pm 0.31^\circ\text{C}$, female: $38.19 \pm 0.31^\circ\text{C}$, $p=0.941$; Block 3 – male: $38.66 \pm 0.35^\circ\text{C}$, female: $38.27 \pm 0.19^\circ\text{C}$, $p=0.157$). Additionally, there were no differences in sweat rate between sexes any blocks of exercise throughout the trials (Block 1 – male: $1.20 \pm 0.39\text{L}\cdot\text{hr}^{-1}$, female: $0.58 \pm 0.33\text{L}\cdot\text{hr}^{-1}$, $p=0.693$; Block 2 – male: $1.05 \pm 0.20\text{L}\cdot\text{hr}^{-1}$, female: $0.88 \pm 0.31\text{L}\cdot\text{hr}^{-1}$, $p=0.337$; Block 3 – male: $1.14 \pm 0.47\text{L}\cdot\text{hr}^{-1}$, female: $0.65 \pm 0.35\text{L}\cdot\text{hr}^{-1}$, $p=0.410$). **CONCLUSION:** While these preliminary data show only maximum temperature difference in the final block of exercise, additional data is needed to fully elucidate the impact of prolonged exercise heat exposure on both males and females. This investigation aims to help to answer any questions about special military considerations for males and females during prolonged missions or training in the heat.

97 May 29 10:15 AM - 10:30 AM Effects of Solar Radiation Exposure on Self-regulated Exercise Intensity and Thermoregulation in the Heat Outdoors

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(No relevant relationships reported)

High radiant heat load reduces endurance exercise performance in the heat indoors, but this remains unconfirmed in outdoor exercise. **PURPOSE:** The present study examined the effects of variations in solar radiation exposure on self-regulated exercise intensity and thermoregulatory responses in the heat outdoors at a fixed rating of perceived exertion (RPE). **METHODS:** Ten male participants completed 45-min cycling exercise in hot outdoor environments (about 31°C) at a freely chosen resistance and pedal cadence at an RPE of 13 (somewhat hard). Participants were blinded to resistance, pedal cadence, distance and elapsed time and exercised at three sunlight exposure conditions: clear sky (mean \pm SD: 1072 ± 91 W·m⁻²; HIGH); thin cloud (592 ± 32 W·m⁻²; MID); and thick cloud (306 ± 52 W·m⁻²; LOW). Rectal and skin (chest, upper arm, thigh and calf) temperatures, heart rate, skin blood flow and blood pressure were recorded at rest and during exercise. **RESULTS:** Power output (HIGH 96 ± 22 W;

MID 103±20 W; LOW 108±20 W) and resistance (HIGH 1.3±0.3 kp; MID 1.4±0.2 kp; LOW 1.5±0.3 kp) were lower in HIGH than MID and LOW (Power output $p<0.001$; Resistance $p<0.01$). Pedal cadence was lower as solar radiation increases (HIGH 64.5±5.1 rpm; MID 65.9±4.2 rpm; LOW 67.7±3.9 rpm) and was different between all trials (all $p<0.001$). The core-to-skin temperature gradient was narrower, body heat gain from the sun (SHG) was greater and thermal sensation was higher with increasing solar radiation and all variables were different between all trials (all $p<0.01$). Mean skin temperature was higher in HIGH than MID and LOW ($p<0.01$), but rectal temperature was similar between trials ($p=0.485$). **CONCLUSIONS:** We conclude that self-regulated exercise intensity in the heat outdoors at a fixed RPE of somewhat hard is reduced with increasing solar radiation because of greater thermoregulatory strain, perceived thermal stress and SHG. Moreover, solar radiation below about 600 W·m⁻² might be of benefit to maintain endurance physical performance in the heat.

98 May 29 10:30 AM - 10:45 AM

A New Paradigm To Quantify The Reduction Of Physical Work Capacity In The Heat.

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(No relevant relationships reported)

Heat stress reduces physical work capacity (PWC), which can incur major economic deficits. In the context of climate change, an accurate prediction model for PWC as a function of heat stress severity is urgently required, allowing accurate forecasting of its expected future economic impacts. **PURPOSE:** Evidence shows that physical work at self-selected intensities is characterised by a largely stable working heart rate (HR) indicating a constant cardiovascular strain. Given that both heat stress and work load affect HR, we developed a constant cardiovascular strain methodology to quantify heat-induced reductions in PWC at a workload between moderate and heavy based on WHO definitions. **METHOD:** Sixteen young adult male participants (heterogenous in fitness and body characteristics) performed ten experimental trials each consisting of 1-hour of treadmill walking exercise at a HR clamped at 125 b·min⁻¹. The first experimental trial was conducted in a reference environment with no heat stress (15°C, 50% rh). The remaining nine trials were conducted at the same fixed target HR in WBGT ranges of 21 to 41°C (variations in both temperature and humidity). The total kilojoules of energy above resting, generated during treadmill work in each heat-stress experimental trial was expressed as a percentage of that achieved in the reference condition, enabling quantification of the change in PWC (%). **RESULTS:** Clamping the heart rate during physical work in the heat produced individualised predictions of PWC which were sensitive to WBGT and aerobic fitness. Reductions in PWC (12 ± 10 %) were noted at a WBGT of 20°C (i.e. 30°C, 20% rh). In this condition, no losses in PWC were reported in those with high aerobic fitness (≥ 60 ml/kg/min), whereas PWC fell by 20-25% for individuals with a $\dot{V}_{O_{2max}}$ of 35 to 40 ml/kg/min. At a WBGT of 41°C, PWC fell by 75 ± 11%, indicating that some work was still possible even during extreme heat exposure. **CONCLUSION:** Reductions in PWC were sensitive to WBGT and fitness, allowing for computation of a new formula to predict PWC changes and associated losses in GDP as a result of climate change. Funding was provided by 'Heat-Shield', European Union's Horizon 2020 research and innovation programme under the Grant agreement no. 668786.

99 May 29 10:45 AM - 11:00 AM

Impact of Fan Use on Physical Work Capacity in Extreme Heat

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(No relevant relationships reported)

Emerging evidence suggests that electric fan use can reduce thermoregulatory and cardiovascular strain at air temperatures as high as 42°C during rest. However, there is a dearth of empirical evidence relating to the safety limits for fan use at various combinations of air temperatures and humidity, and how their use impacts physical work capacity (PWC). **PURPOSE:** The aim of the current study is to provide new threshold limit values for electric fan use during physical work. **METHODS:** Sixteen young adult males (heterogenous in fitness and anthropological characteristics) performed ~20 trials, consisting of 1 hour of treadmill walking at a fixed heart rate of 130 beats·min⁻¹. The first experimental trial was conducted in a reference environment with no heat-stress (15°C, 50% rh). The remaining trials were conducted at the same fixed heart rate for a maximum of 1 hour at 30-50°C at various humidities.

Each experimental trial was conducted with and without electric fans. The PWC in each heat-stress trial was defined as the total energy expended during 1 hour of treadmill walking and was expressed relative (%) to that expended during the reference condition. The study cohort was split into two subgroups with one group performing trials in minimal clothing (shorts only) whilst the second group undertook trials wearing protective clothing covering the legs, torso and arms (e.g. coveralls).

RESULTS: Based on individual responses to fan exposure during moderate to heavy work undertaken wearing minimal clothing, forced convection was always beneficial at air temperatures ≤34°C. Between 34 and 43°C, a consistent fan benefit was only observed between 40 and 60% relative humidity, with lowered PWC above and below. In contrast, when protective clothing was worn, the beneficial impact of fans between 34 and 43°C was eroded with negligible effects on PWC observed. PWC was consistently impaired by fan use at air temperatures >43°C. **CONCLUSION:** These empirical data will facilitate the formulation of comprehensive threshold limit values for fan use during physical work based on biophysical parameters.

Funding was provided by 'Heat-Shield', European Union's Horizon 2020 research and innovation programme under the Grant agreement no. 668786.

A-22 Free Communication/Slide - Respiratory

Wednesday, May 29, 2019, 9:30 AM - 11:15 AM

Room: CC-105A

100 **Chair:** Stephanie Kurti. James Madison University, Harrisonburg, VA.

(No relevant relationships reported)

101 May 29 9:30 AM - 9:45 AM

Mechanical Unloading of the Respiratory System during 5km Cycling Time Trials in Hypoxia

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(No relevant relationships reported)

In trained endurance athletes, the ability to defend arterial oxy-hemoglobin saturation (SaO₂) during high intensity constant-workload exercise in moderate hypoxia depends in part on the ability to increase minute ventilation (\dot{V}_E). Previous data have shown, however, that despite the existence of a substantial amount of ventilatory reserve ($\dot{V}_{E_{res}}$) in some cyclists, \dot{V}_E surprisingly does not increase during 5km time trials (5kTT) in hypoxia, despite a significant decrease in both SaO₂ and mean power output (P_{TT}) from normoxia. **PURPOSE:** To determine the effect of reducing the work of breathing (\dot{W}_b) on \dot{V}_E , breathlessness (RPB), and P_{TT} during a 5kTT in hypoxia in highly trained cyclists. We hypothesized no change in RPB, while \dot{V}_E would increase with an attenuated decrement in SaO₂ and P_{TT} from normoxia.

METHODS: Fourteen trained male cyclists ($\dot{V}_{O_{2max}} = 58.7 \pm 4.7$ ml·kg⁻¹·min⁻¹) performed a 5kTT under 3 conditions at sea level: 'CON' (FiO₂ = 0.21), 'HYP' (FiO₂ = 0.16), and 'HYP+He' (FiO₂ = 0.16, with balance helium). Esophageal balloons were used to assess \dot{W}_b in each condition. Inspiratory capacity maneuvers were performed at each km, and flow-volume loop analyses were used to assess the %EFL and $\dot{V}_{E_{res}}$. The modified Borg scale (0-10) was used to assess RPB at each km.

RESULTS: \dot{W}_b decreased from HYP to HYP+He by 30 ± 18% ($p < 0.01$). Despite a substantial $\dot{V}_{E_{res}}$ throughout CON (52 ± 44 L·min⁻¹), \dot{V}_E was not different between CON (117.4 ± 17.9 L·min⁻¹) and HYP (124.8 ± 17.9 L·min⁻¹) but increased during HYP+He (139.5 ± 22.0 L·min⁻¹; $p < 0.05$). While SaO₂ decreased from CON to HYP by 10 ± 1% ($p < 0.01$), SaO₂ increased by 4 ± 1% from HYP to HYP+He ($p < 0.01$). P_{TT} decreased from CON to HYP (-14.2%; $p < 0.01$) and increased from HYP to HYP+He (+5.5%; $p < 0.01$). When comparing HYP to HYP+He, a significant correlation was observed between Δ SaO₂ and ΔP_{TT} ($r = 0.69$; $p < 0.05$). RPB increased from CON (6.0 ± 2.0) to HYP (7.0 ± 2.0 ; $p < 0.05$) and was unchanged from HYP to HYP+He (6.6 ± 2.0).

CONCLUSIONS: In moderate hypoxia, a low ventilatory reserve does not limit 5km time trial performance, where by design, individuals are free to adjust power output. The ability to utilize ventilatory reserve while remaining below a critical threshold of perceived breathlessness appears conducive to maintaining aerobic exercise performance in moderate hypoxia.

102 May 29 9:45 AM - 10:00 AM

Dysanapsis Ratio as a Predictor of Expiratory Flow Limitation in Endurance Trained Athletes

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(No relevant relationships reported)

PURPOSE: To investigate whether the dysanapsis ratio (DR) predicts expiratory flow limitation in highly trained athletes, as has been shown in healthy, active men and women. **METHODS:** Data from 124 highly trained men (age 21.9 ± 3.6 yrs) who performed maximal incremental tests to exhaustion were analyzed. The maximum expiratory flow-volume curve, along with inspiratory capacity maneuvers, were used to determine lung volumes, determine expiratory flows, and to quantify flow limitation. The subjects were partitioned into 'flow-limited' (EFL) and 'non flow-limited' (NEFL) groups, where tidal vs. maximal flow-volume overlap $>5\%$ qualifies as EFL. Group differences were evaluated using independent T-tests, while logistic regression was used to assess the predictive ability of DR, forced vital capacity (FVC), and $\dot{V}O_{2\max}$ on EFL. **RESULTS:** 63% of subjects ($n = 78$) displayed EFL with an average severity of $43.3 \pm 21.0\%$. EFL showed significantly lower $\dot{V}E_{\dot{V}}$ (4.5 ± 0.6 vs. 4.9 ± 0.6 L, $p < .001$), $\dot{V}E_{\dot{V}}/\dot{V}C$ (86.3 ± 7.8 vs. $91.3 \pm 5.7\%$, $p < .001$), and $\dot{V}E_{50}$ (6.1 ± 2.0 vs. 7.6 ± 1.4 L·s⁻¹, $p < .001$). However, no significant differences were found in FVC (5.2 ± 0.7 vs. 5.3 ± 0.8 L, $p = .191$) between groups. EFL showed a significantly smaller DR (0.2 ± 0.1 vs. 0.3 ± 0.1 , $p = .001$) compared to NEFL. There were no differences between EFL and NEFL at peak exercise with respect to $\dot{V}O_{2\max}$ (67.1 ± 8.1 vs. 65.4 ± 4.5 ml·min⁻¹·kg⁻¹, $p = .246$), VE (155.9 ± 26.0 vs. 158.6 ± 26.6 L·min⁻¹, $p = .59$), or frequency of breathing (56.8 ± 8.6 vs. 55.4 ± 10.3 br·min⁻¹, $p = .42$). A significant predictive relationship was observed between DR on EFL (Odds Ratio (OR): 0.55, 95% CI 0.36 to 0.81, $p < .01$). A multivariate analysis indicated that DR (OR 0.35, 95% CI 0.21 to 0.58, $p < .001$), FVC (OR 0.49, 95% CI 0.31 to 0.78, $p = .003$), and $\dot{V}O_{2\max}$ (OR 1.63, 95% CI 1.05 to 2.53, $p = .028$) were significant predictors of EFL. **CONCLUSIONS:** Consistent with previous findings in active subjects, an increase in DR or FVC significantly decreases the likelihood of EFL in highly trained athletes. However, results from this analysis show that when controlling for DR and FVC, an increase in $\dot{V}O_{2\max}$ significantly increases the likelihood of EFL. This relationship was previously found to be non-significant in healthy active individuals and may highlight potential differences that exist within endurance trained populations.

103 May 29 10:00 AM - 10:15 AM

No Sex Differences In Diaphragmatic Fatigue When Matched For Absolute Force During Inspiratory Pressure-threshold Loading

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(No relevant relationships reported)

It has recently been demonstrated that women experience an attenuated cardiovascular response to inspiratory pressure-threshold loading (PTL). Furthermore, due to a significantly longer time to task failure, the rate of development of diaphragmatic fatigue (DF) is slower in women compared to men. It is unclear if the abovementioned differences are due to discrepancies in absolute diaphragm force output. **PURPOSE:** To examine sex differences in DF when matched for absolute diaphragmatic pressure during inspiratory PTL. **METHODS:** Fourteen healthy men ($n = 6$) and women ($n = 8$) performed a single bout of PTL for five minutes. Subjects were required to breathe in a square-wave fashion whilst targeting a transdiaphragmatic pressure (P_{di}) of 92 cm H₂O. Fatigue of the diaphragm was assessed via twitch P_{di} ($P_{di,tw}$) using cervical magnetic stimulation. Cardiovascular responses, including heart rate (HR) and mean arterial blood pressure (MAP) were monitored beat-by-beat throughout PTL. **RESULTS:** Following inspiratory PTL, the total work done by the diaphragm ($\sim 13,500$ cm H₂O·s, $p = 0.50$) and the reduction in $P_{di,tw}$ were not different between sexes ($M = 26 \pm 8\%$, $W = 25 \pm 9\%$; $p = 0.82$). When scaled to body mass, women produced more diaphragmatic pressure ($M = 38 \pm 7$ cm H₂O·s·min⁻¹·kg⁻¹, $W = 45 \pm 8$ cm H₂O·s·min⁻¹·kg⁻¹; $p = 0.01$). There was no effect of sex on Δ HR ($M = +14 \pm 12$ bpm, $W = +15 \pm 9$ bpm; $p = 0.50$) during PTL; however, Δ MAP was lower in women compared to men ($M = +31 \pm 16$ mmHg, $W = +21 \pm 13$ mmHg; $p = 0.03$). **CONCLUSION:** Inspiratory PTL matched for absolute diaphragmatic work results in a similar degree of DF between sexes. Despite performing the same level of absolute diaphragmatic work and developing the same degree of DF, women demonstrate an attenuated inspiratory muscle metaboreflex. Sponsor: Natural Sciences and Engineering Research Council of Canada, UBC Physical Activity and Precision Health Cluster

104 May 29 10:15 AM - 10:30 AM

Effects of Acute Intermittent Hypoxia on Maximal Respiratory Ability after Spinal Cord Injury

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(No relevant relationships reported)

After spinal cord injury (SCI), respiratory complications are a leading cause of morbidity and mortality. A novel technique, acute intermittent hypoxia (AIH) triggers spinal motor plasticity, and can increase tidal volume at rest in humans with SCI. Only sparse, inconclusive literature exists about the effects of AIH on maximal effort respiratory maneuvers after SCI. **Purpose:** this pilot study seeks to investigate the effects of AIH on maximal effort respiratory ability in adults with SCI. **Methods:** 4 community-dwelling, adult males with SCI completed a single AIH or sham treatment in randomized order, 7+ days apart. AIH consisted of 15, 1 minute periods breathing a hypoxic gas mixture (9-13% oxygen), interspersed with 1.5 minute periods breathing room air. Sham treatments replicated AIH, but used air (21% oxygen) versus hypoxic episodes. Blood oxygen saturation was monitored. Maximal inspiratory pressure (MIP) and maximal expiratory pressure (MEP) were recorded prior to and 30 minutes after AIH and sham. Pre and post scores for each condition were compared using non-parametric Friedman's two-way ANOVA by ranks. **Results:** Baseline blood oxygen saturation averaged $97 \pm 2\%$. During AIH, saturation decreased to an average of $82 \pm 3\%$, then returned to baseline. Blood oxygen saturation remained stable during sham treatments. MIP did not differ at any point on either day (pre-AIH, 90.4 cmH₂O \pm 34.33; post-AIH, 99.35 cmH₂O \pm 17.6; pre-sham, 98.8 cmH₂O \pm 21.3; post-sham, 85.2 cmH₂O \pm 17.3; $X^2 = 6.231$, $p = .101$). MEP did not differ at any point on either day (pre-AIH, 91.2 cmH₂O \pm 23.1; post-AIH 93.4 cmH₂O \pm 26.8; pre-sham 80 cmH₂O \pm 25.6; post-sham 85.4 \pm 21.1; $X^2 = 2.4$, $p = .494$). Individually, 3 participants increased MIP after AIH, but decreased after sham; the fourth participant increased MEP after AIH, but decreased after sham. **Conclusion:** These pilot study results suggest AIH may affect maximal effort respiratory ability in adults with SCI. Although group means did not differ, individual outcomes varied with AIH improving one outcome in each participant versus sham. Further research is warranted to examine response variations and to determine the therapeutic potential of AIH after SCI. **Support:** Brooks-PHHP Research Collaboration; Center for Respiratory Research and Rehabilitation at the University of Florida.

105 May 29 10:30 AM - 10:45 AM

Combined Influences of Inspiratory Loading and Subsystolic Circulatory Occlusion on Blood Pressure Responses

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(No relevant relationships reported)

Group III/IV muscle afferent feedback from the respiratory and locomotor muscles influence the blood pressure response during exercise. Stimulation of these respiratory and locomotor muscle afferents (via inspiratory loading (IL) or subsystolic circulatory occlusion (CUFF), respectively) augments the blood pressure response during exercise. However, it is unknown if the combination of IL and CUFF (IL+CUFF) results in a greater blood pressure response than observed with IL or CUFF. **PURPOSE:** To compare the blood pressure responses with IL, CUFF and IL+CUFF during exercise in healthy adults. **METHODS:** Nine adults (6M/3W; 29 ± 6 yrs; BMI: 27.4 ± 4 kg/m²) were recruited. Participants performed four 10 min cycling exercise bouts at 40% peak oxygen uptake. For each exercise bout, the first 5 min consisted of spontaneous breathing (SB). The second 5 min consisted of voluntary hyperventilation (i.e. breathing frequency of 40 breaths per min with 50% duty cycle) with IL (30% maximum inspiratory pressure), CUFF (80 mmHg), IL+CUFF or no intervention (CTL) in randomized order. Systolic and diastolic blood pressure (SBP and DBP, respectively) were measured using manual sphygmomanometry. MAP was calculated as (SBP-DBP)/3+DBP. **RESULTS:** Compared to SB, MAP and SBP were greater with CTL, IL, CUFF and IL+CUFF (all, $p < 0.01$). Compared to SB, DBP was greater with IL, CUFF, and IL+CUFF (all, $p < 0.01$). During the second 5 min of exercise, there were differences across all conditions in MAP (CTL: 93 ± 11 ; IL: 100 ± 10 ; CUFF: 107 ± 10 ; IL+CUFF: 113 ± 11 mmHg) (all, $p < 0.01$). During the second 5 min of exercise, there were significant differences across all conditions in SBP (all, $p < 0.01$) except IL was not different than CUFF ($p = 0.09$) (CTL: 134 ± 20 ; IL: 144 ± 20 ; CUFF: 150 ± 22 ; IL+CUFF: 159 ± 23 mmHg). During the second 5 min of exercise, there were significant differences across all conditions in DBP (all, $p < 0.01$) except no differences existed between CUFF and IL+CUFF ($p = 0.15$) (CTL: 73 ± 8 ; IL: 79 ± 8 ; CUFF: 86 ± 6 ; IL+CUFF: 89 ± 7 mmHg). **CONCLUSIONS:** These data demonstrate that combined stimulation of respiratory

and locomotor muscle afferent feedback results in a greater blood pressure response than either alone. These findings have important implications for populations that exhibit exaggerated locomotor and respiratory muscle reflexes (e.g., heart failure).

106 May 29 10:45 AM - 11:00 AM

Roles Of ROS and Akt In Reoxygenated Respiratory Muscle from PO₂ Cycling-Treated Smoking Mice

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(No relevant relationships reported)

PURPOSE: To test the hypothesis that reactive oxygen species (ROS) and protein kinase B (AKT) are signaling molecules involved in the protective effect of PO₂ cycling during reoxygenation in smoking-induced COPD mice. **METHODS:** To develop COPD symptoms, male C57BL6 mice were exposed to cigarette smoking for two hr per day, five days a week for three consecutive months. The smoking mice were then sacrificed, and their diaphragm was dissected out for muscle function analysis. Each muscle strip was mounted in a contractile chamber treated either with 5 cycles of PO₂ cycling or with the respective inhibitors for ROS (Tiron, 1 mM; N-acetyl cysteine, NAC, 1 mM; n = 7) or AKT (MK-2206, 50 μM; n = 5) for 30 min before PO₂ cycling. Muscle was then switched to hypoxia for 30 min, followed by 15 min of reoxygenation. In the middle of reoxygenation (5-10 min), each muscle strip was electrically stimulated for five min using square-wave electrical pulses (70 Hz, 250-ms train duration, at 30 V) at 37 °C. Muscle force was recorded and end contractile force during the 5-min contraction was normalized by the maximal baseline force to represent muscle function. Control muscles followed the same protocol but in the absence of PO₂ cycling or inhibitor treatment. Data were expressed as mean ± SE and statistically compared using one-way ANOVA. **RESULTS:** Our data indicate that PO₂ cycling significantly improved diaphragm function during reoxygenation in smoking mice (18 ± 1.3% for PO₂ cycling vs. 8 ± 1.5% for control, p < 0.05). However, inhibition of either ROS or AKT abolished such protective effects on diaphragm (11 ± 2.5% for Tiron + NAC + PO₂ cycling; 6 ± 2.1% for AKT inhibitor + PO₂ cycling; 18 ± 1.3% for PO₂ cycling, p < 0.05). **CONCLUSIONS:** In smoking-induced COPD mice, we suggest that PO₂ cycling can improve the diaphragmatic function during reoxygenation potentially through the intracellular signaling of ROS and AKT.

107 May 29 11:00 AM - 11:15 AM

Does Acute Preprandial Exercise Attenuate Postprandial Airway Inflammation In Active Younger And Older Adults?

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(No relevant relationships reported)

Even a single high-fat meal (HFM) is associated with increased airway inflammation. While exercise may modify postprandial airway inflammation, the protective effect may be diminished by age. **Purpose:** To determine whether an acute bout of preprandial exercise attenuates postprandial airway inflammation in active younger and older adults. **Methods:** 8 younger active (YA: 23.5 ± 4.5 y/o) and 5 older active (OA: 64.8 ± 2.6 y/o) that habitually exceed physical activity (PA) guidelines completed two HFM sessions in a randomized order. In exercise + HFM (EX+HFM), subjects performed exercise at a heart rate of 65% VO_{2peak} to expend 75% of the caloric content of the HFM. In both sessions, subjects refrained from exercise for 48 hours prior to the HFM challenge (except for the exercise session in EX+HFM), and visited the lab after a 12-hour fast to consume the HFM (12 kcal/kg BW: 57% fat, 39% CHO, 4% protein). Triglycerides (TG) and exhaled nitric oxide (eNO) were measured at baseline, 2- and 4-hours post-HFM. **Results:** The mean eNO at baseline for the YA and OA was not significantly different (p=0.17). The increase in eNO from baseline to 2 hours in the HFM condition was 13.1 ± 26.9% and during the EX+HFM was 2.5 ± 11.6% in the YA adults, and was -1.2 ± 11.3% in the HFM alone and 10.8 ± 15.0% in the EX+HFM. However when analyzing all subjects together, the airway inflammatory response was not significantly different across time (p=0.08), by age (p=0.23), or by condition (p=0.80). There was a significantly greater TG response in the HFM condition compared to the EX+HFM condition in OA (p<0.05), which was also lower in the YA (p<0.05). **Conclusions:** With these preliminary analyses, airway inflammation does not appear to be altered by age or preprandial exercise, however the triglyceride response is modified by acute exercise and age.

Supported by 4-VA grant

A-23 Clinical Case Slide - Elbow and Wrist

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM
Room: CC-304E

108 **Chair:** Anne Allen, FACSM. *Allen Spine and Sports Medicine, Wilmington, NC.*

(No relevant relationships reported)

109 **Discussant**

Karen Newcomer, FACSM. *Mayo Clinic, Rochester, MN.*

(No relevant relationships reported)

111 May 29 9:30 AM - 9:50 AM

Unusual Wrist Injury Presentation in a Football Player

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(No relevant relationships reported)

HISTORY: 17-year-old high school football player presented for sideline evaluation with right wrist pain. The injury occurred when he was tackled and had his wrist twisted and caught under another player. His coach kept him in the game and after one more play, his teammates called out for medical attention. He had diffuse swelling and pain along the ulnar aspect of the distal forearm and wrist. He was placed in a volar splint and sent to the emergency department where x-ray imaging of the wrist was read by radiologist as normal. The athlete followed up in clinic four days later. He continued to have pain, restricted range of motion, and decreased strength. Review of systems was otherwise normal. Past medical history was unremarkable.

PHYSICAL EXAMINATION: Wrist examination showed moderate diffuse swelling but no ecchymosis or deformity. He had tenderness along the ulnar aspect of the distal wrist. There was no tenderness at the anatomic snuff box or scaphoid tubercle. Range of motion was limited in all directions, especially in supination. Strength was 4+/5 in all motions except for supination, which was 3+/5. Special tests including triangular-fibrocartilage complex grind, Watson's, and Finkelstein's were equivocal. Sensation to light touch was intact. Radial pulses were equally palpable bilaterally.

DIFFERENTIAL DIAGNOSIS: 1) Ulnar styloid or hook of hamate fracture. 2) Distal radioulnar joint injury. 3) TFCC injury. 4) Scapholunate or lunotriquetral dissociation.

TESTS AND RESULTS: Initial x-rays at ED were read as normal.

Repeat x-rays were concerning for volar ulna dislocation.

MRI without contrast showed volar dislocation of the ulna.

FINAL/WORKING DIAGNOSIS: Radioulnar joint dislocation with volar displacement of ulna.

TREATMENT AND OUTCOMES:

1. Orthopedic hand surgery referral. Given the length of time since initial injury, closed reduction was performed under general anesthesia.

2. Long arm cast with the forearm in supination position for 4 weeks. Repeat x-rays demonstrated maintenance of reduction. After cast removal, the patient returned to football with a removal wrist splint.

112 May 29 9:50 AM - 10:10 AM

Forearm Pain in a High School Weightlifter

Matthew Severson, Karen Newcomer, FACSM, David Soma.
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(No relevant relationships reported)

HISTORY: A 17 year-old left-handed high school senior baseball player with a history of Langerhans cell histiocytosis presented to the outpatient clinic with pain on the ulnar aspect of his proximal right forearm. The pain had developed over the course of 2 months after he had increased the intensity of his offseason weight training regimen. He first noticed the pain while performing a high volume of upper body lifting, specifically bicep curls; pain was most severe during weightlifting but now occurred even during non-lifting activities. The patient denied any constitutional or neurologic symptoms.

PHYSICAL EXAMINATION: Inspection was unremarkable. Examination revealed moderate tenderness approximately at the junction of the proximal to mid one-third of the right ulna. There was very mild tenderness over the proximal extensor tendons and muscle bellies on the right forearm. He had subtle pain over the ulna with resisted elbow flexion but otherwise normal, pain free range of motion and full strength in the right upper limb. Reflexes and sensation were normal.

DIFFERENTIAL DIAGNOSIS:

1. Muscle strain

2. Extensor tendinopathy
3. Bone tumor
4. Posterior interosseous nerve entrapment
5. Ulnar fracture
6. Exertional compartment syndrome

TEST AND RESULTS:

Right forearm AP and lateral x-rays: negative for fracture or bony abnormality
MRI right forearm without contrast: Incomplete intracortical stress fracture of the mid ulnar diaphysis

FINAL WORKING DIAGNOSIS:

Ulnar stress fracture

TREATMENT AND OUTCOMES:

1. Rest and avoidance of weightlifting or loading of the right upper extremity until follow up
 2. Due to patient reluctance to rest, right wrist/forearm brace while awake to remind him to rest the limb
 3. At 4-5 week follow-up, pain was completely resolved
 4. At that time he was instructed to gradually re-introduce weight-bearing exercises of the right upper limb as tolerated, beginning with isometric wrist strengthening followed by low intensity flexion/extension exercise before progressing to heavier lifts involving larger muscles groups and multi-joint movements
- Patient was able to return to all activities and declined physical therapy.

113 May 29 10:10 AM - 10:30 AM

Elbow Pain in an Adolescent Pitcher

Nicholas C. Canzanello, Brittany J. Moore, Karen L. Newcomer, FACSM. *Mayo Clinic, Rochester, MN.* (Sponsor: Dr. Karen Newcomer, FACSM)

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(No relevant relationships reported)

HPI

Patient is a 16 year old right-hand dominant male baseball pitcher with past medical history of partial tear of the right UCL and OCD of the right lateral trochlea managed with casting 9 months prior. He presented to our clinic with insidious onset right posterolateral elbow and arm pain 2 months after returning to pitching in summer baseball in May.

He described sharp pain in the right lateral elbow with radiation into the posterolateral arm exacerbated with push-ups and bench press. He noticed a painless popping sensation with elbow extension, but denied weakness or sensory changes. The pain was not specifically associated with baseball or pitching and was different from his previous pain.

PHYSICAL EXAM

Mild tenderness at right common extensor tendon origin worsened with 5 push-ups and improved with rest. Mild tenderness at right posterolateral triceps border. Slight weakness of the right triceps with pain. Varus and valgus stress caused no pain, but there was asymmetry with minimally increased laxity during valgus stress on the right. Negative extensor wad stress tests including Cozens, middle finger extension and Mills. No pain with flexor-pronator stretching. No pain with resisted pronation or supination.

DIFFERENTIAL DIAGNOSIS

1. Triceps tendinitis
2. Lateral epicondylitis
3. Radial nerve irritation
4. OCD radiocapitellar joint
5. Intraarticular loose body
6. Stress reaction/stress fracture distal humerus
7. Bony tumor/infection

TEST AND RESULTS

Right elbow non-contrast MRI- Bone marrow edema within the olecranon and distal humerus medially as a result of stress reaction from excessive valgus stress. Thickening of the UCL. Healed osteochondral lesion of the right elbow trochlea.

FINAL DIAGNOSIS

Valgus overload stress injury to distal humerus

TREATMENT AND OUTCOMES

3 months of rest from pitching followed by throwing progression via a pitching rehabilitation program. The program consists of focused strength training (RTC, scapular stabilizers) followed by normalizing throwing mechanics with gradual return to pain free baseball. We discussed with the patient the harmful effects on single sports athletes, particularly pitchers. We recommended he watch his pitch counts closely in the future (he admitted he hadn't been doing that) and take at least 2 months off of baseball during the year.

114 May 29 10:30 AM - 10:50 AM

Medial Elbow Pain - Recreational Athlete

Arie J. van Duijn¹, Shawn D. Felton². ¹*Florida Gulf Coast University, Fort Myers, FL.* ²*Florida International University, Miami, FL.* (Sponsor: Mitchell L Cordova, FACSM)

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(No relevant relationships reported)

HISTORY: 22-year female recreational athlete with history of left elbow pain following a fall on outstretched arm during a running/cutting activity. She noted immediate local pain of 7/10 on VAS and swelling of the medial elbow and forearm. She was unable to fully extend the elbow. **PHYSICAL EXAMINATION:** Edema was noted at the medial elbow, extending into the medial forearm. Palpation of soft tissues, tendon and bony structures revealed significant point tenderness at the medial joint space and at the medial epicondyle. Limited active ROM with extension was noted due to pain. Valgus stress test was positive, with significant discomfort upon moderate loading. Due to significant pain complaints, further physical examination was suspended and clinician progressed to point-of-care ultrasound imaging of the medial elbow complex. **DIFFERENTIAL DIAGNOSIS:** 1. Medical Collateral ligament sprain 2. Medial Collateral ligament disruption 3. Common Flexor Tendon Pathology 4. Pronator Teres Strain 5. Medial epicondyle avulsion fracture 6. Biceps tendon pathology. **TESTS AND RESULTS:** Bilateral ultrasound Imaging of the medial elbow complex revealed disruption of the ligamentous fibers of the UCL anterior band at the joint line. A large hypoechoic gap in the UCL is present, denoting the presence of significant fluid. Gravity valgus stress loading revealed a joint gap of 0.76cm compared to 0.38cm of the uninvolved side. **FINAL WORKING DIAGNOSIS:** Full thickness tear of the anterior bundle of the medial collateral ligament. **TREATMENT AND OUTCOMES:** Since the athlete did not participate in overhead throwing activities, conservative management approach was selected. ROM was limited 0-100 degrees initially to full ROM at 4 weeks post injury. Strengthening was initiated with initial emphasis on core and shoulder musculature, progressed to elbow and forearm musculature, including the flexor/pronator group as an active stabilizer against valgus forces. Patient was symptom-free at 4 months following injury, and ultrasound imaging revealed reduced valgus joint gapping. This case presentation illustrates the utility of ultrasound imaging in diagnosing MCL pathology, especially when physical examination is limited due to patient discomfort, and further illustrates the successful conservative management of a full thickness MCL tear.

115 May 29 10:50 AM - 11:10 AM

Acute Bilateral Elbow Pain In a College Volleyball Player

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(No relevant relationships reported)

History: A 19 year old college volleyball player presents to the athletic training room with chief complaint of bilateral elbow stiffness and swelling for one day. Her evaluation in the training room revealed mild decrease in elbow extension bilaterally with pain at terminal elbow extension. She was observed and treated conservatively with NSAIDs, compression wraps, over a two day period. Elbow swelling improved initially then began to track down the forearm. After day 2 of observation she continued to have muscle soreness and swelling. She denied abdominal pain, changes in urine color or decreased urine output. She was sent the Urgent Care for further evaluation of her symptoms.

Physical Exam: Vitals were normal during training room visits. Initial exam revealed tenderness to palpation over the flexor and extensor masses of the elbow as well as mild swelling. She had a slight decrease in active and passive elbow extension bilaterally and she exhibited pain at terminal elbow extension bilaterally. Flexion was preserved.

Differential Diagnosis: 1) Delayed Onset Muscle Soreness 2) Epicondylitis 3) Valgus Extension Overload 4) Olecranon Stress Fracture 5) Rhabdomyolysis 6) Exertional Compartment Syndrome 7) Olecranon Fossitis

Tests: CBC was within normal limits. Electrolytes were within normal limits.

Creatinine showed mild elevation. CPK was significantly elevated at 40,000 U/L

Final Working Diagnosis: Rhabdomyolysis

Treatment and Outcomes: The patient was admitted the hospital for a 4 day period for IV fluids and observation. Over the course of her hospitalization her CK levels were trended and she was released after CK levels were below 5,000 U/L. Her PCP continued to trend Creatinine levels after she was discharged and they continued to trend downwards. Two weeks after discharge she started on a 3 week gradual return protocol and she remained symptom-free. Follow up labs were drawn prior to her first match and showed only mildly elevated CK (230 U/L) with normal creatinine and GFR. She has been participating in matches at full capacity and remains asymptomatic.

116 May 29 11:10 AM - 11:30 AM

Management of a 58-Year Old Crossfit Athlete with Elbow Pain by Treating the Contralateral Hip RegionMegan L. Pfeffer, DACBSP, DC, ATC. *Voodoo Chiropractic, Nashville, TN.*

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(No relevant relationships reported)

MANAGEMENT OF A 58-YEAR OLD CROSSFIT ATHLETE WITH ELBOW PAIN USING MYERS FASCIAL LINESM. L. Pfeffer, DC, CCSP, ATC, *Voodoo Chiropractic, Nashville, TN***ABSTRACT**

HISTORY: 58 y/o male recreational CrossFit athlete presented with insidious left lateral elbow pain, progressing over several weeks and exacerbated by pull-ups and overhead barbell movements.

CLINICAL EXAMINATION: Patient had mild tenderness over the left lateral epicondyle, as well as moderate tenderness and increased tone in extensor group muscles. Gripping increased left elbow pain. No strength or neurological deficits were noted. Mill's Test was negative. Cozen's Test was positive for pain over the lateral epicondyle. **DIFFERENTIAL DIAGNOSES:** 1. Lateral Epicondylitis 2. Radial Tunnel Syndrome **TREATMENT & RESULTS:** Manual therapy to the forearm extensor group decreased local muscle tension, but had little to no effect on elbow pain following three visits. Stretching, contrast, and rest did not positively impact pain. Referencing the Myers Functional and Arm Lines, treatment of the thoracolumbar junction and right hip region by cupping, dry needling, and spinal adjustment were performed with noticeable improvement noted after the fourth visit. Following another similar treatment, the patient's condition resolved. **FINAL DIAGNOSIS:** Elbow pain secondary to fascial restriction along Myers Functional & Arm Lines **DISCUSSION:** Little has been published regarding the role of fascial lines in diagnosis or treatment of orthopedic injuries. Since local treatment appeared ineffective, looking elsewhere in the biomechanical chain was necessary. Both provocative movements increase lumbar extension if done improperly, creating compensatory dysfunction. Therefore, shoulder & thoracic mobility and core stability were also addressed to prevent future injury. While other factors may have contributed, it appears releasing seemingly unrelated fascial restrictions noticeably impacted the results.

A-24 Clinical Case Slide - Hip and Thigh II

Wednesday, May 29, 2019, 9:30 AM - 11:30 AM

Room: CC-306

117 **Chair:** Andrea Straccioli, FACS. *Children's Hospital Boston, Boston, MA.*

(No relevant relationships reported)

118 DiscussantAngela Smith, FACS. *Nemours Children's Health System, Bryn Mawr, PA.*

(No relevant relationships reported)

119 DiscussantRobert E. Sallis, FACS. *Kaiser Permanente Medical Center, Fontana, CA.*

(No relevant relationships reported)

120 May 29 9:30 AM - 9:50 AM

Atraumatic Left Thigh Mass In An Adolescent Multi-sport AthleteMark Riederer, C.S. *Mott Children's Hospital, Ann Arbor, MI.*

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(No relevant relationships reported)

Atraumatic left thigh mass in an adolescent multisport athlete

Mark F. Riederer, C.S. *Mott Children's Hospital/University of Michigan, Ann Arbor, MI*

HISTORY: A 14-year-old adolescent volleyball, baseball, and soccer athlete presents for evaluation of a two month history of left mid-thigh tightness, discomfort and bulge. Upon multiple attempts to elicit an injury mechanism, there was no single, discrete

injury that he can recall. He experiences some tightness when running. He denies feeling weak in the hip or knee. He denies any bruising. He can feel a hard mass in the location of his symptoms.

PHYSICAL EXAMINATION: He has a normal gait without limp. There is no visible swelling, bruising or deformities of the left thigh. Approximately over the mid to superior quadriceps there is an area of approximately 4 cm x 3 cm that is slightly indurated, non-tender but the patient reports it is uncomfortable to palpate. There is no fluctuance. There is no limitation or pain with active and passive range of motion at the knee or hip. Hip flexion and knee extension strength are a 4/5 without pain with resistance. The remainder of the physical examination is non-contributory.

DIFFERENTIAL DIAGNOSIS:

1. Quadriceps strain
2. Myositis ossificans
3. Quadriceps hematoma
4. Lipoma
5. Occult tumor

TEST AND RESULTS:

Initial imaging included plain radiographs, which did not show any acute or chronic osseous abnormalities. The soft tissues appear normal. Musculoskeletal ultrasound demonstrated a large hypoechoic defect within the rectus femoris muscle. An MRI showed a full-thickness tear of the indirect muscle of the rectus femoris, with a 1.5 cm craniocaudal gap/retraction of the indirect muscle at the myotendinous unit.

FINAL/WORKING DIAGNOSIS:

Full-thickness tear of the indirect head of the left rectus femoris tendon with retraction of the myotendinous unit

TREATMENT AND OUTCOMES:

Due to the fact that the patient was not very symptomatic, we recommended a trial of non-operative management. This included rest from sports and physical therapy to work on strengthening. Displeased with this plan, the family sought a second opinion from the team physician for a local Division I college volleyball team. In a telephone follow up conversation with the patient's mother, the team physician also recommended non-operative management.

121 May 29 9:50 AM - 10:10 AM

Thigh Pain In A Multi-sport Youth AthleteAloiya R. Earl, Brett C. Bentley, Earl R. Stewart. *The University of Alabama, Tuscaloosa, AL.*

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(No relevant relationships reported)

HISTORY: A healthy 10-year-old male multi-sport athlete experienced insidious onset of right thigh pain associated with limp for about one week prior to office presentation. The pain started during his school day and had progressively worsened over the week, which caused him to be unable to complete his baseball practices. The pain was worse with running and jumping. He did not have nocturnal pain, weight loss, or night sweats. Of note, he had an identical presentation about 8 months prior in his contralateral thigh which was diagnosed as a compression-sided stress fracture of his left femoral neck and treated conservatively. **EXAM:** Afebrile. Well-appearing. Limping gait. Lumbar spine exam WNL. Bilateral knee exam WNL. Left hip exam WNL. On exam of his right hip, he had tenderness diffusely in his proximal anterior and lateral thigh and over his AHS. He had full hip ROM but with pain at the extremes of flexion, IR, and ER. Strength of LLE WNL. Strength of RLE limited to 4/5 with hip abduction and hip flexion due to pain. Seated and supine log roll positive for pain. Unable to perform a single-leg hop on his right side. He had pain with bowing of his femur. Neurovascular examination of bilateral LE WNL. **DDX:** Acute synovitis, stress fracture, Legg-Calve-Perthes disease, SCFE, pathologic fracture **RESULTS:** XR pelvis 10/10/18: No apparent osseous abnormality. MRI right hip 10/11/18: Edema within the medial femoral neck, most likely stress-related. 10/15/18 CMP, PTH, TSH, Vit D: WNL. **FINAL/WORKING DIAGNOSIS:** Compression-sided stress reaction of the right femoral neck, which was his second stress injury within 8 months, the first being in his left femoral neck **TREATMENT/OUTCOME:** The patient was treated for his second stress injury with conservative management again. He was instructed to be NWB with crutches for 6 weeks, after which he would have a follow up visit and if doing well clinically and radiographically, would progress to partial protected weight bearing and formal PT to transition back to sport. Given his normal lab workup, he was also referred to an orthopedic hip specialist to evaluate for possible biomechanical contributions to abnormal stress through the femoral neck or connective tissue disorders. His sports schedule was reviewed. Multi-sport participation was encouraged, but with a 3-month consecutive break during the year.

122 May 29 10:10 AM - 10:30 AM

Insidious Onset of Thigh Swelling After Trauma in a Triathlete

Alexander Jason Bressler¹, Hanh Larson², Robert Sallis, FACSM¹. ¹Kaiser Permanente, Fontana, CA. ²Pomona Valley Hospital Medical Center, Pomona, CA. (Sponsor: Robert Sallis, FACSM)

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(No relevant relationships reported)

HISTORY A 78-year-old female triathlete presented to clinic to follow-up on injuries sustained during a cycling accident. Evaluation in the ED on the day of injury showed facial bone fractures and small peripheral parenchymal hematomas in the right frontal and temporal lobes for which she had follow-up scheduled. In clinic two days later, she complained of pain and bruising over her right hip. She was diagnosed with an abrasion and contusion of the right hip and treated with ice and NSAIDs. She returned four weeks later with worsening right hip pain, described as constant, throbbing, non-radiating, and worse with weight-bearing. It was associated with swelling and a tender mass that had developed gradually over the right hip. She denied fevers or chills.

PHYSICAL EXAMINATION Vitals were normal at both visits. Initial exam of the right hip showed a large abrasion, mild ecchymosis, and tenderness. She had full range of motion without pain or edema. She also had normal balance and gait. Four weeks later, the right hip had a 15 x 17 cm, warm, tender mass over the lateral aspect of the thigh, without erythema. FABER and FADIR were negative, and muscle strength, pulses, and sensation were normal. The abrasion was well-healed. **DIFFERENTIAL DIAGNOSIS** 1. Hematoma 2. Contusion 3. Bursitis 4. Abscess 5. Neoplasm **TESTS AND RESULTS** CBC was normal. Radiographs of right hip were negative for fracture or soft tissue abnormalities. MRI of the right lower extremity showed a heterogeneous fluid collection measuring 22 x 4 x 6 cm (H x W x D, 528 cc) overlying the right hip with small internal foci of hemorrhage/debris, and peripheral rim enhancement without any areas of internal enhancement. **FINAL WORKING DIAGNOSIS** Morel-Lavallée lesion **TREATMENT AND OUTCOMES** The patient underwent aspiration, doxycycline sclerotherapy, and percutaneous drainage. Post-procedure US was negative for any significant fluid collection. Repeat MRI three weeks after the procedure showed incomplete resolution/recurrence of the lesion measuring 20 x 1.5 x 2.8 cm (84 cc). The patient had follow-up with orthopedics and elected for conservative treatment with compression dressings. She returned to triathlon training and has subsequently completed a 100-km bike race at 6 months post injury.

123 May 29 10:30 AM - 10:50 AM

Hamstring Pain - Biker

Kathleen Shaughnessy, Sean M. Harris. *Memorial Hermann, Houston, TX.*

(No relevant relationships reported)

HISTORY: A 53-year-old male reports to physical therapy with L posterolateral thigh pain. Three years prior, pt's spring ligament popped and required surgical reconstruction. During the patient's surgery, he had a nerve block to the lateral hamstring. Patient completed necessary therapy and attempted to return to exercise. Following attempts at exercising, patient reported sporadic symptoms of leg weakness. Patient has had two normal nerve conduction tests as well as a normal MRI of the back, knee, and hip. At initial evaluation, patient is unable to bike or run, and describes symptoms of localized weakness and achiness post-exercise.

PHYSICAL EXAMINATION:

Posture normal, no apparent gait deviations. Pain localized to the distal lateral hamstring. Full, pain-free lumbar spine, hip, and knee AROM and overpressure. Gross LE strength testing within normal limits except for L hamstring (3+/5). Dynamometer reading R: 38lbs, L 25lbs. Contraction did not reproduce patient's pain. Symptoms present with elongation of L hamstring muscle. Deep squat limited by "tightness" in L calf.

DIFFERENTIAL DIAGNOSIS:

1. Distal Peripheral Nerve Entrapment
2. Hamstring Tendinopathy
3. Mechanical Dysfunction

TESTS AND RESULTS:**Neural Tissue Testing:**

- Positive slump test
- Painful arc of motion: Patient had symptoms at 40 degrees short of vertical that dissipate once patient's leg was lifted to 35 degrees
- Positive straight leg testing
- Reflexes were within functional limits

FINAL/WORKING DIAGNOSIS:

Distal peripheral nerve entrapment of mechanical nature.

TREATMENT AND OUTCOMES:

- 5 physical therapy sessions over 5 weeks
- Ergonomic desk set up
- Sciatic nerve sliders from slump position
- Progressive hamstring strengthening

- Aerobic circuit training
- Dry needling
- Two needles were inserted into the short head of the biceps and laterally to where the nerve runs.
- Improved LEFS from 60 to 80 in 5 weeks
- Neural symptoms normalized at 3 weeks
- Hamstring strength improved to 37lbs at 4 weeks (per dynamometer)
- Return to running/biking activities at 5 weeks

124 May 29 10:50 AM - 11:10 AM

Thigh Pain in a Baseball Player

Valerie Rygiel, Hallie Labrador. *NorthShore/University of Chicago, Chicago, IL.* (Sponsor: Carrie A. Jaworski, FACSM)

(No relevant relationships reported)

HISTORY:

Patient is a 14 year old male who presented to sports medicine clinic for evaluation of three weeks of right quadriceps pain that began while running during baseball practice. He was initially prescribed physical therapy for a presumed right quadriceps strain but on follow up two months later he continued to have pain with activities as well as a deformity in his right thigh that was growing in size.

PHYSICAL EXAMINATION:

On exam patient was well appearing, his right quad had no erythema or ecchymosis. He had a palpable mobile mass in the mid-thigh that was nontender to palpation but protruded with resisted knee extension. The remainder of the quadriceps muscle belly was nontender. His lower extremity strength and sensation were preserved.

DIFFERENTIAL DIAGNOSIS:

1. Quadriceps tear with retraction
2. Normal anatomic variant
3. Fascial herniation
4. Soft tissue mass

TEST AND RESULTS:

XRAY Right Femur: No acute fracture

MRI Right Femur w/wo Contrast: Grade 1 strain of rectus femoris muscle at the myotendinous junction, suggesting intramuscular degloving mechanism.

FINAL WORKING DIAGNOSIS:

Rectus Femoris intramuscular degloving injury

TREATMENT AND OUTCOMES:

The patient continued to work with physical therapy and was able to slowly reintroduce sport specific activities over the next month without recurrence of pain. His deformity has reduced significantly in size.

125 May 29 11:10 AM - 11:30 AM

Thigh Injury- Lacrosse

Timothy O. Boone, Jr.. *University Of Maryland, Baltimore, MD.*

(No relevant relationships reported)

HISTORY: 20 year old sophomore lacrosse player sustained an acute injury to his right thigh while playing football during his senior year of high school. At that time, patient had reported immediate swelling of the thigh but had a delay in presentation to an outside sports medicine physician for about 3 months. Patient completed medical therapies outside of the recommendation of the sports medicine physician which allowed patient to play lacrosse during his senior year and throughout his freshman season of college. When completing off season workouts during his sophomore year, he complained of focal pain at his right thigh with his right knee giving out.

PHYSICAL EXAMINATION: His initial examination revealed a palpable mass over the right thigh with mild tenderness. When presenting 2 years later, his exam revealed no abnormality on inspection but there was a deep, immobile, non-tender palpable growth over anterior right femur with full range of motion of the right knee, hip and back.

DIFFERENTIAL DIAGNOSIS: 1. Heterotopic Ossification 2. Parosteal osteosarcoma

TEST AND RESULTS:

1. Right Femur X-ray (1/9/2017): 15.8 x 4.8 cm soft tissue calcification overlying the proximal femoral diaphysis with a 1.6 x 0.6 cm bone island in the distal femur.
2. Right Femur X-ray (9/18/2018): 13.9 x 1.8 cm matured soft tissue calcification over the anterior lateral aspect of the femur with 1.3 cm oval sclerotic density in the distal femoral metaphysis
3. MRI right thigh(10/2/2018): Mature heterotopic ossification that is contiguous with the anterolateral femoral diaphysis. Heterotopic ossification extends within the vastus intermedius muscle and measures 1.5cm x 6cm x 13cm.

FINAL/WORKING DIAGNOSIS: Mature heterotopic ossification of the right thigh

TREATMENT AND OUTCOMES:

1. Referred for surgical resection of the mass from right thigh due to symptoms, which was completed 1 month after secondary presentation
2. Immediately after surgical intervention, patient was allowed partial eight bearing x 1-weeks with knee locked in full extension and will continue Indomethacin for a total of 6 weeks

3. Patient about 7 days after from surgical intervention, patient advised by surgeon to begin work with physical therapy to wean off crutches and out of brace to work on knee ROM and quadriceps activation
4. Pathology results pending at this time

A-25 Clinical Case Slide - Knee I

Wednesday, May 29, 2019, 9:30 AM - 11:10 AM
Room: CC-105B

126 Chair: William W. Dexter, FACSM. *Maine Medical Center, Portland, ME.*

(No relevant relationships reported)

127 Discussant

Bryan Wiley. *Kaiser Permanente, Rancho Cucamonga, CA.*

(No relevant relationships reported)

128 Discussant

Beverly C. Land, FACSM. *US Army Retired, Fairfax, VA.*

(No relevant relationships reported)

129 May 29 9:30 AM - 9:50 AM

Knee Pain - Baseball

Scott Goldberg, John H. Stevenson, Lee Mancini. *University Of Massachusetts, Worcester, MA.*

(No relevant relationships reported)

HISTORY: A 16 year old high school hockey player and baseball pitcher noticed lateral knee pain and intermittent swelling for about 2 months prior to presentation. He does not recall any trauma or injury. He did have a viral URI and episode of strep pharyngitis several weeks before this started. He denies radiation of the pain. He does note some catching and locking sensation of the knee. He feels that his knee flexion is limited. He treated the knee with ice, ibuprofen, and acetaminophen through the season and was able to complete his baseball season prior to presenting to his PCP for evaluation. Because no definite etiology was identified in this visit, MRI was ordered, which showed complex loculated effusion, enlarged popliteal lymph nodes, and synovial thickening. There were no structural injuries appreciated.

PHYSICAL EXAMINATION: Initial exam in the sports medicine clinic revealed tenderness at the lateral joint line and 1+ knee effusion. There was no erythema or warmth at the joint. He had full active and passive range of motion and full strength. Ligamentous testing was normal.

DIFFERENTIAL DIAGNOSIS:

PVNS

Rheumatologic condition

Lymphoma/Leukemia

Lyme disease

Traumatic hemarthrosis

TEST AND RESULTS:

Repeat MRI with additional views: Complex loculated effusion; Synovitis/synovial proliferation; No hemosiderin staining with blooming artifact

Joint aspiration: 20 cc cloudy yellow synovial fluid; TNC 37,270, Neutrophils 73%

Cytology: No malignant cells

ANA: 1:80 homogeneous

Rheumatoid Factor: Negative

Lyme: Negative

ESR: 9

CRP: 21.8

CBC: WBC 5.9, Hgb 15.5, Hct 45.4, Plt 287

FINAL WORKING DIAGNOSIS: Juvenile idiopathic arthritis (JIA)

TREATMENT AND OUTCOMES:

Referred to pediatric rheumatologist

Bilateral knee aspiration and corticosteroid injection

Prednisone taper

Methotrexate therapy

Check anti-CCP antibodies

Referred to ophthalmology to rule out uveitis

130 May 29 9:50 AM - 10:10 AM

Knee Pain- Football

Megan Liberty¹, Jason Read². ¹*University of Florida College of Medicine- Jacksonville, Jacksonville, FL.* ²*Nemours Children's Specialty Care, Jacksonville, FL.*

(No relevant relationships reported)

HISTORY: A 14-year-old male football player presented to our sports medicine clinic complaining of left knee pain and swelling. Onset of knee pain was 2 months prior and he began to complain of intermittent swelling over the last 3-4 weeks prior to this initial visit. There was no reported history of trauma or injury. Pain worsened with activity and was localized to his anterior knee and medial joint line. NSAIDs and a knee brace did not alleviate his symptoms. He denied any associated knee instability, popping, locking or patellar instability. Neurological signs and symptoms were absent. Review of systems was otherwise negative. **PHYSICAL EXAMINATION:** Examination revealed a moderate sized left knee effusion with tenderness to palpation around the patella and medial joint line. There was no ecchymosis or erythema. Strength exam was normal. Knee range of motion was decreased in both flexion and extension secondary to swelling. There was pain on patellofemoral grind test with a negative patellar apprehension test. He had a negative Lachman and McMurray test. Anterior and posterior drawer tests were also negative. No ligament laxity was appreciated with varus or valgus stress testing. Examination of the contralateral knee was normal. He was otherwise well appearing with a normal gait. **DIFFERENTIAL DIAGNOSIS** 1. ACL tear 2. Meniscus tear 3. Fracture 4. Juvenile idiopathic arthritis 5. Osteochondritis dissecans **TESTS AND RESULTS** 3 view x-rays of left knee were obtained and normal. MRI revealed distal femoral osteomyelitis with associated intraosseous and subperiosteal abscess with deep posterior knee soft tissue abscess. CBC showed WBC 11.7, Hgb 10.5, Hct 32.2, Platelets 576. CRP 9.45mg/dL, ESR 57mm/hr. **FINAL/WORKING DIAGNOSIS** Osteomyelitis of the left distal femur with intraosseous and subperiosteal abscess **TREATMENT AND OUTCOMES** 1. Taken to the OR for incision and drainage 2. Cultures returned positive for oxacillin sensitive staphylococcus aureus. Pediatric infectious disease was consulted. A PICC line was placed and he completed a 6-week course of IV clindamycin. 3. Follow up x-rays taken 1-month post-op were normal 4. A full return to sports is expected.

131 May 29 10:10 AM - 10:30 AM

Knee Injury - Trampoline

Sabrina P. Sawlani, Brian McCall, Brian J. Donohue. *Presence Resurrection Medical Center, Chicago, IL.* (Sponsor: Poonam Thaker, FACSM)

(No relevant relationships reported)

HISTORY: 21-year-old male presents to ER for left knee injury after mis-landing a flip while jumping on a trampoline. He hyperextended his left leg, felt a pop and severe pain with numbness of left foot. Notable deformity which self-reduced.

PHYSICAL EXAMINATION: LLE: Ecchymoses and edema of distal thigh, knee and proximal leg. ROM- active and passive knee flexion and extension limited due to pain. DP/PT pulses nonpalpable, capillary refill mildly delayed, and cooler to touch distally. Diminished sensation of dorsomedial foot and lateral leg. Unable to extend toes or dorsiflex ankle. Exam under anesthesia with positive Lachman, anterior drawer, posterior drawer and varus stress tests.

DIFFERENTIAL DIAGNOSIS:

1. Knee dislocation with vascular compromise and peroneal nerve injury
2. Anterior cruciate ligament tear
3. Posterior cruciate ligament tear and posterolateral corner injury
4. Lateral collateral ligament rupture
5. Meniscus tear
6. Tibial plateau fracture
7. Distal femur fracture

TEST AND RESULTS:

-XR L Knee 4+ Views: Medial tibial condyle possible fracture.

-CT Angiogram LLE: Popliteal artery severe stenosis at level of tibial plateau.

Comminuted medial tibial plateau fracture.

-Diagnostic angiogram: Cut-off of popliteal artery at level of knee, unable to cross with stent.

FINAL WORKING DIAGNOSIS: Left knee dislocation with popliteal artery rupture and left medial tibial plateau fracture

TREATMENT AND OUTCOMES:

1. Emergent vascular surgery with ligation of L popliteal artery and repair of transected L popliteal artery with reverse saphenous vein interposition graft.
2. Orthopaedic Surgery external fixator placement and fasciotomies with skin closure to prevent possible reperfusion injury/compartiment syndrome.
3. 2 weeks post-injury, ORIF medial tibial plateau and replaced ex-fix. Delayed ligament reconstructions unnecessary due to ligaments remain stable.
4. 6 weeks post-injury, removal of L leg external fixator. Nonweightbearing and in physical therapy.
5. 3 months post-injury, EMG for persistent foot drop with severe L peroneal neuropathy at knee.

6. 4 months post-injury, ambulating.
 7. 8 months post-injury, referred to peripheral nerve surgery specialist for decompression of L common peroneal nerve at fibular head, and excision of posterior and anterior crural intermuscular septae.

132 May 29 10:30 AM - 10:50 AM

Postoperative Knee Complication - Soccer

Kathleen Maguire, Lyle Micheli, FACS. *Boston Children's Hospital, Boston, MA.* (Sponsor: Lyle Micheli, FACS)

(No relevant relationships reported)

History:

17 year old female status post left ACL reconstruction with hamstring autograft presents one week after surgery with pain and swelling over posteromedial knee. A blood blister was noted and drained. She started on Keflex to prevent superficial wound infection. The following day she returned in exquisite pain with skin discoloration and formation of a collection over the posteromedial knee. This was presumed to be an infected hematoma and she was taken to the operating room for a postsurgical knee washout.

Physical Examination:

Examination noted an abscess at the popliteal fossa medially with surrounding erythema. The area over this collection was warm and tender to touch. The patient had no calf pain or swelling.

Differential Diagnosis:

1. Hematoma
2. Knee infection, bacterial or fungal
3. DVT
4. Contact dermatitis
5. Hemophagocytic lymphohistiocytosis (HLH)
6. Still's disease
7. Pyoderma gangrenosum
8. Behcet's

Tests and Results:

1. Single OR tissue culture positive for *s. hominis* and *p. acnes* early in hospital course, subsequent OR cultures negative for growth
2. Multiple blood cultures negative for growth
3. OR tissue biopsy shows marked neutrophilic infiltrate and abscess formation, clinically consistent with pyoderma gangrenosum (PG)

Final Working Diagnosis: Pyoderma gangrenosum

Treatment and Outcomes:

1. Surgery: 19 combined orthopedic and plastic surgery procedures including irrigation and debridement, wound VAC changes, and skin grafting of left knee
2. Infectious Disease (ID): Multiple courses of antibiotics for presumed left knee postoperative infection. Antibiotics discontinued once PG diagnosis was established
3. Hematology: PICC related DVT treated with anticoagulation, anemia managed with transfusions
4. Rheumatology/Dermatology: Due to the patient's highly elevated inflammatory markers, coagulopathy, anemia, and repeated procedures without significant detectable pathogenic organism, there was concern for an immune-mediated systemic inflammatory response. OR tissue biopsy supported this diagnosis. The patient was started on prednisone and Anakinra and the antibiotics were discontinued
5. She completed her course of anticoagulation, weaned off steroids and immunosuppressive medication and has had no recurrent symptoms

133 May 29 10:50 AM - 11:10 AM

Unexpected Knee Pain in a Young Field Hockey Player

Terrence Tsui, John Herbert Stevenson. *University of Massachusetts, Worcester, MA.* (Sponsor: Pierre Rouzier, FACS)

(No relevant relationships reported)

HISTORY: A healthy 12-year-old-female field hockey player presented with 2 weeks of left knee pain that began while she was running in a straight line going into a game. She denied trauma to her knee and did not previously have knee pain. She suddenly felt a severe sharp pain localized to her proximal tibia and had trouble ambulating due to pain. She took ibuprofen, iced, and rested for a few days and was able to ambulate with minimal pain afterwards. She tried returning to practice but still had significant pain with running and stairs so was referred to sports medicine clinic by her PMD for further evaluation. Denied knee swelling, buckling, and locking. Denied numbness and tingling in her leg.

PHYSICAL EXAMINATION:

Left knee exam: Full ROM, 5/5 strength in knee flexion and extension, negative effusion, TTP immediately medial to the tibial tuberosity and over the medial tibial plateau, negative varus/valgus stress test, negative anterior and posterior drawer test, negative Lachman's test, negative McMurray's test, negative patella facet tenderness, negative grind test.

DIFFERENTIAL DIAGNOSIS:

Osgood-Schlatter disease
 Pes anserine bursitis
 Salter-Harris fracture
 Tibial plateau stress fracture
 Proximal tibial fracture
 Bone contusion

TESTS AND RESULTS:

Labs: Vit. D 25-OH level low, normal PTH and TSH levels
 Left knee XR: No acute fracture or other osseous abnormality detected.
 Left tibia/fibula: No acute fracture or other osseous abnormality detected.
 Left knee MRI: Transverse undisplaced fracture of the proximal tibial metaphysis.
 DEXA scan: WNL

FINAL WORKING DIAGNOSIS:

Left knee pain secondary to a transverse undisplaced fracture of the proximal tibial metaphysis.

TREATMENT AND OUTCOMES:

Non-weightbearing with crutches for 6 weeks, PT
 Ice and acetaminophen for pain
 Vit. D supplementation
 Improvement in pain at 3 week FUV and complete resolution of pain at 6 week FUV
 Started weight-bearing after 6 week FUV with gradual increase in weight-bearing activities and eventually back to field hockey

A-26 Rapid Fire Platform - Biomarkers in Sport, Performance and Health

Wednesday, May 29, 2019, 9:30 AM - 10:50 AM

Room: CC-Hall WA2

134 **Chair:** William Byrnes, FACS. *University of Colorado Boulder, Boulder, CO.*

(No relevant relationships reported)

135 May 29 9:30 AM - 9:40 AM

Relationship Between Hepcidin, Interleukin-6, And Ferritin In Division-I Cross-country Runners Over A Competitive Season

Jesse A. Goodrich¹, Sewan Kim¹, Dillon J. Frisco¹, Kimberly Detwiler¹, Miguel Rueda¹, Sourav Poddar², William C. Byrnes, FACS¹. ¹*University of Colorado Boulder, Boulder, CO.*

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(No relevant relationships reported)

Iron deficiency, which can be assessed by the iron storage protein ferritin (fer) can negatively affect athletic performance. We have previously observed that Division I cross country (XC) runners have fer levels that are at the low end of normal ranges despite being iron supplemented. The hormone hepcidin and the cytokine/myokine interleukin-6 (IL6) can both influence iron regulation but have not been evaluated in this population.

Purpose: The purpose of this study was to determine how hepcidin and IL6 change over a season in DI XC runners and determine whether changes in these parameters were related to changes in fer, hemoglobin concentration (Hb) or hematocrit (Hct).

Methods: 45 athletes (25 female, 20 male) were recruited from the University of Colorado DI XC team in the fall of 2017. Fasted blood samples were collected in October (before NCAA XC championships), January, and March (during the outdoor track season). Blood samples were analyzed for Hb, Hct, fer, IL6 and hepcidin. All runners were provided with oral iron supplements from a certified nutritionist during this period.

Results: All biomarkers remained stable across the season except Hb, which was significantly higher in March. In males vs. females, there were no differences in hepcidin (24 ± 11 vs. 21 ± 11 ng/mL; $p > 0.05$) or IL6 (16 ± 21 vs. 12 ± 24 pg/mL; $p > 0.05$). When compared to females, males had higher fer (64 ± 33 vs. 47 ± 24 ng/mL; $p < 0.05$), Hct (48 ± 2 vs. 44 ± 3 %; $p < 0.001$), and Hb (16.3 ± 0.7 vs. 14.8 ± 0.8 g/dl; $p < 0.01$). After controlling for sex, there was a positive relationship between hepcidin and fer ($r = 0.47$, $p < 0.01$); 20% of the variability in fer was explained by hepcidin and 51% was explained by individual variability. There were no relationships between IL6 and hepcidin or IL6 and fer.

Conclusion: Despite a consistent iron supplementation regime, hepcidin, IL6 and fer do not seem to systematically change across a season in collegiate runners. As expected, hepcidin and fer were positively related, but there were no relationships between IL6 and other measured parameters. Although fer was at the low end of

normal for both men and women, all other parameters were normal at all time points, suggesting that the normal range of force for endurance athletes may be lower than the general population.

136 May 29 9:40 AM - 9:50 AM

Patterns Of Change In Proteomic Markers Of Overreaching In Collegiate Swimmers

Amy M. Knab¹, David C. Neiman, FACSM², Arnold J. Groen³, Artyom Pugachev³, Alexander Rakitko⁴, Ariel E. Blount¹, McKenzie Stevens¹, Lola Bulatova¹. ¹Queens University of Charlotte, Charlotte, NC. ²Appalachian State University, Boone, NC. ³Proteomics Biosciences, Berlin, Germany. ⁴Lomonosov Moscow State University, Moscow, Russian Federation. Email: knaba@queens.edu

(No relevant relationships reported)

Using global proteomic analysis, a previous study identified a panel of proteins that were linked to FOR and were associated with the acute phase response and innate immune system activation in athletes. **PURPOSE:** The purpose of this study was to track changes in this panel of proteins in 35 swimmers during the course of their normal training cycles during the 2017-2018 competitive season, and then identify relationships between protein expression data, external markers of overreaching (such as training distress scale (TDS)) and academic stress and performance. **METHODS:** Thirty-five NCAA Division II swimmers were recruited to the study (male n=19, female n=16; Age 19.1±1.6 y). Every Monday prior to morning practice, athletes provided a blood sample (via fingerpick) using the Volumetric Absorptive Micro-sampling (VAMS) technology. Athletes also reported TDS, illness, and RPE. **RESULTS:** Thirty-five swimmers completed the protocol (body fat, males = 12.6±5.1%, females 22.6±4.5%; VO_{2max} males = 55.8±5.10, females = 48.1±6.7 ml/kg/min). 1) GLMM on each protein taking week numbers as factor showed that protein levels after Bonferroni correction and tukey test were significant (p-values < 0.05) in selected weeks. 2) In the next step, the weeks were labelled based on objective events or no-events (exams, competitions, exams+competitions, baseline, no-events). LDA analysis including TDS, RPE and illness data was performed, and this analysis separated the baseline week significantly (p-value 0.000972) from exam weeks and weeks with both exams and competitions. 3) Adding protein expression data enhanced this separation between these groups of weeks (p-value 2.237e-05). 4) Protein expression data without metadata gave clear separation between these groups of weeks (p-value 1.435e-07). We were also able to use protein expression data to predict the week groups with an accuracy of 69-73%. **CONCLUSIONS:** Protein expression data shows a separation of baseline, exams and exams + competition time frames indicating a distinct physiologic response to external academic and performance stress. Use of protein expression data, albeit so far to a modest extent, to predict stress levels of the swimmers under these circumstances deserves further study.

137 May 29 9:50 AM - 10:00 AM

The Association Between Sonographic Metrics of Shoulder Injury and Serum Biomarker Profile in Response to a Hand-Cycling Task

Prakash Jayabalan¹, Dhruval Amin², Hyungtaek Kim¹, Julia Fram³, Yen-Sheng Lin¹, Jennifer Soo Hoo⁴. ¹Shirley Ryan AbilityLab, Chicago, IL. ²Rosalind Franklin University, Chicago, IL. ³Northwestern Feinberg School of Medicine, Chicago, IL. ⁴Weill Cornell Medicine, New York, NY. Email: pjayabalan@sralab.org

(No relevant relationships reported)

PURPOSE:

Providing the physician the means of screening for 'at risk' individuals for shoulder pathology would be of benefit in the development of treatment strategies and counseling manual wheelchair users (MWC), who have a high incidence of shoulder pain. The objective of this study is to compare the sonographic and biomarker changes at baseline and following a shoulder related functional task in individuals who are able bodied (AB) versus manual wheelchair MWC. **METHODS:** MWC users (with prior spinal cord injury, n=6) and age-matched AB individuals (n=7) performed a 30-minute hand-cycling task on a stationary, recumbent hand-cycle with standardized increasing resistance during this time-period. Pre- and post hand-cycling, subjects reported their shoulder pain using the visual analog scale, and underwent a physical examination. They also had a standardized sonographic assessment, including assessment of the acromioclavicular distance (AHD), reduction in which is associated with pathology and tendon cross sectional area, and blood/serum measurement of specific biomarkers of cartilage turnover (COMP), inflammation (TNF- α , IL-1 β), cartilage degradation (MMP-1) and collagen type-1 (CTX-1) breakdown.

RESULTS: There was no significant difference in physical examination and pain related metrics post hand-cycling. However, there was a significant reduction in the AHD in the neutral positions (p=0.045) and 60 degrees of passive abduction (0.047) in the dominant arm compared to baseline in both groups. MWC users had significantly

higher baseline concentrations of IL-1 β (p=0.047) compared to AB. Irrespective of group, following 30 minutes of hand-cycling, there was also a significant increase in MMP-1 (p=0.013). Across time-points there was a positive correlation between the CTX-1 concentration in the serum and the AHD in the subject's dominant arm (r=0.7, p=0.03).

CONCLUSIONS:

Ultrasound metrics and certain biological markers are potentially sensitive to anatomic and physiologic changes that may occur in response to a functional shoulder task more so than patient report of symptoms or physical examination. Further delineation of the changes seen in this study could aid in the development of a shoulder evaluation protocol that highlights 'at risk' individuals for shoulder pathology.

138 May 29 10:00 AM - 10:10 AM

Are Molecular Deficits Relevant to Concussion Present in Collegiate Football Players Entering the NFL Draft?

Laura J. Kunces¹, John Keenan², Amanda Carlson-Phillips², Michael A. Schmidt³, Caleb M. Schmidt³, Zung V. Tran⁴.

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(No relevant relationships reported)

PURPOSE: Factors that influence individual susceptibility to brain acceleration forces or poor outcomes in brain injury are not well understood. Characterization of molecular variants in athletes entering a highly competitive contact environment may provide additional insight into factors that influence the longitudinal follow-up of concussion incidence and its trajectory. We examined the metabolic phenotype of collegiate football players entering the 2016 National Football League (NFL) draft. The principal aims were to observe and characterize the molecular status of individual athletes and to quantify the prevalence of athletes with multiple concurrent molecular deficits. These will serve as baseline measures, as concussion incidence and trajectory of this cohort of athletes is followed in their NFL careers. **METHODS:** Blood samples were taken from 30 elite American collegiate football players seven weeks before the NFL scouting combine, and 15 weeks before entering the NFL draft. **RESULTS:** Of 74 analytes, results revealed mean undesirable values in Omega-3 Index (4.66%), AA:EPA fatty acid ratio (29.13), homocysteine (11.4 μ mol/L), vitamin D (30 ng/mL), and magnesium (4.1 mg/dL). Using reference ranges optimized for athletic performance, no athlete had 0, 1 or 2 abnormalities in blood values; 10% had 3, 40% had 4, and 50% of athletes had 5 undesirable values. **CONCLUSIONS:** Molecular deficits in this cohort entering the NFL draft appear to be common. Historical evidence exists showing that the molecular deficits observed in this study have mechanistic correlations with concussion trajectory and outcome. A more thorough examination of molecular features that contribute to poor outcomes in concussion may open the door to precision nutrition and clinical countermeasures, not only in football, but in any sport in which acceleration forces to the brain may be present. Supported by WellnessFX

139 May 29 10:10 AM - 10:20 AM

Associations Between Circulating Basal BDNF, IGF-1 and Physical Fitness

Heikki Kyröläinen, FACSM¹, Matti Santtila², Kai Pihlainen³, Jani Vaara². ¹University of Jyväskylä, Jyväskylä, Finland. ²National Defence University, Helsinki, Finland. ³Finnish Defence Forces, Helsinki, Finland.

(No relevant relationships reported)

Exercise-induced increase in circulating insulin-like growth factor 1 (IGF-1) levels might stimulate brain-derived neurotrophic factor (BDNF) expression. Thus, circulating IGF-1 can travel from the periphery to the brain and there stimulate the expression of BDNF and facilitate long-lasting changes in neural activity. It has been shown that chronic training leads to upregulation of basal levels of both BDNF and IGF-1. Several longitudinal studies have also shown that aerobic exercise acutely elevates circulating BDNF levels in humans. **PURPOSE:** To investigate associations of peripheral BDNF and IGF-1 with several physical fitness components at rest. **METHODS:** 792 adults (26±6 yr) men participated. BDNF and IGF-1 concentrations were analyzed from venous blood samples using an ELISA Assay (Human BDNF ELISA kit, ScienCell Research laboratories, San Diego, California) and Dynex DS 2 ELISA processing system (Dynex Technologies, Chantilly, Virginia). Cardiorespiratory fitness (VO_{2max}) was determined using an indirect graded cycle ergometer test until exhaustion. Bilateral maximal isometric leg (MVCleg) and arm extension forces (MVCarm) were measured using dynamometers. Muscular endurance tests consisted of repeated 1-min push-ups and sit-ups, while standing long jump assessed muscular power. **RESULTS:** The mean±SD BDNF and IGF-1 concentrations were 15.20±3.96 ng/mL, 25.0±6.9 nmol/L, respectively, while VO_{2max} was 41.1±8.8 mL/kg/min, MVCleg 3394±933 N, MVCarm 871±216 N, push-ups 28±14 reps/min, sit-ups 35±12 reps/min, standing long jump 227±26 cm. BDNF and IGF-1 correlated weakly with each

other ($r=-0.146$, $p=0.003$). Linear regression analysis (adjusted for age, smoking and education) revealed that associations between BDNF and physical fitness were weak for $\text{VO}_{2\text{max}}$ ($\beta=-0.077$, $p=0.006$) and muscle fitness ($\beta=-0.077$, $p=0.895$). This was also the case for IGF-1. **CONCLUSIONS:** The associations between peripheral BDNF, IGF-1 and physical fitness components were weak or non-existent at rest in the present cross-sectional design. Thus, it seems that only exercise-induced elevated values of BDNF and IGF-1 may associate with each other and physical fitness components. Therefore, their interactions should be investigated in future studies during acute and / or chronic exercises.

140 May 29 10:20 AM - 10:30 AM

Effects Of An Intensified Training Period On Resting Metabolic Rate, Energy Availability, Blood-biomarkers And Performance

Monica K. Torstveit¹, Thomas B. Stenqvist¹, Anna K. Melin².
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(No relevant relationships reported)

Cyclists often block periodize their training in micro and meso periods with high training volumes to prepare for competition. The effect of such periods on surrogate markers for Relative Energy Deficiency in Sport (RED-S) have not yet been properly investigated. **PURPOSE:** To determine how a mesocycle of four weeks of interval training affects RED-S associated surrogate markers and performance variables in well-trained male cyclists. **METHODS:** Twenty-two participants (age: 33.5 ± 6.6 years, height: 181.4 ± 5.2 cm, weight: 76.5 ± 7.4 kg, $\text{VO}_{2\text{peak}}$: 63.5 ± 6.6 mL·kg⁻¹·min⁻¹) were recruited for a four-week interval training protocol, consisting of three high-intensity interval training sessions per week with an accumulated work duration of 32 minutes per session. Unlimited low intensity training was permitted. Protocol included pre- and post-intervention assessment of resting metabolic rate (RMR) (ventilated hood), body composition by dual x-ray absorptiometry, blood samples, energy intake and exercise energy expenditure to calculate energy availability (EA), and aerobic- and anaerobic performance. **RESULTS:** Four weeks of interval training increased aerobic performance (mean \pm SD of difference); peak power output [18.5 ± 12.4 W, ($p < 0.001$)], $\text{VO}_{2\text{peak}}$ [1.5 ± 2.1 mL·kg⁻¹·min⁻¹, ($p = 0.005$)], and functional threshold power [17.0 ± 11.8 W, ($p < 0.001$)] as well as testosterone levels [1.35 ± 2.13 nmol·L⁻¹, ($p = 0.011$)]. However, triiodothyronine (T_3) [-0.12 ± 0.18 nmol·L⁻¹, ($p = 0.008$)], absolute RMR [-52.2 ± 81.4 kcal per day⁻¹, ($p=0.01$)], relative RMR [-0.8 ± 1.2 kcal per kg FFM⁻¹, ($p=0.01$)], and $\text{RMR}_{\text{ratio}}$ [-0.03 ± 0.04 , ($p = 0.01$)] decreased, and cortisol levels increased (49.3 ± 87.3 nmol·L⁻¹, $p = 0.02$) indicating energy deficiency, while no changes were observed in body weight or -composition, EA, or insulin and insulin-like growth factor 1 (IGF-1). **CONCLUSION:** A successive four weeks of intensified training increased performance and testosterone levels in this group of well-trained male endurance athletes, although surrogate markers of RED-S such as decreased RMR, T_3 and increased cortisol levels were observed. These results indicate the complexity, and the methodological challenges of assessing and evaluating RED-S in male athletes.

141 May 29 10:30 AM - 10:40 AM

Salivary Biomarkers in College Female Basketball Players during the Late Competition Season

Kevin J. Finn, FACSM¹, Jack Ransone, FACSM², Michaela Martinez¹. ¹University of Central Missouri, Warrensburg, MO. ²College of William and Mary, Williamsburg, VA.

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(No relevant relationships reported)

The college basketball season involves multiple competitions and strenuous practice that have been linked to signs of overtraining. During the late competition period, evaluation of stress and recovery can assist coaches in determining player loads to ensure optimal performance. **Purpose:** To assess factors that reflect on stress and recovery through the study of salivary biomarkers. **Methods:** Fifteen members of the college women's basketball team volunteered to participate. Saliva samples (0.75mL) was collected 24 hours before (pre) and 24 hours after (post) a competition during the last three weeks of the regular season. Salivary samples were stored frozen and then sent to a laboratory for analyses at the end of the study period. Biomarker concentrations were determined using indirect ELISA for testosterone, cortisol and secretory immunoglobulin A. In addition, at the time of the saliva collection, subjects were asked to report their perception of overall health, level of anxiety, and mood. ANOVA were used to test for significance (95 level of confidence) for pre-post measures and weekly variance. Correlations between perceptions of health, anxiety, mood, and salivary biomarkers were conducted. **Results:** The means (SD) of the biomarkers and subjective measures are reported below.

Week		Testosterone (pmM)	Cortisol (nmM)	SigA	Health Score	Anxiety	Mood
1	Pre	247.35 (131.34)	4.49 (1.33)	NA	7.67 (1.30)	2.23 (0.83)	3.08 (0.90)
	Post	229.26 (153.70)	5.02 (3.07)	111.84 (88.89)	7.20 (1.70)	2.20 (0.94)	3.21 (0.80)
2	Pre	202.34 (129.75)	7.41 (8.48)	NA	8.00 (1.62)	2.07 (0.92)	3.29 (0.83)
	Post	230.44 (151.49)	6.05 (4.04)	92.31 (54.18)	7.83 (1.34)	1.75 (0.62)	3.45 (0.82)
3	Pre	222.37 (165.02)	5.18 (3.68)	NA	7.73 (1.67)	1.87 (0.74)	3.36 (0.63)
	Post	257.36 (126.07)	4.43 (1.95)	81.55 (29.45)	8.27 (1.27)	1.55 (0.69)	3.00 (0.45)

None of the salivary biomarkers were significantly different in pre-post comparisons nor across the three weeks. Changes in health scores, anxiety, or mood were not significantly different. Overall the testosterone showed significant correlations with cortisol ($r=0.51$), sigA ($p=0.46$), and health score ($p=-.31$). In addition, cortisol was significantly related to health score ($p=-0.24$). Health score showed a negative relationship with anxiety ranking ($r=-.30$) while no other relationships were evident. **Conclusion:** The lack of significance between these variables might indicate that these players did not show indication of stress or lack of recovery during this period of competition.

142 May 29 10:40 AM - 10:50 AM

Salivary IgA as a Predictor of Upper Respiratory Tract Infections in Elite Rugby Union Players

Caoimhe Tiernan¹, Tom Comyns¹, Mark Lyons¹, Alan M. Nevill², Giles Warrington, FACSM¹. ¹University of Limerick, Limerick, Ireland. ²University of Wolverhampton, Wolverhampton, United Kingdom.

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(No relevant relationships reported)

For athletes to optimise their performance, minimising the risk of injuries and illness is essential to reduce the number of training days missed. Upper Respiratory Tract Infections (URTI) are amongst the most common illnesses reported in athletes. An URTI can result in missed training days, which in turn may lead to performance decrements.

PURPOSE: The purpose of this study was to investigate if salivary Immunoglobulin A (sIgA) is a predictor of URTI in elite Rugby Union players.

METHODS: Nineteen male elite Rugby Union players provided morning saliva swabs and completed an illness log documenting symptoms of URTI, bi-weekly (Monday and Friday), over a 10-week training period. Test re-test reliability of sIgA was completed under controlled conditions prior to the study. Multi-level logistic regression was used to analyse the relationship between sIgA and the binary outcome of presence or absence of an URTI.

RESULTS: The results found that a significant decrease in sIgA (-0.00537 (0.00268) ug.mL $p=0.046$) (beta (SE)), increased the odds of a player contracting an URTI. A player was at a greater risk of contracting an URTI, within the subsequent 2-week period, if sIgA decreased by 65% or more.

CONCLUSION: The results show that sIgA is a useful predictor for determining the likelihood of players contracting an URTI. These results provide coaches with an objective monitoring marker, to help reduce the risk of players contracting an URTI and missed training days, which may lead to performance decrements. These results may assist the coaches and support staff in making evidenced based decisions, where sIgA decreases by 65% or more, by adjusting individual player training load and implementing appropriate recovery strategies to ensure optimisation of training.

A-37 Free Communication/Poster - Cardiovascular

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

163 Board #1 May 29 9:30 AM - 11:00 AM**Influence of Whole Blood Donation (~ 470ml) on Peak Power Outputs Across a 96hr Period**

Diane Johnson, Justin Roberts, Dirk Dugdale, Henry Hodgkins, Ronique Gordon, Madie Rowland, Ellen Lockwood, Viviane Merzbach, Antonio Femminile, Flora Veres, Dan Gordon. *Anglia Ruskin University, Cambridge, United Kingdom.*

(No relevant relationships reported)

PURPOSE: Previous studies investigating the effects of blood donation (BD) on power output (PO) concerning all out sprints appear elusive, thus this study determines the effects of BD (~ 470ml) over a period of up to 96 hours on power output during four repeated 15s sprints. **METHODS:** Following local institutional ethical approval 11 participants, 8 males (age 30.3 ± 13.1 years, mass 85.6 ± 10.5 Kg, height 177.8 ± 6.9 cm) and 3 females (age 34.7 ± 10.3 yrs, mass 69.1 ± 11.6 Kg, height 171.2 ± 9.1 cm) volunteered to participate. Testing was conducted in the morning over a two week block with a rest week between testing phases. Week one (W1) was pre-BD and week two (W2) was post BD. Visit one on W1 established haematological levels and $\dot{V}O_{2max}$. Subsequent visits during W1 were for Sprint Interval Testing (SIT), with a resistance of $0.07\text{kg}\cdot\text{kg}^{-1}$ of body mass, with 90s of unloaded pedalling prior to each effort using a Lode Excalibur Sport cycle ergometer. W2 was identical except the participant donated blood on visit 1 post haematological testing only. Additionally throughout testing $\dot{V}O_2$, cardiac output, stroke volume and heart rate using thoracic impedance cardiography, while Near Infrared Spectroscopy measured O_2 delivery at the muscle. **RESULTS:** Pre-BD ($Hb=14.61 \pm 0.72\text{g}\cdot\text{dL}^{-1}$, $Hct=42.91 \pm 2.12\%$) compared to post BD of day 1 ($Hb=13.57 \pm 0.97\text{g}\cdot\text{dL}^{-1}$, $Hct=39.91 \pm 3.02\%$) reduced by 7.09%. Hb percentage decreases continued over days 1-2 (2.68%) and days 2-3 (2.55%), a percentage increase (1.98%) occurred between days 3-4, values yielded significance in all cases ($P < 0.0001$). ΔPPO (W) pre-BD on day 1 (46.2 ± 180.3), 2 (45.5 ± 150.7), 3 (18.7 ± 74.7) and 4 (31.9 ± 99.4) compared to post BD on day 1 (170 ± 153.0), 2 (156.6 ± 125.4), 3 (88.7 ± 106.6) with the exception of day 4 (84.9 ± 72.7) all revealed significance ($P=0.006$, $P=0.005$ and $P=0.04$ respectively). There was no interaction for time for either pre or post BD periods for either ΔPPO or mean PO ($P > 0.05$).

CONCLUSIONS: The data suggests that BD has significant effects on Hb and Hct up to 96 hours post BD. ΔPPO was also significantly influenced up to 72 hours post BD, this is potentially attributed to a down regulation of the resynthesis of PCr between sprints from decreased O_2 availability. These findings have significant implications for individuals wishing to undertake sprint interval-based exercise post BD.

164 Board #2 May 29 9:30 AM - 11:00 AM**Is Heart Rate Variability a Suitable method For Monitoring The Effect Of A Training Session In Synchronized Swimming?**

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(No relevant relationships reported)

PURPOSE: To determine whether heart rate variability (HRV) is a suitable method for monitoring the effect of a training session (TS) in elite synchronized swimmers. **METHODS:** We recorded resting HRV (Rest) in 12 elite swimmers (mean age: 21.5 ± 3.5 yrs) for 3 days over one week, interspersed by 48 h, prior to the 2015 World Swimming Championships. During the last TS, we continuously monitored heart rate (HR) and obtained salivary cortisol (SC) samples before and after the session. We measured capillary blood lactate (La_{peak}) 2, 4, and 8 min after the TS and monitored recovery HRV (Rec), which was averaged for the following 5-min periods after the TS: Rec_{20-25} , Rec_{25-30} and Rec_{30-35} . We assessed rate of perceived exertion (RPE) and tested the association between La_{peak} , SC, and RPE and the relative changes ($\Delta\%$) of the natural logarithm (Ln) of the HRV-derived indices [standard deviations of the distance of rate to rate (SD_r and SD_d), the root mean square successive difference of intervals (RMSSD), and the high- and low-frequency domain parameters (HF and LF, respectively)]. We calculated the individual coefficient of variation (CV) of LnRMSSD for each recovery period.

RESULTS: $LnLF$ (ms^2) was lower in Rec_{25-30} (5.72 ± 1.05) than in Rec_{20-25} and Rec_{30-35} (6.68 ± 0.97 , 6.26 ± 1.29 ; $P < 0.05$). On average, $CV=10.7\%$. La_{peak} was correlated positively with $\Delta\%LnRMSSD$, $\Delta\%LnLF$, $\Delta\%LnSD_r$, and $\Delta\%SC$.

CONCLUSIONS: Isolated HRV data from synchronized swimmers may less accurate than other physiological markers for assessing the effect of TSs as a result of exercise bouts performed in apnea.

165**Board #3**

May 29 9:30 AM - 11:00 AM

Synchronization Of Foot Strike And Cardiac Cycle During Treadmill Running In Non-endurance Trained Individuals

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(No relevant relationships reported)

Synchronizing cardiac diastole with foot strike during running may maximize the efficiency with which skeletal muscle promotes venous return of blood to the heart. Recent research has found that diastolic stepping results in a lower heart rate (HR) compared to systolic stepping in elite endurance runners. **PURPOSE:** To assess HR, metabolic responses, and perceived exertion to running when foot strike occurs during either cardiac systole (CS) or cardiac diastole (CD) in non-endurance trained individuals. **METHODS:** Eight non-endurance trained participants (7 males; Age: 25.3 ± 8 yr; BMI: $23.6 \pm 3.2\text{ kg}\cdot\text{m}^{-2}$) performed 2, 5-min bouts of treadmill running at a comfortable pace (5.4 ± 0.5 mph) with foot strike occurring during either CD or CS. Participants wore a chest strap that transmitted accelerometer and HR data to a tablet computer with proprietary software. The software generated an auditory beep that was synced with either 45% (CD) or 100% (CS) of each cardiac cycle. Participants were instructed to match their steps to the beeps during both conditions (CD or CS) which were randomized between trials and blinded to the participants. HR, oxygen consumption ($\dot{V}O_2$), O_2 -pulse, minute ventilation (VE), and respiratory exchange ratio (RER) were recorded continuously and averaged over the last 3 minutes of each condition. Rating of perceived Exertion (RPE) was recorded during the final minute of each condition. Paired T-tests were used to compare the dependent variables between conditions and all tests were considered significant at the 0.05 level. **RESULTS:** HR was significantly lower when foot strike occurred during CD compared with CS (163.0 ± 5 vs. 170.1 ± 4 bpm; $P < 0.05$). Furthermore, there was a trend for O_2 -pulse to be greater during CD (16.3 ± 1.5 vs. 15.7 ± 1.4 ml/beat; $P = 0.07$). VE (73.3 ± 5 vs. 74.4 ± 4 l/min), $\dot{V}O_2$ (35.0 ± 1.3 vs. 35.3 ± 1.2 ml/kg/min), and RPE (10.5 ± 0.7 vs. 10.3 ± 0.8) were not significantly different between CD and CS, respectively. **CONCLUSION:** During relatively short, steady-state running conditions, synchronization of foot strike with CD results in a significantly lower HR when compared to CS. This may lead to enhanced cardiac filling, which may be beneficial to running performance in non-endurance trained individuals.

166**Board #4**

May 29 9:30 AM - 11:00 AM

Heart Rate Response During A Collegiate Esports Tournament

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(No relevant relationships reported)

HEART RATE RESPONSE DURING A COLLEGIATE ESPORTS TOURNAMENT

S. Valladao, T.L. Andre, D. Cox. The University of Mississippi, Oxford, MS. During the last decade, electronic sports (esports), or competitive video gaming, has rapidly increased, generating nearly \$1 billion per year and is now composed of millions of gamers around the globe (online and live). However, the physiological effects of these gaming competitions have not been thoroughly examined yet. A myriad of literature focuses on heart rate (HR) and traditional athletic competition but very little research has addressed the heart rate responses of individuals playing competitive esports and none to date have examined heart rate during collegiate esports tournament in collegiate club sport competitors. **METHODS:** Male members of the University of Mississippi esports team ($n=14$; age = 19.8 ± 1.0 years; BMI = 24.1 ± 5.5 ; esports mean hours per week = 18.9 ± 11.6) participated in the study during the Egg Bowl esports tournament. A 5-minute ambient (seated) heart rate was collected using a Polar H10 HR monitor prior to esports competition. Upon sitting on stage, recordings for HR began immediately prior and ended immediately post to their esports matches while remaining seated. For the statistical analyses, Paired-samples t-tests were utilized. Results were considered significant at ≤ 0.05 . **RESULTS:** Mean HR during was significantly elevated compared to pre (131.4 ± 19.0 bpm vs. 97.1 ± 19.9 bpm; $p = 0.000$) and peak HR during was significantly elevated compared to pre (188.1 ± 32.9 bpm vs. 119.6 ± 20.1 bpm; $p = 0.000$). **CONCLUSION:** Given the elevated HR observed in the study, further understanding of the physiological response to competitive esports in the tournament setting is critical for developing interventions to potentially mitigate the physiological stress experienced by esports athletes.

- 167 Board #5 May 29 9:30 AM - 11:00 AM
Heart Rate Response During Esport: Fortnite
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 (No relevant relationships reported)

Abstract

Esports popularity has rapidly grown both in online play and viewing. Little research has addressed the heart rate responses of individuals playing esports and none in the platform of the Esport: Fortnite over a longer duration. **Purpose:** Determine the heart rate response during a 3-hour seated session of the Esport: Fortnite. **Methods:** Individuals (n=23; age = 20.7 ± 2.1 years; BMI = 25.8 ± 3.5) who play at least 6 hours of esports per week were recruited to participate in the study from around the University of Mississippi. On two separate occasions a 15-minute seated HR was collected using a Polar H10 heart rate monitor to measure mean resting HR. Participants wore the Polar heart rate monitor during their regular Esport: Fortnite session time for 3-hours. Paired sample t-tests were utilized to compare mean resting and peak heart rates to mean and peak esport HR. Results were considered significant at $p < 0.05$. **Results:** There was a significant increase in mean esport session HR compared to resting HR (75.6 ± 9.6bpm vs. 69.8 ± 10.5bpm; $p = 0.003$) and peak seated esport session HR (119.8 ± 16.3bpm vs. 80.1 ± 10.8bpm; $p < 0.001$). **Conclusions:** Further understanding of the physiological stress induced with chronic playing of esports is warranted given this initial studies results given the increases in individuals seated heart rate.

- 168 Board #6 May 29 9:30 AM - 11:00 AM
Association Between Supine Versus Standing Heart Rate Variability, Aerobic Fitness and Exercise Responses in Women
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 (No relevant relationships reported)

Heart rate variability (HRV) is used to guide endurance training prescription but the optimal body position for daily recordings is unclear. **PURPOSE:** To assess supine and standing HRV associations with aerobic fitness and submaximal exercise heart rate (HReX) responses to an aerobic interval session.

METHODS: Healthy women (n = 8, age = 23 ± 3 years) performed a graded treadmill test for the determination of maximal oxygen consumption ($\dot{V}O_{2max}$). Over the subsequent 5 days, post-waking measures of supine and standing natural logarithm of the root mean square of successive RR intervals (LnRMSSD) were averaged to establish baseline. Subjects then performed an interval training session consisting of 7 x 3 min of treadmill running at 90% of the velocity attained at $\dot{V}O_{2max}$ ($v\dot{V}O_{2max}$), with two minutes of walking at 4 km·h⁻¹ between sets. Immediately before and 24 h post-interval session, a submaximal test consisting of 3 min of running at 60, 70, 80, and 90% of $v\dot{V}O_{2max}$ was performed with HReX recorded at the end of each stage. HRV measures were recorded the morning after the interval session for comparison to baseline and changes in HReX. **RESULTS:** $\dot{V}O_{2max}$ ranged from 32.5 - 54.4 ml·kg⁻¹·min⁻¹. Baseline supine LnRMSSD was significantly associated with $\dot{V}O_{2max}$ ($r = 0.77$, $p = 0.03$). No differences in supine (4.26 ± 0.57 vs. 4.30 ± 0.70 , $p = 0.81$) or standing (3.26 ± 0.67 vs. 3.26 ± 0.87 , $p = 0.98$) LnRMSSD were observed between baseline and 1 day post-interval session. However, individual changes in standing LnRMSSD were significantly associated with their changes in HReX at 60% $v\dot{V}O_{2max}$ ($r = -0.71$, $p < 0.05$) where those with a decrease in LnRMSSD relative to baseline demonstrated increases in HReX and vice versa. Additionally, we observed a large, non-significant relationship between $\dot{V}O_{2max}$ and changes in standing LnRMSSD ($r = 0.69$, $p = 0.056$) where those with reduced standing LnRMSSD relative to baseline at 24 h post-interval session tended to have lower $\dot{V}O_{2max}$ and vice versa. **CONCLUSIONS:** These results indicate that standing HRV may provide a better indication of individual exercise responses whereas supine HRV provides a better indication of aerobic fitness level among healthy women.

- 169 Board #7 May 29 9:30 AM - 11:00 AM
Relationship Between Heart Rate Variability Threshold and 5-km Outdoor Running Performance in Non-athletes
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 (No relevant relationships reported)

The analyses of heart rate variability threshold (HRV_T) under a controlled treadmill incremental exercise test (IET) is considered a practical strategy for cardiac parasympathetic depression and anaerobic threshold assessment. However, the prognostic value of HRV_T for outdoor running performance is unknown. **Purpose:** To correlate the exercise intensity at the HRV_T assessed during a treadmill incremental test and the 5-km outdoor running time in young men. **Methods:** 14 beginner runners (23.5 ± 4.4 yrs, BMI: 23.2 ± 2.7 kg/m²) underwent a treadmill IET. The R-R intervals were collected continuously during exercise test using a heart rate monitor (Polar® v800) and heart rate variability was analyzed by the SD1 index of Poincaré Scatterplot map. HRV_T was considered the load (km/h) corresponding to the point of stabilization at which there was no further significant decline in the values of the SD1 index even with increasing intensity. After a 48h period, the participants individually performed a 5-km running trial on an outdoor 250-m track. The participants were encouraged to conclude the 5-km running test as quickly as possible. Due to non-normality of the data and the sample size, we used the Spearman's correlation test with p-value set at 5%. **Results:** The exercise intensity at HRV_T was 7 (7-8) km/h and the time to complete the 5-km trial was 25.2 (23.2-28.5) minutes. A strong correlation was observed between the treadmill speed at the HRV_T and the time expended to cover the 5-km running test (Figure 1). **Conclusion:** HRV_T evaluated during an IET under controlled conditions was negatively correlated with the outdoor 5-km running performance in young non-athlete men. Our results may open a new application to the HRV_T as a practical tool for the prognostic evaluation of a 5-km running performance.

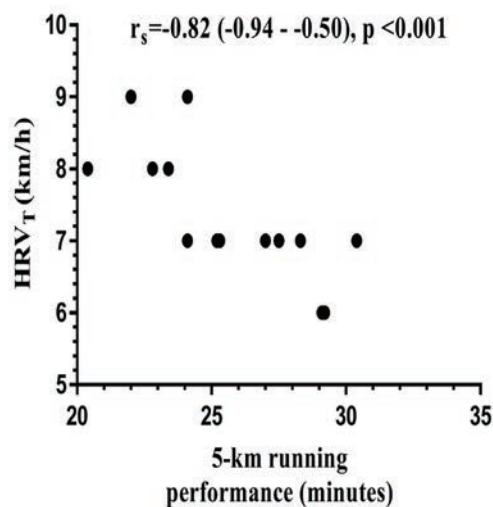


Figure 1- Relationship between HRV_T and 5-km time trial.

- 170 Board #8 May 29 9:30 AM - 11:00 AM
Effects of Hemodynamic Responses and Vascular Endothelial Function to Blood Flow Restriction Exercise Training
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 (No relevant relationships reported)

PURPOSE: The study aimed to compare hemodynamic responses and vascular endothelial function after 8 weeks resistance exercise with different blood flow

restriction (BFR) in healthy adults. **METHODS:** Twenty-four participants (men 20.63 ± 0.88 yr) were randomly assigned to three groups: resistance exercise without occlusion cuff (CON), resistance exercise with occlusion cuff pressure set at 65% resting systolic blood pressure (BFR-L) and resistance exercise with occlusion cuff pressure set at 130% resting systolic blood pressure (BFR-H). Each subject underwent five bouts of 1-minute 30% 1RM resistance exercise with 2-min interval, 5 times a week for 8 weeks. Left ventricular fractional shortening (FS), left ventricular ejection fraction (LVEF), velocity, stroke volume (SV) resistance index (RI), Vascular endothelial growth factor (VEGF), vascular endothelial growth factor receptor (VEGF-R) and interleukin-6 (IL-6) were measured. **RESULTS:** 1. After 8 weeks, compared with AC in BFR-H group (94.42 ± 20.99), AC in the CON group (106.13 ± 18.86) and BFR-L group (108.08 ± 19.22) significantly increased ($p < 0.05$). 2. After 8 weeks, SBP was increased in the BFR-L group (3.37 ± 0.674 mmHg), BFR-H group (4.50 ± 1.21 mmHg) and in the CON group (-6.37 ± -1.02 mmHg). Exercise immediately after 8 weeks, DBP decreased in the BFR-H group (6.44 ± 0.305 mmHg) and the CON group (4.25 ± 0.281 mmHg), and the difference was statistically significant ($p < 0.05$). 3. After 8-week training, compared with the expression of VEGF-R and IL-6 in CON group (641.23 ± 12.68 pg/ml, 7.00 ± 0.76 pg/ml), their expression in the BFR-L group (711.12 ± 16.88 pg/ml, 7.39 ± 0.51 pg/ml) and BFR-H group (703.63 ± 15.49 pg/ml, 11.16 ± 0.82 pg/ml) significantly increased ($p < 0.05$). **CONCLUSIONS:** BFR-L is beneficial to the improvement of aortic compliance. BFR-L and BFR-H all can cause reduction of DBP after exercise, which can be related to increased secretion of local VEGF and VEGF-R, causing angiogenesis and reducing peripheral resistance.

171 Board #9 May 29 9:30 AM - 11:00 AM
Comparing Total Hemoglobin Mass Between Selected NCAA Division I Athletes And Recreationally Active Students

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(No relevant relationships reported)

Total hemoglobin mass (tHb) is linearly related to total body mass, however, whether this relationship is altered by lean tissue mass, training or sex remains controversial.

PURPOSE: To investigate if lean mass is a more appropriate determinant of tHb compared to body mass across NCAA DI athletes and controls. We will also determine if this relationship is altered by sex and/or training status.

METHODS: Nordic (6F & 6M) and alpine (5M) skiers, football players (7M) and recreationally active student controls (9F & 10M) from the University of Colorado Boulder participated. The optimized carbon monoxide rebreathing procedure was used to determine tHb. Body composition was determined via DXA. Since female athletes were not present in all groups, statistical analyses were performed for males across all groups and a separate comparison was made between female nordic skiers and control groups.

RESULTS: The overall correlations of tHb with body mass or lean tissue mass were significant ($R^2 = 0.73$ & $R^2 = 0.88$), but the positive relationship was stronger when using lean mass ($p < 0.001$).

For males, body mass and lean tissue mass were greater in football with no significant differences between any other group. Football had a greater tHb compared to control and alpine (1168.7 ± 126.9 vs. 925.9 ± 123.0 & 936.8 ± 151.9 g), but was not different than nordic (1052.5 ± 166.7 g). Nordic tHb was greater than control, but not different from alpine. When tHb was normalized using body mass and lean mass, nordic (14.5 ± 1.5 & 16.5 ± 1.2 g/kg) was greater than football (10.4 ± 0.9 & 14.4 ± 1.5 g/kg), alpine (11.6 ± 1.1 & 14.2 ± 0.6 g/kg) and control (11.8 ± 0.6 & 14.6 ± 0.8 g/kg) groups while no differences between any other groups were found.

For females, body mass, lean tissue mass and tHb (656.4 ± 72.9 vs. 566.1 ± 66.0 g) were not different between nordic and control. When tHb was normalized using body mass, nordic (11.3 ± 0.7 g/kg) was greater than control (9.5 ± 1.0 g/kg), but when tHb was normalized using lean mass there was no difference (14.5 ± 1.1 vs. 13.8 ± 1.4 g/kg).

CONCLUSION: Lean tissue mass explains a greater amount of variability in tHb compared to total body mass. In males, to examine the effect of endurance training on tHb, it is more appropriate to normalize by lean mass. Additional research is needed when comparing the effects of endurance training between female groups.

172 Board #10 May 29 9:30 AM - 11:00 AM
Observation Of Heart Rate Variability Response To Collegiate Esports Tournament

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(No relevant relationships reported)

OBSERVATION OF HEART RATE VARIABILITY RESPONSE TO COLLEGIATE ESPORTS TOURNAMENT

G.B. Rhoden, S. Valladao, T.L. Andre, D. Cox. The University of Mississippi, Oxford, MS'

Heart rate variability (HrV) derives from the intricate relationship of sympathetic and parasympathetic autonomic regulation of heart rate. HrV has been utilized as a marker of stress and recovery in traditional sports, however, to date no investigations examined the HrV response to esports. **PURPOSE:** To determine the HrV response during a competitive live esports tournament in collegiate club esports competitors.

METHODS: Male members of the Ole Miss esports team ($n=14$; age = 19.8 ± 1.0 years; BMI = 24.1 ± 5.5 ; esports mean hours per week = 18.9 ± 11.6) participated in the study during a live esports tournament. A pre-HrV and post-HrV (5-minutes each) measures were collected using a Polar H10 HR monitor with the Elite HrV mobile app while seated. Participants were seated for 5 minutes before obtaining pre- and post-HrV measures. For during competition HrV measure, recordings for HrV began immediately prior to their esports matches and ended immediately post while remaining seated. For the statistical analyses, One-Way Analysis of Variance (ANOVA) was used for RMSSD, ln(RMSSD), and R-R intervals. Tukey's post hoc test were used when necessary. Paired-samples t-test were utilized for LF:HF ratio and HF. Results were considered significant at $p \leq 0.05$. Results are reported as mean \pm standard deviation.

RESULTS: R-R intervals during were significantly lower than pre- and post- (pre: 643.64 ms \pm 138.54 ms; during: 465.71 ms \pm 68.99 ms; post: 616.07 ms \pm 109.98 ms, $p = 0.002$). HF post competition was significantly decreased compared to pre (325.83 ms² \pm 341.81 ms² vs. 494.55 ms² \pm 526.84 ms²; $p = 0.046$). No significant differences were found for RMSSD (pre: 25.67 ms \pm 17.48 ms; during: 15.50 ms \pm 12.34 ms; post: 23.72 ms \pm 18.07 ms; $p = 0.223$), ln(RMSSD) (pre: 3.00 ms \pm 0.77 ms; during: 2.51 ms \pm 0.69 ms; post: 2.86 ms \pm 0.90 ms; $p = 0.249$), or pre and post LF:HF ratio (pre: 4.47 ± 2.96 vs. post: 5.54 ± 3.62 ; $p = 0.260$). **CONCLUSION:** This is the first investigation to observe the HrV response to a live esports competition. Future investigations should examine differences between esports games and time durations.

173 Board #11 May 29 9:30 AM - 11:00 AM
One-Year Changes in Cardiovascular Risk Markers in Police Officers

Steven E. Martin, Danielle Kravits, Kory Sealy, Karina Wilson, Jason R. Lytle, Sean T. Stanelle, John S. Green, FACSM, Stephen F. Crouse, FACSM. *Texas A&M University, College Station, TX.* (Sponsor: Stephen F. Crouse, FACSM)

(No relevant relationships reported)

PURPOSE: The present study retrospectively examined one-year changes in certain traditional and non-traditional cardiovascular disease (CVD) risk markers in police officers ($n = 84$). Subjects were full time police officers employed by a moderate-to-large municipality. **METHODS:** As a part of their annual physical exam, police officers underwent evaluation of several CVD risk markers including body weight, a graded exercise test (GXT; Bruce protocol), pushups completed in 1 minute, situps completed in 1 minute, handgrip strength, body composition (through DEXA), and fasting bloodwork. Maximal oxygen uptake (VO_{2max}) was estimated using the Foster equation. Resting systolic blood pressure (RSBP) and resting diastolic blood pressure (RDBP) were measured before the start of the GXT protocol. Blood analysis was performed by a College of American Pathologists-accredited laboratory. All blood samples were analyzed for total cholesterol (TC), triglycerides (TG), high-density lipoprotein (HDL) cholesterol (HDL-C), low-density lipoprotein (LDL) cholesterol (LDL-C), glucose (GLU), LDL particle number (LDLnum), LDL size (LDLsz), small LDL particle number (sLDLnum), HDL particle number (HDLnum), and HDL size (HDLsz). All data were analyzed using paired t-tests ($p < 0.05$). **RESULTS:** With respect to the fitness testing variables measured, significant increases were noted in pushups performed (4 pushups) and handgrip strength (4.45 kg) while RDBP was significantly reduced (4 mm/Hg). Within the traditional fasting blood panel, GLU was significantly increased (5.5 mg/dL) while LDL-C was significantly reduced (8.4 mg/dL). Non-traditional CVD risk markers were also significantly altered. Increases were noted in LDLnum (309 nmol/L), sLDLnum (347 nmol/L), and HDLnum (6.6 umol/L) while reductions in LDLsz (0.53 nm) and HDLsz (0.5 nm) researched statistical significance. **CONCLUSIONS:** While beneficial changes were noted in several traditional CVD risk markers, unfavorable alterations occurred in the majority of the non-traditional CVD risk markers measured. In addition, these findings support the need for required health and fitness programs for law enforcement personnel.

174 Board #12 May 29 9:30 AM - 11:00 AM
The Impact of Isometric Exercise Muscle Mass on Post-Exercise Blood Pressure

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(No relevant relationships reported)

A single bout of aerobic or resistance exercise can lead to a temporary drop in blood pressure (BP) following exercise; a phenomenon referred to as post-exercise hypotension (PEH). Like aerobic and resistance exercise, isometric exercise training can reduce resting BP however, considerably less is known regarding the ability of this type of exercise to elicit PEH. PEH may be more robustly stimulated with a larger

active muscle mass, therefore, isometric leg exercise (ILX) (large muscle mass) may have greater potential than isometric handgrip exercise (IHGX) (small muscle mass) to evoke PEH. **PURPOSE:** To determine the impact of a bout of large (ILX) and small (IHGX) muscle mass isometric exercise on post-exercise blood pressure. **METHODS:** Twelve healthy males (23.7 ± 3.5 yrs) completed 3 experimental visits (1 IHGX, 1 ILX, 1 control (rest no exercise)). Blood pressure (systolic and diastolic; SBP and DBP) was assessed at baseline and at 15, 30, 45 and 60 min post-exercise or control with an automated sphygmomanometer. Isometric exercise consisted of 4 alternating 2 min isometric contractions (quadriceps (ILX) or handgrip (IHGX)) at 30% maximum voluntary contraction. Contractions were separated by 1 min of rest. Participants completed each condition on a separate day (order counterbalanced). **RESULTS:** SBP was lower than baseline at 15 and 45 min post ($p=0.013$ and $p=0.014$ respectively); but this did not differ between the control, IHGX and ILX conditions ($p=0.256$, Control: baseline 110 ± 7.3 mmHg, average post 106.7 ± 8.6 mmHg; IHGX: baseline 110 ± 10.3 mmHg, average post 107.4 ± 8.3 mmHg; ILX: baseline 113.25 ± 11.7 mmHg, average post 111.8 ± 11.2 mmHg). DBP did not differ from baseline (Baseline DBP: control 69.17 ± 7.4 mmHg, IHGX 68.6 ± 7.9 mmHg, ILX 72.3 ± 7.4 mmHg) at any time point in any condition ($P>0.05$). However, DBP 15 min post was higher in the ILX (73.4 ± 8.9 mmHg) vs. the IHGX (68.3 ± 7.9 mmHg) and Control (68.3 ± 8.6 mmHg) conditions. **CONCLUSION:** PEH did not occur following a single session of either IHGX or ILX suggesting that this type of exercise may not be a potent stimulus for PEH in this population, even when engaging the larger quadriceps muscle mass. Further research is required to identify the importance of the duration and intensity of isometric exercise on post-exercise blood pressure. Funded by NSERC

175 Board #13 May 29 9:30 AM - 11:00 AM
The Effects Of Long-term Functional Training On VO_{2max}
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 (No relevant relationships reported)

High intensity functional training (HIFT) programs have been gaining popularity as an alternative to enhance many fitness domains in a more efficient time period. These programs are characterized by alternation of short periods of intense multimodal exercises with low paced activities or rest. Recent analysis demonstrated inconclusive evidence for beneficial adaptations following short term HIFT participation (Claudino et al., 2018). Aerobic capacity showed disparity results following 5-12 weeks of training, highlighting the limited research for longitudinal aerobic adaptations of HIFT participants. **PURPOSE:** The aim of this study was to investigate the VO_{2max} changes of long-term participation in HIFT on subjects with previous training experience. **METHODS:** The subjects were 11 male, 34.7 years \pm 8.3, with at least five months of HIFT training prior to enrolling in this study. While frequently participating in HIFT, they underwent two VO_{2max} graded exercise maximal exertion tests using a modified treadmill protocol separated by at least 1 year. Subjects warmed up for 3 minutes at 8 km/h and 0% grade, then started running at 9 km/h with 0.5 km/h increase every 30 seconds until exhaustion. Exhaustion was defined as two of the four criteria: plateau of VO₂ for at least two consecutive readings, RPE of at least 18, RER \geq 1.1 and peak heart rate (HR) of at least 90% of age-predicted maximal HR. **RESULTS:** There was no statistically significant changes between pre and post VO_{2max} (-2.02 ± 3.99 ml/kg/min). Similarly, weight (91.06 ± 13.41 vs 91.97 ± 14.07) and RER (1.05 ± 0.04 vs 1.05 ± 0.08) did not change. Subjects did experience a statistically significant decrease in peak HR from pre-testing (184.18 ± 7.65 bpm) to post-testing (176.45 ± 9.71 bpm), $p = 0.009$. **CONCLUSIONS:** These results suggest that long-term HIFT training provides no improvement in VO_{2max} in participants that already have experience with HIFT, as aerobic adaptations seem to be better evidenced during the early stage of the training period. The decreased peak HR denotes a positive cardiovascular response induced by HIFT and its effects on the increased stroke volume, diminished sympathetic drive, increased blood volume and oxidative adaptations in type II muscle fibers.

176 Board #14 May 29 9:30 AM - 11:00 AM
Prime: Hemodynamic/vascular Changes Following Peripheral Focused Low-mass, High-repetition Training In Older Adults
 Joaquin Ortiz de Zevallos¹, Michael A. Welsch, FACSM², Mary N. Woessner³, Neil M. Johannsen⁴, Daniel P. Credeur⁵, Conrad P. Earnest, FACSM⁶, William E. Kraus, FACSM⁷, Jason D. Allen, FACSM¹. ¹University of Virginia, Charlottesville, VA. ²University of Mississippi Medical Center, Jackson, MS, USA, Jackson, MS. ³Victoria University, Melbourne, Australia. ⁴Louisiana State University, Baton Rouge, LA. ⁵University of Southern Mississippi, Hattiesburg, MS. ⁶Texas A&M University, College Station, TX. ⁷Duke University School of Medicine, Durham, NC. (Sponsor: Professor Jason D. Allen, FACSM)
 (No relevant relationships reported)

Advancing age is associated with changes in arterial structure and function that contribute to increased blood pressure, pulse pressure and cardiovascular disease risk. Exercise training beneficially moderates these risks. **Peripheral Remodeling** through Intermittent Muscular Exercise (PRIME) is a novel training approach, involving peripheral focused low-mass high-repetition exercises that imposes a low cardiorespiratory strain. Initiation of structured exercise with PRIME, rather than aerobic training (AT) yields superior benefits in functional ability/capacity, in elderly subjects.

PURPOSE: To determine if PRIME, improves hemodynamic and vascular profiles in subjects >70 y who are at risk for losing functional independence. **METHODS:** Seventy-five subjects (52 F, Age: 76 ± 5 y) were tested at baseline and after 4 wk (Phase I) of either PRIME or AT. All subjects were then enrolled in an 8-wk of combined AT and resistance training (RT) (Phase II). The change scores for (1) Blood Pressure (Brachial-B and Aortic-A), (2) Vascular Stiffness (Pulse Wave Reflection-PWR, and velocity-PWV and Augmentation Index AIX) and (3) Vascular function (Brachial artery flow-mediated dilation - BAFMD), were analyzed. **RESULTS:** At the end of Phase II, there was a significant time effect for B and A blood pressures (bSBP = -4.37 ± 11.95 , bMAP = -2.77 ± 8.69 , bDBP = -2.64 ± 8.66 , aSBP = -4.13 ± 11.31 , aMAP = -2.42 ± 8.31 , and aDBP = -1.97 ± 7.40 mmHg, all $p<0.05$). Additionally, there was a significant effect for time for BAFMD from baseline ($4.35 \pm 2.90\%$) for both interventions after Phase I and Phase II (5.25 ± 3.12 and $6.68 \pm 2.76\%$ respectively, $p<0.01$). There was a group effect in favor of PRIME at Phase I for bMAP (-4.66 ± 10.08 vs -0.35 ± 9.11 mmHg), bDBP (-4.08 ± 8.27 vs -0.49 ± 7.56 mmHg), aMAP (-4.70 ± 10.08 vs -0.76 ± 8.60 mmHg), and aDBP (-4.32 ± 7.93 vs -0.89 ± 6.86 mmHg) (all $p<0.05$). No significant changes were noted in PWR, PWV or AIX. **CONCLUSIONS:** These findings confirm that exercise training improves hemodynamic profile and vascular reactivity in individuals >70 y. Interestingly, individuals who followed PRIME showed greater hemodynamic benefits at 4 wks. PRIME may represent a novel approach to achieve hemodynamics benefits in individuals with limited cardiovascular function.

177 Board #15 May 29 9:30 AM - 11:00 AM
Effects of Domestic and International Tournaments on Heart Rate Variability in Elite Rugby Sevens Players
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 (No relevant relationships reported)

Rugby sevens tournaments involve up to six matches within two days, are often held over consecutive weekends and frequently involve travel to and from international venues. The intense physical demands of competition, short recovery time between tournaments and the added stress of international travel warrant further investigation into recovery status monitoring among elite players. **PURPOSE:** To retrospectively evaluate heart rate variability and athlete self-report measures of recovery status (ASRM) in response to consecutive domestic and international tournaments among an elite rugby sevens team. **METHODS:** Olympic-level players ($n = 10$ males) recorded post-waking natural logarithm (Ln) of the root mean square of successive R-R interval differences (RMSSD) and ASRM (subjective ratings of Sleep, Energy, Soreness, Recovery and Mood) throughout a 1-week period prior to the domestic tournament to serve as baseline and daily thereafter until 2-days post-international tournament. Daily LnRMSSD and ASRM parameters were compared with baseline values. Total distance (TD), high speed distance (>18 km \cdot h⁻¹, HS) and session rating of perceived exertion (sRPE) were compared between tournaments. The team advanced to the finals on both occasions. **RESULTS:** Relative to baseline (4.53 ± 0.40), large and moderate effect size reductions in LnRMSSD ($p = 0.02 - 0.07$) were observed on day-two of the international tournament (4.05 ± 0.36) and one day post-international tournament (4.06 ± 0.59), respectively. Travel to the international tournament (1650 km) involved an early departure time, missed flight connection and 3 a.m. hotel arrival,

which negatively affected ratings of LnSleep (2.09 ± 0.06 vs. 1.82 ± 0.35 , $p < 0.05$) and LnEnergy (2.04 ± 0.08 vs. 1.73 ± 0.23 , $p < 0.05$). No differences in TD (3662 ± 967 vs. 4018 ± 973 m), HS (641 ± 251 vs. 611 ± 191 m) or sRPE (602 ± 241 vs. 658 ± 277 au) were observed between tournaments ($p > 0.05$). **CONCLUSIONS:** Decrements in LnRMSSD were observed in response to the international, but not domestic tournament, despite no differences in match-physical demands. Thus, factors separate from competition alone (e.g., travel-related stress) may impact players' physiological response to a tournament.

178 Board #16 May 29 9:30 AM - 11:00 AM
The Effects of an Intensive Endurance Training Period on Nocturnal HRV and Endurance Performance

Piia Kaikkonen¹, Juha Ahtiainen². ¹Tampere Research Center of Sports Medicine, Tampere, Finland. ²Neuromuscular Research Center, Faculty of Sport and Health Sciences, University of Jyväskylä, Jyväskylä, Finland.

(No relevant relationships reported)

PURPOSE: The optimal balance between training load and recovery is essential for the development of physical performance. In the athletic population, relatively good knowledge usually exists of individual tolerance for training. In recreationally training individuals with less training background, the optimal balance may be more difficult to estimate. The main aim of this study was to find out whether a ten-day intensive endurance training period of the non-athletic population is overreaching, and whether the changes in endurance performance can be detected in nocturnal HRV.

METHODS: 13 recreationally endurance trained healthy men (25 ± 3 y, 179 ± 6 cm, 79 ± 14 kg, VO_{2max} 43 ± 6 ml/kg/min) participated in two-week baseline training period with two exercises in a week (PRE, 30 min at 70 % of P_{max}) and a 10-day intensive training period with nine exercises (INT, 30 min at 70 % of P_{max}). All the exercises on were performed on a bicycle ergometer. Each exercise included a 5-minute warm-up and cool-down (50% P_{max}). Maximal aerobic performance test on a bicycle was carried out before and at the end of both training periods. Nocturnal RR-intervals were measured during three consequent nights at the end of PRE and INT. A mean of all three nights was used in the analysis.

RESULTS: Endurance performance improved during the INT (from 294 ± 41 W to 306 ± 41 W, $P = 0.006$). No change occurred in VO_{2max} (PRE 45 ± 6 , INT 46 ± 4 ml/kg/min). Nocturnal HR (PRE 71 ± 9 bpm, INT 69 ± 9 bpm) or RMSSD (PRE 50 ± 14 ms², INT 54 ± 21 ms²) did not change. Participants were retrospectively divided to higher (Resp_H) and lower responders (Resp_L) according to the change (%) in Pmax during the INT. Resp_H had lower RMSSD at PRE (38 ± 4 ms² vs. 51 ± 9 ms², $P = 0.019$) and INT (40 ± 4 ms² vs. 53 ± 11 ms², $P = 0.043$) when compared to Resp_L. No difference in nocturnal HR or Pmax at PRE was detected between groups.

CONCLUSIONS: A ten-day intensive training period was not overreaching for the recreationally trained young men, as the improvement in endurance performance indicates. Despite the rather high training intensity, no change in nocturnal cardiac autonomic function was detected. The results of the present study suggest that in order to improve endurance performance of recreationally trained individuals, relatively high training intensities may be well tolerated.

A-38 Free Communication/Poster - Monitoring

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

179 Board #17 May 29 9:30 AM - 11:00 AM
Validity And Reliability Of Heart Rate Devices Compared Second-by-second Versus Minute-by-minute

James W. Nalvalta, FACSM, Gabriela Guzman, Crystal Maxwell, Jeffrey Montes. *University of Nevada, Las Vegas, Las Vegas, NV.*
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(No relevant relationships reported)

The Consumer Technology Association (CTA) has guidelines for heart rate that wearable devices should be evaluated second-by-second. However, many investigations in the literature have reported minute-by-minute evaluations.

PURPOSE: To determine whether the interpretation of validity and reliability of three heart rate sensing bras during exercise would be similar if data were evaluated second-by-second versus minute-by-minute. **METHODS:** Nine females completed 14-min protocols while wearing the Sensoria Fitness biometric sports bra, the Adidas Smart sports bra, or the Berlei sports bra concurrently with the Polar H7 heart rate monitor (criterion measure). The protocol involved 1-min standing rest on the treadmill, 3-min walking warm up, 5-min run, 5-min walk. Participants rested between bouts until heart rate was within 10 bpm of resting. Validity was determined through three methods: Mean Absolute Percent Error (MAPE), Bland-Altman bias and Limits of Agreement (LOA), and Intraclass Correlations (ICC). Reliability was determined through ICC

analysis, and significance was accepted at $p < 0.05$. **RESULTS:** MAPE, bias and LOA, and ICC for second-by-second and minute-by-minute evaluations are shown in table 1. The reliability ICC values are shown in table 2.

Device	MAPE (Sec)	MAPE (Min)	Bias (Sec)	Bias (Min)	LOA (Sec)	LOA (Min)	ICC (Sec)	ICC (Min)
Sensoria	1.08	0.98	0.17	-0.07	4.78 to -4.43	3.19 to -3.33	0.996	0.998
Adidas	3.11	3.04	0.44	-0.10	22.63 to -21.76	25.66 to -25.85	0.902	0.955
Berlei	1.08	4.81	-0.34	0.40	6.93 to -7.62	21.44 to -20.64	0.989	0.911

Device	Reliability ICC (Sec)	Reliability ICC (Min)
Sensoria	0.965	0.956
Adidas	0.864	0.842
Berlei	0.961	0.955

CONCLUSIONS: The validity measures of MAPE, Bland-Altman bias and LOA, and ICC appear to be minimally influenced by sampling rate. Reliability measures are consistent regardless of rate. While further investigation is necessary, this data provides evidence that CTA guidelines for heart rate sampling are minimally influenced if taken at longer periods.

180 Board #18 May 29 9:30 AM - 11:00 AM
Validity In Step Counting Of Wearable Devices During Uphill Trail Running

Robert W. Salatto¹, James W. Nalvalta, FACSM¹, Jeffrey Montes¹, Nathaniel G. Bodell¹, Jacob W. Manning², Mark DeBeliso, FACSM². ¹University of Nevada, Las Vegas, Las Vegas, NV.

²Southern Utah University, Cedar City, UT. (Sponsor: James W Nalvalta, FACSM)

(No relevant relationships reported)

In today's technological society, there are many options for wearable exercise tracking technology. With a growing emphasis for outdoor recreation, there is a need to validate these devices in a natural setting. **Purpose:** The purpose of this study was to examine the reliability of wearable step tracking devices during uphill trail running. **Methods:** Participants (n=12) completed a self-paced one-mile uphill run, wearing step tracking devices including: Stryd Power Meter (criterion) Garmin Fenix 5 watch (wrist), Suunto Sport watch (wrist), Motiv ring (finger), Fitbit Surge 2 (ankle), Polar A360 (ankle), Garmin Vivosmart (ankle), and Samsung Gear 2 (ankle). Validity was determined via Bland-Altman analysis (limits of agreement; LoA), a mean absolute percentage error (MAPE) lower than 10%, and Intraclass Correlation (ICC) greater than 0.70. Significance was accepted at the $p < .05$ level. **Results:** The wrist and finger-worn devices were all valid compared to the criterion measure (see table 1). Of the devices secured around the ankle, only the Polar A360 was considered valid for step count (see table 1).

Number	Device	MAPE (%)	ICC, p-value	Bias, LoA
1	Garmin Fenix*	5.1	0.962, <0.001	-59±87, -229 to 112
2	Suunto Sport*	8.5	0.971, <0.001	-145±82, -306 to 15
3	Motiv Ring*	5.1	0.907, <0.001	-29±144, -252 to 311
4	Fitbit Surge 2	16.1	0.741, =0.001	-245±274, -293 to 783
5	Polar A360*	9.1	0.774, =0.001	-70±293, -644 to 505
6	Garmin Vivosmart	11.0	0.506, =0.033	-240±654, -1522 to 1041
7	Samsung Gear 2	12.5	0.785, =0.001	-149±240, -321 to 618

Conclusion: Several devices (1, 2, 3, 5) demonstrated reliable step counting during uphill trail running. The devices that were not valid (4, 6, 7) were attached around the ankle. Results indicate that several valid devices are available for tracking steps in a trail running situation, however caution should be used for choice of wearable and where it is positioned on the body.

- 181** Board #19 May 29 9:30 AM - 11:00 AM
Changes In Lower Body Strength Among 5676 Free-living Persons Using An App-based Program
 Joey Eisenmann, James Moreland, Jace Derwin, Trevor Watkins, Dan Giuliani. *Volt Athletics, Seattle, WA.* (Sponsor: Shawn Arent, FACSM)
Reported Relationships: J. Eisenmann: Consulting Fee; Volt Athletics.

The myriad of beneficial effects of strength training are well-known in humans. However, most previous studies have relatively small sample sizes ($n < 50$) and a brief duration of training (< 3 months). Furthermore, they lack ecological validity. **PURPOSE:** In this study, we leverage the widespread usage of smartphones and a mobile app-based strength training program to investigate the development of muscular strength in 5676 free-living humans from 4 months to 4 years. **METHODS:** We studied a dataset consisting of 5676 people with 24,471 total observations over a period of 4 months to 4 years (mean duration 463 ± 271 days). Lower body muscular strength was taken as the estimated 1-repetition maximum (1RM) using the Epley equation for the barbell back squat exercise. Participants must have had more than one estimated 1RM to be included in the analysis during the period in which they participated in a progressive, periodized strength training program consisting mainly of compound exercises 1-3 times per week. A multi-level growth model with random effects was used to describe strength gains. Variables of baseline strength, gender, training experience, training frequency, volume and intensity were also included in the modeling. **RESULTS:** Lower body strength increased significantly over time (L-Ratio = 91985, $p < .0001$). The mean \pm SE baseline 1RM squat was 98.2 ± 1.12 kg and the largest gains occurred within the first 6 months of initiating the training program (e.g. 3.9 ± 0.12 kg/month from baseline to 6 months; 24% increase) with improvements continuing through 1 year (1.9 ± 0.15 kg/month from 6-12 months; 36% increase from baseline), 2 years (0.9 ± 0.08 kg/month from year 1 to 2; 46% increase from baseline), 3 years (0.5 ± 0.19 kg/month between years 2-3), and 4 years (0.3 ± 0.65 kg/month in years 3-4). **CONCLUSIONS:** This study showed that an app-based strength training program results in substantial and continual increase in lower body strength in a large free-living sample up to 4 years. Subsequent analyses will examine the influence of several demographic and acute training variables and their interactions to confirm and expand upon existing meta-analyses. This study has implications for the application of mobile technology, Big Data, and the Living Lab concept to the field of exercise science.

- 182** Board #20 May 29 9:30 AM - 11:00 AM
Validity of the Adidas Smart Bra in Measuring Heart Rate during Exercise Transitions
 Gabriela Guzman, Crystal Maxwell, James W. Navalta PhD., FACSM. *University of Nevada, Las Vegas, Las Vegas, NV.* (Sponsor: James W. Navalta, FACSM)
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(No relevant relationships reported)

Wearable technology is becoming very popular; offering a variety of applications for it. **PURPOSE:** The current investigation was designed to evaluate the validity of a heart rate sensing bra during transitions from rest to self-paced running and walking. **METHODS:** Nine females completed a 14-min protocol while simultaneously wearing the Adidas Heart Rate Monitoring Smart Bra and Polar H7 heart rate monitor (criterion measure). The protocol involved 1-min standing rest on the treadmill (to determine resting heart rate), 3-min walking warm up, 5-min run, and 5-min walk. The validity of the sports bra was determined by three methods: mean absolute percent error (MAPE), Bland-Altman bias and limits of agreement (LOA), and intraclass correlations (ICC) with a value greater than 0.7 and significance < 0.05 . Those three methods were used to compare second to second data. **RESULTS:** When all conditions were considered (7569 datapoints), MAPE = 3.11%, bias = 0.44 ± 11.34 and LOA range = -21.75 to 22.63, and ICC = 0.902 ($p < 0.001$). For the resting condition (549 datapoints), MAPE = 2.07%, bias = 0.08 ± 3.46 and LOA range = -6.69 to 6.86, and ICC = 0.977 ($p < 0.001$). The transition from rest to a walking warm up (1621 datapoints) yielded MAPE = 0.047%, bias = 94.38 ± 13.88 and LOA range = 67.16 to 121.59, and ICC = 0.923 ($p < 0.001$). With respect to the transition from warm up to running (2700 datapoints), MAPE = 5.60%, bias = 0.47 ± 18.38 and LOA range = -35.55 to 36.49, and ICC = 0.768 ($p < 0.001$). When the transition from running to walking was considered (2700 datapoints), MAPE = 1.09%, bias = 0.11 ± 1.97 and LOA range = -3.74 to 3.96, and ICC = 0.995 ($p < 0.001$). **CONCLUSION:** These pilot results indicate that the Adidas Heart Rate Monitoring Smart Bra is valid for most conditions (rest, warm-up, walking). Progressing from active warm-up to run should be viewed with caution, as heart rate measurements were not all valid in this condition.

- 183** Board #21 May 29 9:30 AM - 11:00 AM
Impact Identification With Machine Learning From Low Frequency Wearable Sensor Data Among National Ice-hockey Players
 Aaron M. Pilotti-Riley¹, Davor Stojanov¹, Muhammad Sohaib Arif¹, Erik M. Bollt², Stephen J. McGregor¹. ¹Eastern Michigan University, Ypsilanti, MI. ²Clarkson University, Potsdam, NY. (Sponsor: Dr. Andrew R. Coggan, FACSM)
(No relevant relationships reported)

Purpose

To determine if machine learning approaches could be used to improve impact identification from low frequency data collected from wearable sensors (WS) among national ice-hockey team members.

Methods

23 members of the U.S. National (NTDP) U18 team consented to procedures approved by EMU Human Subjects Committee. Using previously validated impact events identified from data collected at 100 Hz (Impact Processor, Zephyr MD), we used two neural network approaches, autoencoder (AE), neural network that can reconstruct inputs of large data sets and multi-layer perceptron (MLP), a neural network that uses non-linear activation of multiple layers of interconnecting nodes as well as support vector machine (SVM) to attempt to improve the identification of impacts from summary data recorded at 1 Hz. A dataset, selected from 8 players with the highest ice time in one game, was comprised of 86 impacts and 88602 samples were used to train the AE. Variables from 1 Hz data used to train the AE included Activity and Peak resultant acceleration as well as Peak and Min accelerations in the Vertical, Lateral and Sagittal planes. The trained AE was then applied to the validated test set from 8 players for 3 games consisting of 409 impacts and 462138 datapoints. Accuracy was determined by F1 score ($F1 = 2 * (\text{precision} * \text{recall}) / (\text{precision} + \text{recall})$), where precision = true positives / (true positives + false positives) and recall = true positives / (true positives + false negatives).

Results

Using only trained AE, 187 true positives, 3299 false positives and 222 false negatives were identified with an F1 score of 0.096. To improve accuracy, AE was used as filter with MLP for classification, which identified 184 true positives, 225 false negatives and only 26 false negatives resulting in an F1 score of 0.594. Finally, using AE filter and the SVM classifier with class weights produced the best results with 272 true positives, 137 false negatives and only 50 false positives and an F1 score of 0.744.

Conclusion

These data show that using autoencoder programming with additional classification (MLP or SVM) impacts can be identified at 1 Hz with relatively high F1 scores in ice hockey using trunk-worn wearable sensors. Finally, using sensor fusion techniques, it is likely impact identification in ice-hockey could be entirely automated.

- 184** Board #22 May 29 9:30 AM - 11:00 AM
Monitoring External Training Loads and Neuromuscular Performance For Division I Basketball Players Over the Pre-Season
 Aaron Heishman, Ryan M. Miller, Eduardo D.S. Freitas, Brady S. Brown, Bryce D. Daub, Michael G. Bembem, FACSM. *University of Oklahoma, Norman, OK.* (Sponsor: Michael G. Bembem, FACSM)
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(No relevant relationships reported)

External training load (TL_E) is used to quantify the biomechanical load accrued during training. The countermovement (CMJ) jump is used to evaluate neuromuscular fatigue and recovery in response to TL_E . However, limited research has coupled TL_E parameters with changes in neuromuscular performance variables from the CMJ. **PURPOSE:** The purpose of this investigation was twofold: 1) to characterize TL_E across the pre-season and 2) examine the differences in TL_E per session and CMJ performance across the 5 weeks of pre-season training in NCAA D1 basketball athletes. Additional analyses examined the influence of position and scholarship standings. **METHODS:** TL_E was monitored in 14 male athletes during 22 basketball practice sessions over the course of the pre-season. In addition, weekly CMJs were used as an indicator of neuromuscular fatigue and performance. A 3-way (2 X 2 X 5) Repeated Measures Analysis of Variance with Bonferroni post hoc analysis was used to examine differences in the average TL_E per session each week and differences in the CMJ variables of Flight Time: Contraction Time (FT:CT) and Jump Height (JH) across time and between position (Guard vs. Forward/Center) and academics (Scholarship vs. Walk-on). Statistical significance was set at $p \leq 0.05$. **RESULTS:** Player load per minute (PL; PL/min) was significantly higher during Week 1 and Week 2 compared to Week 3 ($p < 0.05$). No significant differences were observed for average PL, high inertial movement analysis (IMA), or Total Jumps per session across the 5 weeks of pre-season ($p > 0.05$). A significant group X time interaction indicated Scholarship athletes had greater PL, PL/min, 2 Dimensional PL, High IMA, and Total Jumps compared to the Walk-on athletes. Player position did not influence TL_E . No significant

differences were observed in FT:CT or JH over the 5 weeks of preseason ($p > 0.05$) or between groups ($p > 0.05$). **CONCLUSION:** The present study characterizes the TL_E demands in collegiate basketball during the pre-season. The average TL_E per week did not vary across 5 weeks of training, while differences in intensity (PL/min) were evident. While no differences were observed between position groups, there was a significant difference in TL_E between scholarship and walk-on athletes.

185 Board #23 May 29 9:30 AM - 11:00 AM

Accuracy of Activity Monitors in Measuring Energy Expenditure and Heart Rate During a Gym-based Routine

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(No relevant relationships reported)

PURPOSE: Two wrist-worn monitors (FBS and GVF) and an armband (SWA) were evaluated in measuring energy expenditure (EE) and heart rate (HR) during a gym-based routine. **METHODS:** Men ($n = 21$) and women ($n = 16$) completed a gym-based routine comprised of 15-min stationary cycling (SC), 15-min treadmill running (TR), and 35-min resistance training (RTR) at self-selected intensities while wearing the monitors. All monitors were compared to a portable metabolic analyzer (OM) for EE. The FBS and GVF were compared to a chest HR monitor (PM) for maximal HR (HR_{max}) and average HR (HR_{avg}). **RESULTS:** Compared to the OM, the FBS and GVF produced higher EE estimates while the SWA overestimated EE during TR and underestimated EE for the rest (Table 1). Equivalency testing determined that no monitor was equivalent to the OM, although the SWA yielded the most favorable agreement for whole session as the 90% CI (410.9-500.1 kcal) overlapped the higher end of the equivalency zone (423.6-517.7 kcal) by only 12.7 kcal. Acceptable measurement error ($\leq 20\%$) for whole session was produced by the SWA and for TR by the SWA and GVF, while for RTR the GVF had the highest measurement error (Table 1). Significant bias was observed for the FBS and GVF during SC (10.1 ± 39.2 kcal and 18.6 ± 33.7 kcal), RTR (47.4 ± 52.7 kcal and 82.0 ± 79.2 kcal), and whole session (83.2 ± 93.7 kcal and 104.4 ± 131.9 kcal). In regards to HR_{avg} and HR_{max} , both monitors' 90% CIs fell in the equivalency zones with the exception of HR_{avg} measured by the FBS for RTR. The GVF had an improved accuracy over the FBS as indicated by lower error rates for HR_{avg} (SC: 2.0% vs 5.9%; TR: 2.4% vs 3.1%; and RTR: 2.4% vs 9.5%) and HR_{max} (SC: 0.8% vs 1.4%; TR: 0.9% vs 1.5%; and RTR: 0.9% vs 7.0%). **CONCLUSION:** The study protocol simulated real-world conditions to facilitate naturalistic application of the findings. No monitor accurately estimated EE, however, the SWA had the most favorable estimates. The FBS and GVF demonstrated comparable performance for both EE and HR estimates.

186 Board #24 May 29 9:30 AM - 11:00 AM

Innovations in Heart Rate Monitoring Devices and Smart Applications: Physical Configuration Matters!

Calixte Aholu, Nicole J. Smith, Catherine G.R. Jackson, FACSM, David A. Kinnunen. CSU Fresno, Fresno, CA. (Sponsor: Catherine G.R. Jackson, FACSM)

(No relevant relationships reported)

Bluetooth/ANT+ heart rate monitors and smart device applications have the potential to advance heart rate monitoring in non-clinical settings. New innovative applications allow for heart rate monitoring of multiple users simultaneously; however, preliminary attempts to use a particular commercially available model in a typical university gymnasium setting revealed persistent issues with signal interruption; thus, the trustworthiness of the data was limited.

PURPOSE: To reduce the prevalence of signal interruption by determining the best physical configuration of components.

METHODS: A quasi-experimental repeated measures design was utilized to determine the best configuration of the system components. Cluster and ANOVA analyses determined good, better, and best configurations. The dependent variable was signal interruption and the unit of analyses was the number of signal interruptions per two-minute session. The independent variables were height (1.8m, 3.6m, and 5.4m), angle (60°, 75°, and 90°), and location (left corner, middle, right corner) of the transmitter component. University students, male and female adults ages 19-25 with no apparent health problems, were recruited to participate during undergraduate physical education teacher education lab classes. Participants were monitored while participating in physical activities during normal class sessions. Classes were conducted in a typical indoor gymnasium slightly larger than a single standard collegiate-sized basketball court.

RESULTS: Inspection of the graphs and ANOVA analyses revealed that the best configuration of the system was transmitter device placement at a height of 1.8m F(2,

1,052) = 54.86, $p < .001$, partial $\eta^2 = .09$, at a 60° angle F(2, 1,052) = 12.50, $p < .001$, partial $\eta^2 = .02$, and in the left corner location F(2, 1,052) = 24.28, $p < .001$, partial $\eta^2 = .04$.

CONCLUSIONS: The height, angle, and location of the transmitter component all played a significant role in reducing the prevalence of signal interruption. It was determined that the best results were found with the lowest height and smallest angle chosen. Therefore, random placement of transmitter height, angle and location will not yield the best heart rate monitoring results.

187 Board #25 May 29 9:30 AM - 11:00 AM

Absolute Validity And Test-retest Reliability Of Step Counts For Fitbit Flex 2 In Pram Walking

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(No relevant relationships reported)

PURPOSE: To test the absolute validity and test-retest reliability in two kinds of pram walking settings and help researchers and postnatal women to choose suitable tools for monitoring physical activity levels. **METHODS:** 12 participants who were adult women (23.2 ± 0.7 years old) wore Fitbit Flex 2 on both wrists to perform the outdoor protocol: Two rounds of state distance pram walking of two settings (one round for each setting): (1) Both hands pushing setting; (2) One hand pushing setting. The step counts from Fitbit Flex 2 were compared to video recording to assess the absolute validity and test-retest reliability. **RESULTS:** The average Mean Absolute Percentage Error (MAPE) of step counts for left and right wrists in both hands pushing setting were -43.1% and -49.1%. In one hand pushing setting, the average MAPE of step counts for wrist of dominant hand was -52.6%, and -5.1% for wrist of non-dominant hand. In both hands pushing setting, the Fitbit Flex 2 had a low correlation (ICC=0.40) for wrist of dominant hands while the correlation of wrist of non-dominant hand was good (ICC=0.85). In one hand pushing setting, the correlations are excellent (ICC=0.99) for wrist of non-dominant hand and moderate for wrist of dominant hand (ICC=0.68). **CONCLUSIONS:** The absolute validity of step counts for Fitbit Flex 2 was poor when device applied on the wrists of both hands in both hands pushing setting and dominant hand in one hand pushing setting while the absolute validity was high when the device applied on the wrist of non-dominant hand in one hand pushing setting. The test-retest reliability is excellent to good when the device wore on the wrist of non-dominant hand and moderate to poor on the wrist of dominant hand.

188 Board #26 May 29 9:30 AM - 11:00 AM

Comparisons of Portable Metabolic Sensors During Outdoor Cycling

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(No relevant relationships reported)

Wearable technology has increased in prevalence and in the ability to monitor health related data. Additionally, the ability to record training data through various sensors has become essential in developing highly personalized training programs. Metabolic measurements have typically been confined to laboratory settings, but portable metabolic carts make the collection of these metrics in real world conditions possible.

Purpose. The purpose of this study was to compare measurements of VO_2 from two different portable metabolic carts, a new consumer focused cart (A) and a research grade cart (B), in outdoor cycling under steady state conditions.

Methods: A total of 10 participants were included in the study. All participants were recreationally trained cyclists who had track racing experience. Participants completed a ramped VO_{2max} test with lactate sampling from capillary blood at one minute intervals. Lactate threshold (LT) was estimated as the first stage prior to an increase of >1 mmol in lactate concentration. Participants later completed six 10-minute intervals in a pairwise manner at 50, 70, and 85% of their power at LT on an outdoor velodrome. Expired gasses during these intervals were analyzed by two different portable metabolic carts (A&B). Data from approximately 6-9 min of each interval were averaged. Comparisons between the two devices were made using paired t-tests.

Results: Average age of participants was 44.3 ± 3.01 years and VO_{2max} was 51.56 ± 2.74 mL/kg/min. Cart A was unable to capture enough data when cycling at 50% of LT and therefore no comparisons were possible. There were significant differences ($p < 0.001$) in absolute VO_2 (1890.0 \pm 245.1 mL/min vs. 2627.3 \pm 262.0 mL/min) between carts A&B respectively when cycling at 70% of LT. Additionally, there were significant differences ($p < 0.001$) in absolute VO_2 (2269.9 mL/min \pm 362.3 vs. 3069.3 \pm 317.5 mL/min) between carts A&B respectively when cycling at 85% of power at LT.

Conclusions: Measurements of VO_2 while cycling in an outdoor environment may not be consistent across devices.

Supported by FAST Grant from Sam Houston State University

189 Board #27 May 29 9:30 AM - 11:00 AM

Accuracy of an Armband Heart Rate Monitor

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(No relevant relationships reported)

Activity monitors have demonstrated success at facilitating positive physical activity behavior changes in diverse populations by providing self-monitoring, motivation, and timely feedback, yet questions loom due to a paucity of data on the accuracy of armband heart rate monitors (ABM). **Purpose:** The purpose of this investigation was to assess the accuracy of the ABM under aerobic exercise conditions. **Methods:** 15 male and 5 female college-aged subjects (age 20.9 ± 1.7 , ht. 177.0 ± 9.1 cm, body mass 72.8 ± 13.4 kg) engaged in steady state aerobic exercise on a treadmill while wearing the ABM and a hard wire electrocardiograph (ECG). PAR-Q+ and a brief medical screening preceded participation. Resting measures were obtained pre (sitting & standing) and post (sitting) aerobic exercise. The treadmill protocol included 3 minute stages at 1% grade with speeds of 53.6 meters/min, 80.4 meters/min, 107.2 meters/min, 160.8 meters/min, 187.6 meters/min, 214.4 meters/min, and a cool-down at 53.6 meters/min. **Results:** Statistical analysis by paired t-tests revealed NSD between HR of 74 \pm 14 & 74 \pm 14, 98 \pm 14 & 98 \pm 14, 120 \pm 16 & 121 \pm 19, 156 \pm 17 & 156 \pm 19, 175 \pm 17 & 176 \pm 17, and 187 \pm 16 & 187 \pm 16 b/min at speeds of 80.4, 107.2, 160.8, 187.6, and 214.4 m/min, for ABM & EKG, respectively. Only the 53.6 speed revealed a significant difference in HR of 90 \pm 13 vs 92 \pm 13 for ABM and EKG, respectively. In addition, there was a high correlation and low standard error between the ABM and ECG measures ($r = .998$, $SE = .2$). At speeds of 80.4 ($r = .981$, $SE = .59$), 107.2 ($r = .952$, $SE = 1.31$), 160.8 ($r = .99$, $SE = .7$), 187.6 ($r = .98$, $SE = .77$), and 214.4 meters/min ($r = .995$, $SE = .38$) there was also a high correlation and low standard error. Contrary to all other trials, the 53.6 meters/min trial ($r = .992$, $SE = .38$) showed a significant difference at the $p < .01$ level (.004). **Conclusion:** At all workloads in excess of 53.6 m/min, the ABM provides accurate HR measures, however for the novice exercise enthusiast or the slow paced walker, ABM may be insufficient for accurate HR monitoring.

190 Board #28 May 29 9:30 AM - 11:00 AM

Validation of Garmin Fitness Tracker Biomechanics

Bryson Carrier, Tim Holmes, Lauren Williams, Siri Dahl, Libby Weber, Andrew Creer, Tyler Standifird. *Utah Valley University, Orem, UT.*
(No relevant relationships reported)

Purpose: As fitness trackers become more available, the need for independent validation has become more important to drive accuracy in training decisions and physiologic research. Therefore, the purpose of this study was to find the reliability and accuracy of the data collected from the Garmin fenix 3 HR fitness tracker. **Methods:** 17 healthy, recreational runners (9 male, 8 female, 28.11 ± 7.38 yrs, 70.26 ± 10.76 kg, 173.77 ± 5.96 cm) performed three running conditions (flat, incline (5%), and decline (-5%)) on an instrumented treadmill used to collect ground reaction force data. Infrared markers were placed on the foot and trunk and tracked with a 16 camera motion capture system. The data was processed using Visual 3D software (5.0, C-Motion, Inc., Germantown, MD, USA) and variables extracted were compared to data collected by the Garmin fenix 3 HR (Garmin Ltd., Olathe KS). **Results:** Statistical analysis was done via a 2-tailed paired t-test comparing the data taken from the motion capture system and instrumented treadmill to the data collected by the Garmin watch. There were no differences between the Garmin and the treadmill for flat stride length, declined stride length, inclined run cadence, declined run cadence, and inclined ground contact time. Differences ($p < .05$) were observed in inclined stride length, flat run cadence, flat vertical oscillation, inclined vertical oscillation, declined vertical oscillation, flat ground contact time, and declined ground contact time. **Conclusion:** Overall the Garmin fenix 3 HR fitness tracker was found to be reasonably reliable for certain variables, such as stride length and run cadence, but not reliable for vertical oscillation and ground contact time. Certain considerations should be taken as to the accuracy of the variables when using this data to drive training adaptations.

191 Board #29 May 29 9:30 AM - 11:00 AM

Validation of Garmin Fitness Tracker Metabolic Data (VO_{2max})

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(No relevant relationships reported)

Purpose: As fitness trackers become more available, the need for independent validation has become more important to drive accuracy in training decisions and physiologic research. Therefore, the purpose of this study was to determine the accuracy of predicted maximal aerobic fitness assessment (VO_{2max}) from the Garmin

fenix 3 HR fitness tracker when compared to a lab based VO_{2max} test. **Methods:** 6 healthy recreational runners (4 male, 2 female, 25.4 ± 2.5 yrs, 69.0 ± 6.0 kg, 174 ± 5.7 inches, 35.4 ± 29.9 km/wk) participated in two testing sessions; a graded exercise test to exhaustion (GXT) on a treadmill and a 15-minute submaximal outdoor track session. During the treadmill GXT expired gases were collected and analyzed using a metabolic cart, with the highest value being considered VO_{2max}. Heart rate was measured continuously via telemetry, with the highest value recorded as the maximal heart rate (HR_{max}). Participants then completed a submaximal outdoor run on a track between 48 hrs and 7 days after the lab test. The outdoor run involved maintaining at least 70% of HR_{max} for 15 minutes while wearing a Garmin fenix 3 HR watch and Garmin HR monitor chest strap. The watch was reset to default settings prior to inserting participant data into the watch for each test. Statistical analysis was done via a 2-tailed paired t-test, comparing the lab and field measures. **Results:** There was no difference between the treadmill GXT (51.8 ± 7.8 ml/kg/min) and the Garmin estimated value from the outdoor run (53.2 ± 4.1 ml/kg/min) for VO_{2max}. **Conclusion:** Overall the Garmin fenix 3 HR fitness tracker was found to provide an accurate estimate of VO_{2max} when compared to an actual GXT. Based on these data it would appear that the Garmin fenix 3 HR watch with chest strap may provide individuals an accurate assessment of their aerobic capacity for simple self-monitoring.

192 Board #30 May 29 9:30 AM - 11:00 AM

Sports Performance Wearable Technology, sEMG, and Manual Muscle Testing: Practical Methods for Measuring Maximal Voluntary Contractions

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(Sponsor: Daniela A. Rubin, FACSM)

(No relevant relationships reported)

PURPOSE: The development in sports performance wearable technology has allowed for the monitoring of an athletes' internal load via surface electromyography (sEMG) - based garments. These garments have been shown to be a valid tool for measuring sEMG in sports settings. However, to conduct valid comparisons of sEMG, current methods often involve referencing data from a particular movement to a maximal voluntary contraction (MVC). MVCs are typically measured using an isokinetic dynamometer (ISO); however, with the application of sEMG in a sports environment utilizing an ISO can be impractical. An alternative is the use of manual muscle testing (MMT), in which manual resistance is applied by a trained practitioner to invoke a MVC. The purpose of this study was to compare sEMG-based garment measurement of MVCs elicited using ISO versus MMT in lower extremity muscles. **METHODS:** Twelve healthy, physically active participants (7 males, 5 females) were recruited for this study. Participants were fitted with a sEMG-based compression short or leggings embedded with sEMG sensors. Following a dynamic warm-up, participants performed, in a randomized order, either ISO or MMT normalization protocols to measure the MVC of the vastus medialis (VM), vastus lateralis (VL), bicep femoris (BF) and gluteus maximus (GM). Data were sampled at 1KHz and band pass filtered, with the peak amplitude of the MVC used for analysis. Paired samples t-tests ($p < .05$) were used to compare the mean peak amplitudes from each muscle between ISO and MMT protocols. Pearson's correlations ($p < .05$) were conducted to evaluate the degree of the relationship of peak amplitudes obtained by the two protocols for each muscle. **RESULTS:** No significant differences ($p = .47-.88$) were found between any of the muscles when comparing mean peak amplitudes for the ISO and MMT protocols. Significant correlations indicated a positive association between peak amplitudes obtained through ISO and MMT for the VM, RF, and BF ($r > 0.80$, $p < .001$ for all) and for the GM ($r = .63$, $p = .022$). **CONCLUSIONS:** The present data demonstrated that similar sEMG MVC data for the VM, VL, BF, and GM were recorded for the ISO and MMT. This suggests that the use of MMT, when administered by a trained member of staff, could be a practical method for normalizing each of the measured muscles to the MVC in a field environment.

193 Board #31 May 29 9:30 AM - 11:00 AM

NICA Injury Surveillance System: Concussion Risk Factors

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(No relevant relationships reported)

Scientific Abstract

Clinical experience highlights the dangers of the sport of mountain biking, with a high volume of contusions, laceration, fractures and concussions. Scientific literature to date has been sparse with regards to injuries in this population. While participation in this sport can transform the lives of the racers with its emphasis on fitness and fun, injuries can significantly limit the student-athlete's ability to exercise. However, this project has strong potential to make high school mountain bike racing a safer sport.

PURPOSE: To determine the most common injury occurring in mountain biking athletes and identifying specific risk factors in the most common injury—concussions. **METHODS:** An incident survey was developed using redcap software to give coaches the capacity to report trauma and all circumstances contributing to their athletes' injuries. The Spring 2018 league presented 4,671 students, and the end of the Fall 2018 league added 13,343 more student athletes. In total, this presented a total of 18,014 student athletes from 2018 to look at.

Demographics were recorded: age, year in school, division, sex, league, and state. The incline and trail conditions were also accounted for as variables. Weather was marked on the survey, and circumstances for crashes were accounted for—practice, race, passing, familiarity with trail, etc. Statistical and machine learning methods were then used to recognize the most commonly occurring injury and decipher risk factors.

RESULTS: It is still too early in the project for firm conclusions, but early analysis of the NICA database has shown concussions to account for up to 23% of all injuries recorded in the injury surveillance system in 2018. Team practice accounts for 56.3% of injuries. Downhill racing accounts for 72% of concussions, as well as a distinct gender bias with males.

CONCLUSION: Concussions account for the most injuries with regard to competitive mountain biking. The varsity league accounts for the least amount of concussions, which suggests injury prevention needs to be taught early on to less experienced riders. Safety strategies on courses, with equipment, and with skills training should be implemented to lower the amount of concussions (and total injuries) for athletes in the coming years.

A-39 Free Communication/Poster - Muscle Dynamics

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

194 Board #32 May 29 9:30 AM - 11:00 AM EEG Measurement In Elderly People During Stepping Exercise With Visual Perception Tasks

Takahide Kato¹, Taichi Hayasaka¹, Tsukasa Sanuki¹, Takashi Kawagoe², Stanley M. Yamashiro³. ¹National Institute of Technology, Toyota College, Toyota, Japan. ²Aichi Medical University, Nagakute, Japan. ³University of Southern California, Los Angeles, CA.

(No relevant relationships reported)

The increased risk of falling with aging leads to a recurrent problem in elderly in need of long-term care and may become a major social problem. A reduction in muscular strength and a decline in perceptual function are listed as causes of falls. As a countermeasure to fall risk the effect of various types of exercise training and visual perception tasks (VPT) were tried. Recently, previous studies measured electroencephalograms (EEG) during exercise with wireless electroencephalograph. The evaluation of EEG in elderly during exercise with VPT and comparing results in young may provide a novel insight on prevention of falls. **PURPOSE:** The aim of this study was to examine whether the EEG signals during stepping exercise could be amplified by VPT and aging. We measured EEG during stepping exercise with or without VPT for subjects of ages: 70s, 40s, and 20s. **METHODS:** 11 males in 70s (73±5 yrs), 10 males in 40s (44±3 yrs), and 10 males in 20s (20±1 yrs) carried out stepping exercise for 5 min with or without VPT. EEG during stepping exercise was measured using a wireless electroencephalograph (EMOTIV EEG headset). We analyzed the averaged power spectral density (PSD) for all electrodes with time frequency analysis, and a phase locking index (PLI) with phase synchronization quantification. Statistical comparisons were made using two-way ANOVA. **RESULTS:** PSD without VPT in age 70s (1692±77 dBμ) was larger than in 40s (1374±78 dBμ) and 20s (828±78 dBμ) ($p < 0.05$). Moreover, PSD magnitude increased with VPT in all ages (70s: 1795±73, 40s: 1645±79, 20s: 1075±79 dBμ, $p < 0.05$). PLI of θ wave with VPT in age 70s (0.086±0.0019) was smaller than 40s (0.101±0.0021) and 20s (0.110±0.0021) ($p < 0.05$). PLI of α wave with VPT in age 70s was less than without VPT (0.087±0.0011 vs. 0.091±0.0012, $p < 0.05$), whereas PLI of β wave with VPT in 70s was larger than without VPT (0.094±0.0006 vs. 0.091±0.0007, $p < 0.05$).

CONCLUSIONS: EEG signals in elderly during stepping exercise is larger than in middle age and young, and is enhanced by VPT. Additionally, the phase pattern may help explain the differences of cognitive functions for VPT between age groups. Supported by The Naito Research Grant.

195 Board #33 May 29 9:30 AM - 11:00 AM Does Squat Depth and Width Influence Quadriceps Muscle Activation?

Matt Denning¹, Brad Gardiner², Tyler Standiford³, Lauren Williams³. ¹Brigham Young University - Idaho, Rexburg, ID. ²Weber State University, Ogden, UT. ³Utah Valley University, Orem, UT. (Sponsor: Doug Powell, FACSM)

(No relevant relationships reported)

Squats are a popular closed-chain exercise that benefit strength, power, and balance. Squats are often performed with varying depths and widths. Squat variation may elicit different demands on the neuromuscular system. **PURPOSE:** This study investigated muscle activation of the vastus lateralis (VL) and vastus medialis (VM) during 9 different squat variations. **METHODS:** 13 healthy, college-aged adults (6 female, 7 male, mass = 73.5 ± 15.0 kg; height = 1.7 ± 0.09 m) performed body-weight squats at 3 widths (standard (shoulder width), wide (150% of shoulder width), and widest (200% of shoulder width)) and 3 squat depths (shallow (55 degree knee flexion), parallel (90 degree knee flexion), and deep (125 degree knee flexion)). Electromyography (EMG) and marker data were used to determine peak EMG amplitudes during the eccentric and concentric phases of the squat. 2x3 ANOVAs were used to evaluate the simultaneous effect of squat depth and width on peak EMG amplitude. EMG data were filtered using a root mean square approach and normalized to a 30-degree squat reference position. **RESULTS:** Generally, muscle activation increased with greater squat depth, but did not change with greater squat width. Specifically, VL amplitude during the concentric phase was 61% and 119% greater during the parallel (232.7 ± 81.5% reference value; $p < 0.01$) and deep squat (315.2 ± 133.3% reference value; $p < 0.01$) when compared to the shallow squat (144.2 ± 52.4% reference value). Similarly, VM amplitude during the concentric phase was 70% and 88% greater during the parallel (262.9 ± 207.6% reference value; $p = 0.03$) and deep squat (292.2 ± 171.4% reference value; $p < 0.01$) when compared to the shallow squat (155.6 ± 99.8% reference value). Surprisingly, there was no statistical difference in EMG amplitude during the eccentric phase or for the depth by width interactions ($p > 0.05$). **CONCLUSIONS:** These data support the idea that deep squats can be used to generate increased muscle activity of the lower-extremities. Our data also indicate that increased squat width does not increase muscle activity, although our study only examined muscles primarily used for sagittal-plane movement. Further research is needed to investigate the intertwined relationship between squat depth and width on muscle activation for additional lower-extremity muscles.

196 Board #34 May 29 9:30 AM - 11:00 AM Contractile Parameters Of The Knee Extensors In Young, Middle-aged, And Older Males

Phuong L. Ha, Alex A. Olmos, Matthew T. Stratton, Alyssa R. Bailly, Micah J. Poisal, Joshua A. Jones, Benjamin E. Dalton, Amber N. Haire, Trisha A. VanDusseldorp, Yuri Feito, FACSM, Garrett M. Hester. Kennesaw State University, Kennesaw, GA. (Sponsor: Dr. Yuri Feito, FACSM)

(No relevant relationships reported)

Peak power (PP) is decreased in older adults; however, less is clear regarding the determinants of PP, contractile torque and velocity. Furthermore, it is unknown if these measures are affected differently in middle and old age. **PURPOSE:** To compare PP and its determinants for the knee extensors in young, middle-aged, and older males. **METHODS:** As part of a larger ongoing investigation, contractile properties of the knee extensors were assessed in healthy, untrained young (YM: $n = 8$, age = 20.5 ± 1.6 yrs), middle-aged (MM: $n = 6$, age = 46.0 ± 2.9 yrs) and older (OM: $n = 6$, age = 69.0 ± 3.10 yrs) males using a Biodex System 4 dynamometer. Upon completing a familiarization visit, a testing visit involving three maximal voluntary isotonic knee extensions, performed at 40% of isometric peak torque, was completed. Participants were instructed to "kick out as hard and fast as possible" prior to each contraction. Power was calculated as the product of torque and velocity for the isotonic contractions using custom written software and PP was recorded. In addition, velocity (VEL) and torque (TQ), at the moment in time PP occurred, were recorded. One-way analyses of variance and Games-Howell post hoc tests were used to compare groups. **RESULTS:** PP was lower in OM compared to YM (50%; $p = 0.021$), but was similar in MM compared to YM and OM ($p > 0.05$). VEL was decreased in OM compared to YM (36%; $p = 0.007$) and MM (24%; $p = 0.044$), however, no difference was noted between MM and YM. TQ was similar between groups ($p = 0.147$). **CONCLUSION:** Our preliminary data indicate that reductions in VEL for the knee extensors occur between middle and old age prior to a decrease in PP, while TQ is maintained in old age. Thus, VEL appears to be more dramatically affected by age, and the age-related decrease in PP may be primarily mediated by impaired velocity capacity.

197 Board #35 May 29 9:30 AM - 11:00 AM

Effect Of Knee Joint Angle On Neuromuscular Activation Of The Quadriceps Femoris During Fatiguing Contractions

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(No relevant relationships reported)

In muscle fatigue studies, repetitive muscle contractions at a submaximal force level (e.g., 50% of maximum voluntary contraction [MVC]) are frequently used as a fatiguing task such as isometric knee extensions. Contrary to submaximal fatiguing contractions, when MVC is used to induce muscle fatigue, muscle force will decrease despite maximal effort and amplitude and/or frequency of electromyographic (EMG) signals will also change with the development of muscle fatigue. However, it is unclear the effect angle of knee joint on the neuromuscular activation of individual muscles of quadriceps femoris during repetitive knee extension tasks. **PURPOSE:** We sought of this study was to assess the effect of knee joint angle on the neuromuscular activation pattern of the four individual muscles in the quadriceps femoris during repetitive fatiguing MVCs. **METHODS:** Fifteen healthy men and women (age, 25 ± 3 years; height, 165 ± 11 cm; weight, 57 ± 10 kg) performed two fatiguing tasks consisting of 40 MVCs at knee joint angles of 80° (flexed) and 140° (extended). Neuromuscular activation of the vastus intermedius (VI), vastus lateralis (VL), vastus medialis (VM) and rectus femoris (RF) was recorded using surface electrodes, and median frequency (MF) and root mean square (RMS) of EMG signals (normalized by pre-test MVCs) were calculated. **RESULTS:** MVCs significantly decreased from the 10th to the 40th repetition at both knee joint angles. The MFs of VI and VM in the flexed knee joint angle and that of RF at the flexed and extended knee joint angles were significantly decreased after the 10th repetition. There were no significant changes in normalized EMG amplitude in any muscles specific to knee angle. Stepwise regression analysis revealed predictive synergistic action may take place in RF, VM, and VI in the flexed joint angle and between RF and VM at the extended joint angle. **CONCLUSION:** These results suggest that neuromuscular activation of RF and VM is independent, but activation of VI and VL is dependent, upon knee joint angle, which may, in part, explain joint angle-specific muscle fatigue.

198 Board #36 May 29 9:30 AM - 11:00 AM

Joint Flexibility Is Affected by Muscle Size in Human Planter Flexors

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(No relevant relationships reported)

PURPOSE: Only one study has reported that a larger muscle thickness may relate to a lower joint flexibility in the planter flexors (Kubo et al. *Eur J Appl Physiol* 85, 2001). Muscle volume (MV), compared to muscle thickness, is known to be more appropriate for evaluating muscle size. To further clarify the findings of the previous study, in this study, we examined the relationship between joint flexibility and MV in the planter flexors. **METHODS:** In study 1, we recruited 96 healthy young males (age: 21.6 ± 1.4 years). The planter flexor muscle thickness was measured using ultrasonography (US). The planter flexor MV was estimated using lower leg length and muscle thickness based on a multiple regression equation, which was reported in previous study (Miyatani et al. *Eur J Appl Physiol* 91, 2004). In study 2, we recruited 38 healthy young males (age: 21.5 ± 2.2 years). The planter flexor MV was calculated by multiplying the sum of successive cross-sectional areas measured using magnetic resonance imaging (MRI), and included MVs of the soleus (SOL), gastrocnemius medialis (GM), and gastrocnemius lateralis (GL). In both studies, to evaluate planter flexor flexibility, dorsiflexor active range of motion (ROM) and planter flexor passive stiffness were measured using a dynamometer system. The dorsiflexor ROM was defined as dorsiflexion angle (i.e., end-ROM) which was reached by maximal effort during active dorsiflexion. The planter flexor stiffness was calculated from the linear slope of the torque-angle curve between 10° and 20° dorsiflexor angles during passive dorsiflexion. **RESULTS:** In study 1, US-estimated planter flexor MV was significantly correlated with dorsiflexor ROM ($r = -0.431$, $P < 0.001$) and planter flexor stiffness ($r = 0.474$, $P < 0.001$). In study 2, MRI-measured planter flexor MV was significantly correlated with dorsiflexor ROM ($r = -0.484$, $P = 0.002$) and planter flexor stiffness ($r = 0.592$, $P < 0.001$). Furthermore, all three MVs among planter flexors were significantly correlated with dorsiflexor ROM ($r = -0.481$, $P = 0.002$ for SOL; $r = -0.360$, $P = 0.027$ for GM; $r = -0.432$, $P = 0.007$ for GL) and planter flexor stiffness ($r = 0.559$, $P < 0.001$ for SOL; $r = 0.502$, $P = 0.001$ for GM; $r = 0.510$, $P = 0.001$ for GL). **CONCLUSION:** The present findings suggest that joint flexibility of planter flexors is affected by their MVs in healthy young males.

199 Board #37 May 29 9:30 AM - 11:00 AM

Lower Extremity Joint Power and Muscle Activation in High and Low Lactate Threshold Cyclists

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(No relevant relationships reported)

When comparing cycling and inclined treadmill running in well-trained cyclists, two groups have emerged in prior research: 1) cyclists with equally high LT_{VO_2} while cycling and running uphill (HLT) and 2) cyclists with low cycling LT_{VO_2} (LLT) but high running LT_{VO_2} (closely matching those of the HLT cyclists). The physiological and biomechanical differences between HLT and LLT cyclists have yet to be completely described.

PURPOSE: To determine differences in absolute/relative joint powers and knee extensor muscle activation between HLT and LLT cyclists. **METHODS:** Sixteen well-trained endurance athletes completed cycling and running VO_{2max} and cycling and running lactate threshold (LT_{VO_2}) testing, and were separated into two groups based on cycling LT_{VO_2} (HLT: $n=8$) and (LLT: $n=8$). Hip, knee, and ankle absolute and relative joint powers (the percent contribution to total joint powers) and electromyography (EMG) assessed muscle activation of the knee extensors (vastus lateralis (VL), vastus medialis (VM), and rectus femoris (RF)) were compared between groups during submaximal cycling (60-90% VO_{2max}). **RESULTS:** VO_{2max} was similar in the two groups when cycling (HLT: 4.57 ± 0.17 vs LLT: 4.42 ± 0.15 L/min) and running (HLT: 4.47 ± 0.13 vs LLT: 4.49 ± 0.16 L/min). HLT cyclists had higher LT_{VO_2} while cycling compared with the LLT group (HLT: 3.68 ± 0.21 vs LLT: 3.10 ± 0.15 L/min); however, no differences in running LT_{VO_2} were found (HLT: 3.73 ± 0.18 vs LLT: 3.71 ± 0.13 L/min) ($p > 0.05$). Blood lactate concentration increased with work rate and was lower in the HLT group at 80 and 90% of VO_{2max} compared with the LLT group ($p < 0.05$). There were no differences between groups in absolute joint specific power across work rates ($p > 0.05$). However, relative hip contribution was significantly greater in the HLT group at 90% VO_{2max} compared to the LLT group ($p < 0.05$). Furthermore, VM EMG activity was higher in the LLT group at 60 and 70% VO_{2max} ($p < 0.05$); yet there were no between group differences in VL or RF activation ($p > 0.05$). **CONCLUSION:** HLT cyclists have a greater relative hip contribution during submaximal cycling power and reduced stress on a knee extensor muscle (i.e. lower VM activation) compared to LLT cyclists.

200 Board #38 May 29 9:30 AM - 11:00 AM

Can Transcranial Direct Current Stimulation Improve Counter-movement Jump Performance ?

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(No relevant relationships reported)

Transcranial direct current stimulation (tDCS) is a non-invasive brain stimulation technique and has been known to reliably alter motor cortical excitability. Anodal stimulation increases cortical excitability and cathodal stimulation inhibits cortical excitability. However, the effects of tDCS on counter-movement jump (CMJ) is currently unknown. **PURPOSE:** The aim of this study was to investigate the effects of tDCS on CMJ performance in healthy men. **METHODS:** A double-blinded crossover design was used. Fourteen male subjects (age: 22 ± 2 yrs, height: 174.43 ± 5.74 cm, weight: 68.66 ± 9.47 kg) received three time stimulations, each time an anodal tDCS (a-tDCS) or cathodal tDCS (c-tDCS) or sham tDCS randomly. The electrodes are placed over primary motor cortex (M1) bilaterally and the opposite electrodes pair over the ipsilateral shoulders. Each stimulation lasted 20 min, 48-72 hours apart and current was set at 2mA. Participants were required to get anthropometric measurements and familiar with CMJ in advance. Then, completed five CMJ tests before and after each stimulation, with one minute recovery interval between each test. The best three of the five CMJ in each moment was selected for analysis. Two-way (condition × time) ANOVA with repeated measures were used for CMJ height, flight time, and initial velocity. **summary of RESULTS:** There was a significant interaction between condition and time for CMJ height ($F_{(2,39)} = 7.948$, $p < 0.001$), flight time ($F_{(2,39)} = 8.228$, $p < 0.001$), and initial velocity ($F_{(2,39)} = 8.375$, $p < 0.001$). There were no significant main effects for condition or moment for any of the outcome measures ($p > 0.05$). Post-hoc analysis showed that there were no significant differences between conditions both on pre- and post-stimulation moments ($p > 0.05$). However, post a-tDCS performance was significantly superior to pre a-tDCS for CMJ height, flight time and initial velocity ($p < 0.001$ for all). There were no significant pre-post changes in both c-tDCS and sham-tDCS conditions ($p > 0.05$ for all). **CONCLUSION:** Our findings demonstrate that anodal tDCS may be a valuable tool to enhance vertical jumping ability, which is very important for human sport performance.

- 201** Board #39 May 29 9:30 AM - 11:00 AM
Relationship between Muscle Damage Magnitude and Sense of Knee Position
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It has been proposed in the literature that muscle damage may temporarily and negatively affect proprioceptive capacity, which can be tested through the ability to replicate angles, while muscle damage can be verified by quantifying creatine kinase (CK) in the bloodstream.

PURPOSE: to verify the relationship between muscle damage and sense of position in the isokinetic dynamometer, in knee extensors, after an eccentric exercise protocol. **METHODS:** ten male college students (age: 20.6 ± 1.8 years, body mass: 75.0 ± 11.7 kg, height: 177.4 ± 6.9 cm), with no prior experience with resistance exercises, were submitted to an eccentric exercise protocol, in the isokinetic dynamometer, for induction of muscle damage composed of two phases: 1st phase: 10 sets of 10 repetitions with 30 seconds of rest (100 eccentric contractions) - Speed = $30^\circ / s$. There was a 5 minute break between the phases. 2nd phase: 11 sets of 10 repetitions and 30 seconds of rest (110 eccentric contractions) - Speed = $180^\circ / s$. To evaluate the muscle damage was used the values of CK peak found in the post-tests shortly after exercise, 24h, 48h, 72h and 96h. To verify the sense of position, the subjects, blindfolded, should find the angle of 60° in the right knee on the isokinetic dynamometer. Was used a subtraction of the target value (60°) by the angle performed by the subjects on the day of CK peak. The normality of the sample data was verified using the Shapiro-wilk test and Pearson's correlation was applied between peak CK and significance level of 5%.

RESULTS: There was a significant correlation ($p = 0.014$) between CK and knee position sense, with $r = 0.742$ classified as strong (Devore, 2006).

CONCLUSIONS: the induction of muscle damage caused by eccentric exercise significantly influences the subjects' proprioception, since the higher the CK values, the greater the angular discrepancies between the expected value and the one performed by the subjects.

- 202** Board #40 May 29 9:30 AM - 11:00 AM
Muscle Activity While Swimming in Triathlon Wetsuits
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In a triathlon event, people use various strategies and equipment for enhancing their triathlon performance in each exercise mode (i.e., swim, bike, run). During the swimming portion of a race, triathletes will typically wear a wetsuit that is categorized as either full sleeve or sleeveless. Anecdotally, triathletes may select a sleeveless wetsuit because the full sleeve may increase shoulder movement resistance. **Purpose:** The purpose of this study was to investigate shoulder muscle activity influenced by wetsuit design. **Methods:** Seven subjects (5 male and 2 female, age: 45.7 ± 8.0 yrs, height: 174.8 ± 10.5 cm, mass: 70.1 ± 9.4 kg) participated in the experiment. Muscle activity of the Anterior Deltoid (AD) and Posterior Deltoid (PD) was measured (2000 Hz) using a water proofed electromyography (EMG) system (MiniWave, Cometa, Italy). After a self-directed warm-up, participants were asked to swim 50m at a 'somewhat hard' pace that they could maintain the pace for a sprint triathlon distance (750m) for each condition: No wetsuit (NWS), sleeveless wetsuit (SLW), and full sleeve (FSW). PD EMG data were smoothed using a 4th order Butterworth filter (cutoff frequency = 4 Hz). The smoothed data were used to identify the beginning and ending points of a stroke cycle. Five consecutive stroke cycles were then extracted for analysis as well as the time to complete the five cycles. Data analysis was performed using the raw unfiltered EMG data which were reduced by removing any zero offset, full wave rectifying the signal, and calculating the average EMG across the 5 stroke cycles (PDavg, ADavg). Time and average data were compared between conditions using a 1 x 3 (wetsuit condition) repeated measures ANOVA. **Results:** Muscle activity of both AD and PD were not different among all wetsuit conditions ($p > 0.05$). However, time was different among conditions ($p < 0.05$) with FSW being shorter than NWS ($p < 0.05$), but between the two wetsuits (FSW and SLW) were not different ($p > 0.05$). **Conclusion:** While swimming at a somewhat hard intensity, wetsuit design did not influence muscle activity of the shoulder muscle. However, stroke time was influenced by wearing a wetsuit regardless of design. Triathletes might get a benefit to reduce their swimming race time by wearing a wetsuit regardless of full-sleeve or sleeveless.

- 203** Board #41 May 29 9:30 AM - 11:00 AM
Sex Differences in Correlations Between Muscle Architecture and Impulse in a Heterogenous Group of Athletes
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BACKGROUND: Previous investigations have identified moderate to strong relationships between skeletal muscle architecture (SMA) and performance measures in athletes, however differences between males and females in this regard are not well known. A better understanding of relationships between task-specific impulse windows and SMA in males and females may allow coaches to direct training stimuli toward improving specific morphological underpinnings of sport performance for the athletes under their care. **PURPOSE:** The purpose of this analysis was to determine relationships between components of SMA and isometric impulse in male and female athletes. **METHODS:** Pennation angle (PA), fascicle length (FL), and anatomical cross-sectional area (ACSA) were determined for the vastus lateralis muscle via β -mode ultrasonography in a group of male ($n = 94$) and female ($n = 61$) collegiate, club, and international athletes. Net isometric impulse at 50, 90, 200, and 250 ms was measured during an isometric mid-thigh pull (IMTP) test administered pre-season as part of an ongoing athlete monitoring program. **RESULTS:** Pearson product-moment correlation revealed weak correlations between FL and impulse in males ($r = 0.33$ to 0.36 , $p < 0.05$) but not in females, weak correlations between CSA and impulse in males ($r = 0.39$ to 0.48 , $p < 0.05$), and weak to moderate correlations between CSA and impulse in females ($r = 0.55$ to 0.62 , $p < 0.05$). **CONCLUSIONS:** These results indicate that there may be sex-based differences in the physiological underpinnings of impulse generation in trained athletes, particularly in relation to both muscle size and fascicle length of the vastus lateralis. Further research should investigate changes in these relationships over time and consider contributions from neuromuscular components.

- 204** Board #42 May 29 9:30 AM - 11:00 AM
Comparison in Peak Torque Rotations Between Dominant and Non-Dominant Arms in Powerlifters
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The shoulder joint is naturally instable because of anatomic structure, and depends of passive and active elements, ligaments and muscle, respectively, for proper stability. The bench press, upper body exercise, is one of three exercises of Powerlifting (PL), based on maximum strength. The strength balance between dominant (D) and non-dominant (ND) upper limbs is fundamental to develop a good lift and joint safety. Therefore, not only major muscles are important as pectoral major, but also stability muscles as rotator cuff for shoulder external rotation.

PURPOSE: To compare, in recreational powerlifters, relative peak torque between dominant and non-dominant arms, in external and internal rotation at $60^\circ/s$ and $180^\circ/s$ concentric action velocity for external (ER) and internal rotation (IR) in shoulder joint. **METHODS:** Participants, nine powerlifters (height: 1.73 ± 0.06 cm; weight: 84.1 ± 13.0 kg; bench press 1 repetition maximum: 116.4 ± 19.1 kg; PL minimal experience: 2 years). The muscle group strength for ER and IR were assessed bilateral by Biodex System 4Pro isokinetic dynamometer. The participants were in a seated position, 45° shoulder abduction, $60^\circ/s$ and $180^\circ/s$ concentric mode was adopted for lever velocity for ER and IR in shoulder joint. Dominant and non-dominant sides peak torque normalized to body weight (PT/BW; $Nm \cdot kg^{-1}$) were compared with paired student's t-test. **RESULTS:** Significant difference ($p = 0.02$) was found at the PT/BW for the ER movements between the dominant (47.8 ± 5.8 $Nm \cdot kg^{-1}$) and non-dominant (44.3 ± 6.1 $Nm \cdot kg^{-1}$) sides at the velocity of $60^\circ/s$, but there was no significant difference between sides in IR ($p = 0.15$; $D = 71.7 \pm 16.3$ $Nm \cdot kg^{-1}$, $ND = 66.1 \pm 12$ $Nm \cdot kg^{-1}$); and at $180^\circ/s$ for ER ($p = 0.24$; $D = 48 \pm 5.3$ $Nm \cdot kg^{-1}$, $ND = 45.7 \pm 8.6$ $Nm \cdot kg^{-1}$) and IR ($p = 0.24$; $D = 68.7 \pm 15.5$ $Nm \cdot kg^{-1}$, $ND = 64.6 \pm 8.6$ $Nm \cdot kg^{-1}$). **CONCLUSION:** For recreational powerlifters, there is only difference between dominant and non-dominant arms in ER movement at $60^\circ/s$, which suggests a necessity of unilateral exercises for a better balance between sides. Supported by CNPq scholarship.

205 Board #43 May 29 9:30 AM - 11:00 AM

Age-related Differences in Vertical Jump Power and Muscle Size and Quality of the Vastus Lateralis

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(No relevant relationships reported)

Previous studies have reported that decreases in muscle size and quality of the vastus lateralis (VL) may contribute to the lower vertical jump power observed in old compared to young males. However, we are aware of no previous studies that have examined the contribution of VL muscle size and quality to age-related power differences in females, nor have there been any studies that examined these differences between young, middle, and older age groups. **PURPOSE:** To determine the effects of age on vertical jump power and muscle size (cross-sectional area [CSA]) and quality (echo intensity [EI]) of the VL in young, middle-aged, and old females. **METHODS:** Twenty-six young (age = 22 ± 2 yr; height = 163 ± 7 cm; mass = 61 ± 8 kg), 30 middle-aged (36 ± 5 yr; 164 ± 7 cm; 62 ± 11 kg), and 23 old (71 ± 5 yr; 161 ± 5 cm; 59 ± 10 kg) females underwent two diagnostic ultrasound assessments followed by three countermovement vertical jumps (CMJs). Peak power output (Pmax; W) was measured during the CMJs using a portable force plate. VL CSA (cm²) and EI (AU) were measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe. One-way ANOVAs and post-hoc analyses were used to compare Pmax, CSA, and EI between age groups. Pearson product-moment correlation coefficients (*r*) were used to examine the relationships between Pmax and CSA and EI. **RESULTS:** Higher Pmax and CSA values were observed for the young (Pmax = 2257.40 ± 438.42 W; CSA = 20.59 ± 4.23 cm²) compared to the old (Pmax = 1098.55 ± 242.10 W; CSA = 10.69 ± 2.47 cm²) and middle-aged (Pmax = 1958.20 ± 341.87 W; CSA = 18.05 ± 4.24 cm²) and the middle-aged compared to the old (*P* ≤ 0.001-0.039). EI values for the young (104.29 ± 16.86 AU) and middle-aged (107.71 ± 17.30 AU) were lower than the old (128.35 ± 14.99 AU) (*P* < 0.001), but they were not different from each other (*P* = 0.720). There was a significant positive relationship between Pmax and CSA (*r* = 0.830; *P* < 0.001) and a significant negative relationship between Pmax and EI (*r* = -0.442; *P* < 0.001). **CONCLUSION:** These findings demonstrated that vertical jump power and muscle size and quality decrease with age. The significant relationships observed between Pmax and CSA and EI perhaps suggest that these age-related declines in VL muscle size and quality may play an important role in the lower vertical jump power observed in middle-aged and older adults.

206 Board #44 May 29 9:30 AM - 11:00 AM

Rate Of Velocity, Torque, And Power Development In Middle-Aged And Older Males

Matthew T. Stratton, Alex A. Almos, Phuong L. Ha, Alyssa R. Bailly, Micah J. Poisal, Joshua A. Jones, Benjamin E. Dalton, Amber N. Haire, Trisha A. VanDusseldorp, Yuri Feito, FACSM, Garrett M. Hester. *Kennesaw State University, Kennesaw, GA.* (Sponsor: Yuri Feito, FACSM)

(No relevant relationships reported)

Rapid contractile measures such as rate of velocity (RVD), torque (RTD) and power (RPD) development dramatically decrease with age, but have rarely been concurrently investigated. Further, few studies have examined the relationship between these parameters and functional performance. **PURPOSE:** To compare rapid contractile parameters of the knee extensors in middle-aged and older males, and examine correlates of 5-chair rise (5CR) performance. **METHODS:** As part of a larger ongoing investigation, twelve healthy untrained, middle-aged (*n* = 6, age = 46 ± 2.90 yrs) and older (*n* = 6, age = 69 ± 3.10 yrs) males completed a familiarization visit followed by one testing visit. Using a Biodex System 4 dynamometer, participants performed three maximal voluntary isometric contractions of the right knee extensors followed by three maximal isotonic contractions at 40% of isometric peak torque. Participants were instructed to "kick out as hard and fast as possible" prior to each contraction. The torque and velocity signals were acquired and the power curve was derived from multiplying torque and velocity. RVD and RPD were obtained from isotonic contractions, as the linear slope of the velocity- and power-time curve, respectively. RTD was calculated for the first 50 ms of the isometric torque-time curve. In addition, 5CR, the time to rise 5 times from a chair as quickly as possible was recorded. Groups were compared with independent samples *t*-tests, while Pearson correlation coefficients were used to examine relationships between age, RVD, RPD, RTD, and 5CR. **RESULTS:** RVD (32.15%; *p* = 0.004) and RPD (53.27%; *p* = 0.03) were decreased in older males, but not RTD (*p* = 0.497). In addition, only RVD was correlated with 5CR (*r* = -0.588; *p* = 0.044). **CONCLUSIONS:** While preliminary, these data suggest that dynamic, rapid contractile measures are preferentially affected by age as compared to RTD, and only RVD was related to 5CR performance.

207 Board #45 May 29 9:30 AM - 11:00 AM

The Effects Of Muscular Fatigue And Gender On Lower Extremity Biomechanics During The Forward Lunge

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(No relevant relationships reported)

Purpose. The forward lunge is a common exercise used in strength training and rehabilitation to improve lower extremity strength¹. In other lower extremity exercises, fatigue from high repetitions has been shown to alter biomechanics and increase injury risk^{1,2}. Moreover, fatigue responses appear to be gender specific^{1,2}. Therefore, the purpose of this study was to determine the effects of fatigue and gender on lower extremity biomechanics during the forward lunge. **Methods.** 29 young adults (13 males) participated in the study. Subjects repeatedly completed a set of 7 walking lunges across a ~8 m walkway and 4 stationary lunges on force plates until fatigued. A fatigued state was identified as two consecutive sets that scored a 9 on a modified Borg RPE scale, or a single set that scored a 10. A Vicon motion capture system (Vicon Motion Systems, Oxford, UK) was used to collect the data. Average peak lower limb angles and internal moments of the forward limb were calculated for the baseline set of stationary lunges and the last set (i.e. fatigued set) of stationary lunges. Main effects of gender and fatigue and their interaction were evaluated using a repeated-measures MANOVA. **Results.** Neither a significant fatigue × gender interaction nor gender main effect at the multivariate level were found. A significant multivariate omnibus main effect of fatigue, however, was detected. Variables that changed with fatigue are outlined in Table 1. **Conclusion.** The increase in hip adduction angle, knee adduction angle, and knee adduction moment with fatigue may stress internal stabilizers of the knee^{2,4}. As such, individuals should exercise caution when performing the forward lunge to fatigue.

References. 1) Chappell, JD et al. *Am J Sports Med*, 33, 2005; 2) McLean SG et al. *Med Sci Sports Exer* 39, 2006; 3) Longpré, HS et al. *J Electromyogr Kinesiol* 25, 2015; 4) Power et al. *J. Orthop. Sports Phys. Ther* 40, 2010

Table 2. Average peak lower extremity angles and moments for baseline and fatigued sets (mean ± SE)

Variable	Baseline	Fatigued	p	Change from Baseline
Hip Adduction Angle (°)	3.1 ± 0.9	7.1 ± 0.9	< 0.001	Increase
Hip Abduction Angle (°)	8.2 ± 0.8	6.5 ± 0.7	0.019	Decrease
Hip Flexion Moment (Nm/kg)	0.3 ± 0.02	0.2 ± 0.02	< 0.001	Decrease
Hip Extension Moment (Nm/kg)	1.6 ± 0.06	1.9 ± 0.05	< 0.001	Increase
Hip Adduction Moment (Nm/kg)	0.4 ± 0.06	0.5 ± 0.07	0.004	Increase
Knee Adduction Angle (°)	19.8 ± 2.0	20.9 ± 2.0	0.037	Increase
Knee External Rotation Angle (°)	11.8 ± 1.0	13.5 ± 1.2	0.001	Increase
Knee Flexion Moment (Nm/kg)	0.3 ± 0.02	0.4 ± 0.024	< 0.001	Increase
Knee Extension Moment (Nm/kg)	1.1 ± 0.05	0.9 ± 0.05	< 0.001	Decrease
Knee Adduction Moment (Nm/kg)	0.8 ± 0.01	1.1 ± 0.01	0.048	Increase
Ankle Plantarflexion Angle (°)	6.9 ± 1.4	11.8 ± 1.6	0.001	Increase
Ankle Plantarflexion Moment (Nm/kg)	0.9 ± 0.03	1.1 ± 0.03	< 0.001	Increase
Ankle External Rotation Moment (Nm/kg)	0.2 ± 0.01	0.2 ± 0.01	0.013	Decrease

208 Board #46 May 29 9:30 AM - 11:00 AM

Acute Effects Of Elastic Resistance Band On Post-activation Potentiation In Elite Handball Athletes

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(No relevant relationships reported)

PURPOSE: to evaluate whether a heavy back squat protocol combining free weight plus elastic band (CR) could promote a post-activation potentiation (PAP) during a countermovement jump (CMJ) test and to determine the optimal recovery time to elicit it.

METHODS: Nine male elite Brazilian handball athletes [21.4 ± 2.1 years; 90.3 ± 10 kg; 187.5 ± 5 cm; 10.5 ± 4.2 body fat; 9.7 ± 1.8 years of training experience; 1.81 ± 0.23 of Relative 1RM back squat ($\text{kg} \cdot \text{kg}^{-1}$); 15 hours of weekly training volume] were recruited into the study. The experimental sessions were performed seven days apart in a counterbalanced order. The athletes were required to complete either a CR protocol or a control protocol (CMJs only). Athletes completed a standardized warm-up consisting of 5 min of light-intensity cycling, static stretching exercises, and three consecutive CMJs. After a 3 min rest period, athletes performed baseline CMJs test. The CR protocol was consisted of three sets of 5 repetitions at 85% of 1RM with 3 minutes of rest between sets. Back squat was loaded with 85% of 1RM combining 55% of 1RM using weight-plate and $29.7 \pm 2.04\%$ of the athlete's 1RM in fully erect position (starting position) with elastic band resistance. During control session, the same warm-up routine was included so that the only difference between the PAP and control protocol was the absence of a potentiating stimulus.

RESULTS: One-way repeated measures ANOVA indicated a significant effect of time in CMJ performance within CR condition ($p < 0.01$, $n^2_p = 0.39$). The vertical jump height was significantly greater (6.5%, $ES = 0.85$) at 2-min as compared to baseline. No significant differences in jump height were detected when compared with baseline at 4-, 6-, and 8-minute recovery. Two-way repeated-measures ANOVA revealed an interaction effect ($p < 0.05$, $n^2_p = 0.40$) in PAP response. At 2-min, PAP response was significantly larger (4.9%, $ES = 1.38$) in CR condition than control ($p < 0.05$).

CONCLUSIONS: The combination of free weight and elastic bands during heavy squat exercise seems to be effective to create a post-activation potentiation effect to enhance acute neuromuscular performance at 2-min after preconditioning stimulus.

209 Board #47 May 29 9:30 AM - 11:00 AM
Knee Extensor Torque Is Increased By Far-Infrared Emitting Fabric

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(No relevant relationships reported)

Far-infrared (FIR) emitting materials can increase the availability of nitric oxide and calcium in cell culture, and delay fatigue during ex-vivo skeletal muscle contractions. However, FIR effects on humans' neuromuscular performance remains unknown.

Purpose: To verify the effects of FIR emitting fabric on knee extensors torque and electromyography activity. **Methods:** Fourteen healthy strength trained men (24.3 ± 4 years; 82.8 ± 11.3 kg; 176.3 ± 4.2 cm, 7.3 ± 2.9 years of training experience) participated in one familiarization and two experimental sessions. Experimental sessions occurred two weeks apart and after 96 hours of continuous FIR or Placebo fabric usage, in a randomized, crossover, double-blind, placebo-controlled design study. Isometric and dynamic torques were assessed using isokinetic dynamometer. The best result out of 3 maximum ballistic knee extension contractions (MBC) was recorded pre- and post-dynamic test. Dynamic test was composed by 30 maximum repetitions of knee flexion and extension at $180^\circ/\text{s}$. Peak torque (PT) of each repetition, total work (TW) and fatigue index (FI) of knee extensors were recorded. The mean RMS was calculated from electromyography activity records of superficial quadriceps muscles. Mean quadriceps temperature was assessed pre-protocol with a thermal camera. **Results:** See table. FIR fabric increased pre and post MBC and trend to increase TW. RMS at isometric and dynamic tests, FI, and quadriceps temperature did not change. Additionally, FIR fabric demonstrated higher values of PT at 8th, 12th to 14th and 17th repetitions (all $p < 0.05$). **Conclusion:** FIR emitting fabric is effective to increase isometric and dynamic neuromuscular performance. Further, the absence of changes in electromyography activity and increased performance in single MBC, lead us to suggest that FIR effects are related to muscle contractile machinery improvements.

	FIR			Placebo			p
pre-MBC (Nm)	318.5	±	68.7	299.3	±	68.2	0.01
post-MBC (Nm)	284.1	±	58.2	268.8	±	55.4	0.04
pre-MBC RMS (mV)	0.139	±	0.062	0.142	±	0.082	0.70
post-MBC RMS (mV)	0.143	±	0.059	0.128	±	0.066	0.24
TW (J)	4142.2	±	699.8	4009.3	±	743	0.06
FI (%)	41.7	±	6.6	40.3	±	8.3	0.01
Temperature (°C)	32.48	±	0.77	32.42	±	0.62	0.62

Data are mean \pm standard deviation. p-values are paired T-test ($p \leq 0.05$).

A-40 Free Communication/Poster - Resistance Training

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

210 Board #48 May 29 11:00 AM - 12:30 PM
The Acute Effects of a Resistive Exercise on Sprint Times in High School Track Athletes

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(No relevant relationships reported)

The ability to achieve high velocities in a short period of time is a requisite for success in many sporting activities. Post activation potentiation (PAP) can be defined as an increase in neuromuscular activity that occurs immediately after a high intensity exercise or conditioning activity. PAP may improve subsequent exercise performance that requires high muscular power output. **PURPOSE:** This study attempted to determine the acute effects of incorporating a resistive sprint exercise as a PAP conditioning activity on subsequent sprint time in high school track athletes.

METHODS: A randomized repeated measures crossover study design was used to test fifteen high school track athletes (9 male: 16.8 ± 0.7 years, 183.7 ± 9.7 cm, 77.2 ± 5.8 kg, 6 female: 16.0 ± 1.1 years, 156.2 ± 3.5 cm, 52.2 ± 1.2 kg). Each participant completed two testing sessions: a dynamic WU prior to a 36.6 meter sprint and a dynamic WU followed by a resisted sprint sled pull as a PAP conditioning activity (10-15% of body mass) prior to a 36.6 meter sprint. Testing sessions occurred on two different days with at least 48 hours between each session. A paired T-test was used to determine if there were significant differences in sprint times between the WU strategies. **RESULTS:** The 36.6 meter sprint times following a dynamic WU combined with a resisted sprint sled pull as a PAP conditioning activity were significantly lower (5.54 ± 0.52 seconds) than the 36.6 meter sprint times following the dynamic WU alone (5.64 ± 0.51 seconds) ($p < 0.01$). **CONCLUSION:** Within the parameters of this study it can be concluded that a dynamic WU including a resisted sprint sled pull as a PAP conditioning activity is successful at improving short distance sprint times when compared to sprint times following a dynamic WU alone.

211 Board #49 May 29 11:00 AM - 12:30 PM
The Effects of Five Weeks of Bench Press Training on Salivary Biomarkers of Inflammation in Recreationally-trained College-age Males

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INTRODUCTION: Improvements in immunosenescence have been reported to be associated with regular exercise and physical activity. Multiple investigations have elucidated the effectiveness of aerobic exercise on the attenuation of biological markers of systemic inflammation. However, few studies have evaluated the impacts of resistance training on inflammation, and even fewer have examined the effects of resistance training on salivary biomarkers of inflammation. **PURPOSE:** To evaluate the impacts of 5 weeks of bench press-only training on salivary biomarkers of inflammation in trained college-age males ($N = 23$). Pre and post analyses of salivary biomarkers (IL-1 β , IL-6, IL-8, TNF α , CRP, and Testosterone) were conducted. Five weeks of either standard bench press ($n = 12$) or leg drive focused bench press ($n = 11$) was completed. **RESULTS:** No significant ($p > 0.05$) main effects between groups were observed. Within groups measures did reveal that testosterone significantly decreased by 17.0% in the standard bench press group from pre to post ($p = 0.02$). **CONCLUSIONS:** Five weeks of bench press training did not alter pre-training levels of inflammation measured in saliva. Subjects were required to be currently training and have completed a minimum of 6 months of resistance training (including bench press) prior to starting this study. Since the bench press was the only training exercise, the intensity of training administered may not have been sufficient to elicit notable alterations in overall inflammatory status in this sample.

- 212** Board #50 May 29 11:00 AM - 12:30 PM
Evidence Of A Ceiling Effect For Training Volume In Muscle Hypertrophy And Strength In Trained Men
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 (No relevant relationships reported)

Purpose: To compare the effects of different resistance training (RT) volumes on muscle performance and hypertrophy in trained men.

Methods: The study included 37 volunteers that performed RT for 24 weeks and were divided into groups that performed five (G5), 10 (G10), 15 (G15) and 20 (G20) sets per muscle group per week. Ten repetition maximum (10RM) tests were performed for the bench press, lat pull down, 45° leg press, and stiff legged deadlift. Muscle thickness (MT) was measured using ultrasound at biceps brachii, triceps brachii, pectoralis major, quadriceps femoris and gluteus maximus. All measurements were performed at the beginning (pre) and after 12 (mid) and 24 weeks (post) of training.

Results: All groups showed significant increases in all 10RM tests and MT measures after 12 and 24 weeks of TR ($p < 0.05$). There were no differences in any 10RM test between G5 and G10 ($p > 0.05$) after 12 and 24 weeks. G5 and G10 showed significantly greater increases of 10RM than G15 and G20 for bench press, lat pulldown, leg press and stiff legged deadlift, both at 12 and 24 weeks. There were no group by time interaction for any MT measure.

Conclusions: Five to 10 sets per week might be sufficient for bringing about optimal gains in muscle size and strength in trained men over a 24-week period. There appears to be a deleterious effect for higher volumes (≥ 15 sets per week), especially after 12 weeks of training. These results bring evidence of an inverted "U shaped" curve for the dose response curve for muscle strength, with a possible deleterious effect after exceeding a certain training volume. Whilst the same trend was noted for muscle hypertrophy, the results did not reach significance. Therefore, using low volume RT programs might be an interesting alternative for personal trainers, strength coaches and medical practitioners to increase muscle size and strength in trained men.

- 213** Board #51 May 29 11:00 AM - 12:30 PM
Effects Of An 8-week Mixed-methods Strength Training On Maximal Strength Of Weightlifting Athletes.
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The maximal strength training implies the greatest possible activation of the central nervous system, improving inter and intramuscular coordination and causing considerable benefits recognized by the international scientific community. It is well known that the pyramidal training can give powerful performance results thanks to a progressive increase in the load. However, there are different traditional methods to strength training and all have already been successfully tested. **PURPOSE:** This randomized controlled trial study design with experimenter blinding aimed to compare the effects of an 8-week training period of a Mixed-Methods Strength Training (MST) or Pyramidal Training (PT) on maximal strength performance in weightlifting athletes. **METHODS:** Study participants (20 men, age: 23.9 ± 2.05 years, body mass: 75.6 ± 9.45 kg, height: 1.77 ± 0.05 m, body mass index: 24.09 ± 2.46 kg·m⁻²) were assigned to the MST group ($n = 10$) performed strength training with maximal loads (80-95% of 1RM, 3-min rest) for two sessions per week interspersed with a pyramidal training session (90-sec rest), and PT group ($n = 10$) performed pyramidal training alone (90-sec rest) for three sessions per week. Both groups trained for 8 weeks using a 3:1 loading structure. Measures pre-intervention and post-intervention included one-repetition maximum [1-RM] bench press, barbell deadlifts, lat pull-down, and standing barbell military press. Repeated-measures ANOVA and a paired t-test were used to assess differences in outcome variables across conditions ($p < 0.05$). **RESULTS:** The MST group showed significantly greater improvements than PT in bench press (13.1 ± 0.91 vs. 3.7 ± 0.47 kg, $p < 0.0001$), barbell deadlifts (19.3 ± 1.27 vs. 5.3 ± 0.97 kg, $p < 0.0001$), lat pull-down (17.2 ± 1.72 vs. 2.8 ± 0.79 kg, $p < 0.0001$), and standing barbell military press (13.1 ± 1.54 vs. 1.9 ± 0.59 kg, $p < 0.0001$). **CONCLUSIONS:** These findings suggest that a Mixed-Methods Strength Training characterized by two sessions with maximal loads interspersed with a pyramidal training session may be more effective than the pyramidal training alone for enhancing the maximal strength in weightlifting athletes. It could therefore be considered a valid and motivating alternative to the traditional strength training methods.

- 214** Board #52 May 29 11:00 AM - 12:30 PM
Temporary Increasing in Muscle Thickness and Upper Arm Circumference Immediately After Resistance Exercise
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Temporary Increasing in Muscle Thickness and Upper Arm Circumference Immediately After Resistance Exercise

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Temporary muscle thickness and limb circumference increased immediately after resistance exercise are strongly affected by reactive hyperemia, which is different from muscle hypertrophy induced by resistance exercise. This study is necessary for determining condition of measuring muscle cross sectional area as a muscle hypertrophic effect induced by resistance exercise. Furthermore, this is useful for bodybuilding and physique contests where muscle volume affects results.

PURPOSE: The purpose of this study was to investigate the duration of temporary increasing in muscle thickness and upper arm circumference induced by resistance exercise in the triceps brachii for resistance-trained and untrained subjects.

METHODS: Four kinds of resistance exercises were performed on 28 healthy adult males (26 ± 3 yrs), resistance-trained ($n = 14$) and untrained ($n = 14$). The extracellular water content, muscle thickness, upper arm circumference, oxygenated hemoglobin (oxy-Hb) were examined before exercise, within 5-minute, 30-minute, and 60-minute after exercise. Two-way analysis of variance was used to confirm acute effects.

RESULTS: The extracellular water content of upper arm ($+0.22$ L), triceps brachii muscle thickness ($+3$ mm), upper arm circumference ($+2$ cm) increased only in the resistance-trained subjects 5-minute after exercise compared with before exercise. However, there was no difference between before exercise and 30-minute after exercise values. The oxy-Hb increased immediately after exercise in both resistance-trained ($+42\%$) and untrained subjects ($+39\%$), but no significant difference was observed between resistance-trained and untrained subjects. **CONCLUSION:** Temporary increasing in muscle thickness and upper arm circumference within 5 minute after resistance exercise was a response occurred only in the resistance-trained subjects, and it was confirmed that the response disappeared within 30-minute.

- 215** Board #53 May 29 11:00 AM - 12:30 PM
The Effect Of Strength Training On Physical Performance In Adolescent Female Soccer Players
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Strength training (ST) is amongst the most frequently used strategies to improve soccer performance and it has been used to obtain significant increases in the levels of maximum strength and muscle hypertrophy. Therefore, using appropriate ST programs could enhance several explosive actions that are crucial to the outcome of the game. ST is a method that has shown to be effective in male soccer players but the scarce studies of ST on female soccer players must also be pointed out. **PURPOSE:** To examine the effects of ST on physical performance after a 12-week training period in adolescent female soccer players. **METHODS:** 37 adolescent female soccer players from Spanish soccer team (age: 16.1 ± 1.1 years; height: 159.7 ± 7.1 cm; body mass: 55 ± 7.1 kg) were randomly assigned to an experimental (EG; $n = 19$) or a control group (CG; $n = 18$). All players underwent a regular soccer training 3 times per week. Participants in the EG received ST program (12 weeks, 2 times per week, 20 min per session). The ST program included lower limb strength and core muscle. The players were tested at the beginning and the end of the intervention on bilateral countermovement jump (CMJ) test, unilateral CMJ test, 40m sprint, 180° COD test and V-cut test. Paired t-test was conducted to detect significant differences between the pre and post-tests in both groups. Statistical significant was inferred from $p < 0.05$. **RESULTS:** EG made significantly greater improvement than CG did on CMJ (GE pre 23.5 ± 3.30 cm vs post 25.6 ± 3.65 cm, $p < 0.01$; GC pre 23.3 ± 3.73 cm vs post 23.9 ± 4.35 cm), right CMJ (GE pre 12.9 ± 1.95 cm vs post 14.3 ± 2.44 cm, $p < 0.05$; GC pre 12.1 ± 2.77 cm vs post 13.1 ± 2.65 cm), 40m sprint (GE pre 6.51 ± 0.26 s vs post 6.24 ± 0.25 s, $p < 0.01$; GC pre 6.24 ± 0.21 s vs post 6.29 ± 0.25 s), left 180° COD (GE pre 2.96 ± 0.16 s vs post 2.89 ± 0.18 s, $p < 0.05$; GC pre 2.93 ± 0.15 s vs post 2.91 ± 0.11 s) and V-cut (GE pre 8.05 ± 0.38 s vs post 7.81 ± 0.27 s, $p < 0.01$; GC pre 7.98 ± 0.38 s vs post 7.97 ± 0.39 s). **CONCLUSIONS:** Twelve weeks ST could improve bilateral and unilateral muscular power, speed and

COD ability performance in adolescent female soccer players. The results indicate that safe, effective, and alternative ST can be useful to coaches, especially in competition season where less time is available to training.

216 Board #54 May 29 11:00 AM - 12:30 PM
Effect of a 2-Week Strength Training Learning Intervention on Self-selected Weight Training Intensity
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(No relevant relationships reported)

PURPOSE: Research has found that novice clients, fail to self-select weight that is heavy enough to promote strength gain. The purpose of this study was to determine the effectiveness of a 2-week strength training learning intervention on self-selected resistance training intensity. **METHODS:** Subjects between 18-40 y were placed in a control (CON n=7) or experimental (EXP n=8) group. Each subject was provided practice training on 5 resistance training machines (chest press, leg press, triceps extension, bicep curl, shoulder press). On 6 different training days, separated by at least 48h, subjects completed 2 sets on each machine while blinded to the load. CON were instructed to self-select a load to build strength without feedback. Load, repetitions and ratings of perceived exertion (RPE) were recorded. Starting with a self-selected load, EXP were encouraged to lift to fatigue. If EXP exceeded 12 repetitions, the load was increased (Goal: attain 70%1RM). RPE was assessed each set. Post training days, CON and EXP completed self-selection trials for all lifts, plus 3 novel lifts (pec fly, leg extension, shoulder raise). One repetition maximum (1RM) was assessed last. All loads were converted to % 1RM. Comparisons between groups were made using 2Way ANOVA. **RESULTS:** For % 1RM there were significant main effects for both condition and day (Day 1 EXP=57.2±12.0%; CON=47.2±13.7%; Day 6 EXP=74.7±10.8%; CON=66.2±13.4%). For repetitions there were significant effects across days (Day 1 EXP=10.8±4.8; CON=12.3±4.0; Day 6 EXP=9.3±3.6; CON=10.0±3.0) with significant interaction effects indicating CON did not change repetition number as load increased. There were significant main effects across days for RPE (Day 1=15.4±2.0; Day 6=16.5±1.9). All loads selected exceeded 60% 1RM indicating that both EXP and CON treatment achieved adequate training loads. However, among the novel lifts only the pec fly was greater than 60% 1RM (pec fly 63.0±11.0%; leg extension 39.8±12.5%; shoulder raise 53.1±12.8%). **CONCLUSION:** Two weeks of supervised resistance training resulted in EXP and CON self-selecting loads greater than 60% 1RM. Repeated training exposure resulted in higher self-selected training loads suggesting that repeated exposure to resistance training sessions is an important factor to attain loads that promote strength gain.

217 Board #55 May 29 11:00 AM - 12:30 PM
Acute Resistance Training Does Not Impair Cognitive Function in Costa Rican Older Adults
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Aging imposes a gradual deterioration of brain function and cognitive abilities, which hinder older adult's daily activities and limit their independence and safety. There is a lack of evidence on the acute effects of resistance training (RT) on cognitions in older adults. **PURPOSE:** To determine the acute effect of RT on cognitive performance in healthy Hispanic older adults. **METHODS:** Volunteers were 45 cognitive intact older adults (Mean age = 65.3 ± 3.7 yr.) recruited from a University extension program. Participants were randomly assigned to one of three possible groups (n = 15 in each group): a) High-intensity RT: 3 sets, 8 repetitions at 70% 1-RM, 2-min rest between sets (G1), b) Low-intensity RT: 4 sets, 14 repetitions at 30% 1-RM, 2-min rest between sets (G2), or c) Inactive control (G3). Before and following the experimental intervention, participants completed a comprehensive battery of cognitive tests assessing processing speed, visuospatial processing, executive function and cognitive control, working memory and immediate memory. Following a familiarization phase to RT exercises, participants in G1 and G2 performed 1-RM needed to define the exercise intensity. The intervention session consisted of the cognitive battery tests and five-minute warm-up on a stationary bicycle, followed by the exercise training protocol (knee extension, chest press, knee flexion, seated row, leg press, biceps curl). Immediately after finishing, the cognitive post-test was applied. The control group remained seated on a chair for 30-min and then performed the post-test. A two-way (group x measurement) ANCOVA was carried out using education level as a covariate. **RESULTS:** Significant improvements were found on visuospatial processing in G1 (Pre = 61.6 ± 2.1 vs. Post = 69.7 ± 2.4 pts.; CI95% = 4.8, 11.4; p ≤ 0.001) and G2 (Pre = 62.4 ± 2.2 vs. Post = 67.0 ± 2.5 pts.; CI95% = 1.2, 8.1; p = 0.009). Processing speed, executive function and cognitive control, working memory and immediate memory were unchanged by acute exercise or rest. **CONCLUSION:** Acute RT enhanced or maintained cognitive performance in older adults. Repetitive acute bouts of RT might chronically improve or retard the aging effects on cognitions in older adults.

218 Board #56 May 29 11:00 AM - 12:30 PM
Does the Physiological Tremor Identify the Intensity of Resistance Exercise?

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Although the various methods are commonly used to predict the intensity of aerobic exercise, there is a lack of information on resistance exercise intensity.

PURPOSE: Accordingly, the primary purpose of this study was to determine whether the physiological tremor assessed by accelerometer could recognize the intensity of resistance exercise. **METHODS:** Twenty healthy young men (23.8 ± 0.7 years; mean ± SEM) who have not experienced resistance exercises, were recruited for this study. A variety of intensity (resting, 30%, 50%, and 70% of their predetermined one-repetition maximum (1-RM)) of arm-curl exercise was used to reveal physiological tremor. Total work was held equally by varying the number of repetitions with 5 sets during each of the intensities. The session of intensities was performed in random order with at least a week of wash-out period. The physiological tremor responses were recorded during exercise using accelerometers (3-axis) attached at the dominated wrist and left ear. Also, electromyography (EMG) data were collected from the biceps brachii muscle during the exercise. Physiological tremor and EMG data were shown as average root mean square index.

RESULTS: As we expected, EMG amplitude increased significantly (0.01 ± 0.001 mV, 0.40 ± 0.02 mV, 0.70 ± 0.04 mV, and 1.03 ± 0.05 mV in resting, 30%, 50%, and 70% of RM, respectively, P<0.01) as the intensity of exercise increased. Physiological tremor amplitude significantly increased as the intensity of exercise increased (wrist; 0.008 ± 0.001 m/s², 0.08 ± 0.002 m/s², 0.09 ± 0.002 m/s², and 0.09 ± 0.004 m/s² in resting, 30%, 50%, and 70% of RM, respectively, P<0.01, ear; 0.01 ± 0.001 m/s², 0.03 ± 0.01 m/s², 0.05 ± 0.002 m/s², and 0.07 ± 0.004 m/s² in resting, 30%, 50%, and 70% of RM, respectively, P<0.01). EMG amplitude was significantly related to physiological tremor (r=.632 and r=.649 in wrist and ear, respectively, P<0.01).

CONCLUSION: To our knowledge, this is the first study to suggest the physiological tremor could be an index of the intensity of resistance exercise.

219 Board #57 May 29 11:00 AM - 12:30 PM
The Comparison of Velocity between Front Squat, Back Squat, Sumo and Conventional Deadlift

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 (No relevant relationships reported)

Average concentric velocity (ACV) during barbell exercises varies inversely as a function of load and can be used for determining training loads. It is unclear if ACV differs between variations of similar lifts such as the conventional deadlift (CD) and sumo deadlift (SD) or between the front squat (FS) and back squat (BS). **PURPOSE:** To compare ACV, peak concentric velocity (PCV), and range of motion (ROM) between the FS and BS and between the CD and SD. **METHODS:** In a randomized order, nine participants (N=9; age: 22±4) underwent one-repetition maximum (1RM) testing for the FS, BS, CD, and SD. The open barbell system was used to measure ACV PCV, and ROM during the 1RM protocol. During the first testing session, height, body mass, femur and humerus length were measured; training age, frequency of training, and estimated 1RM were obtained via questionnaire. Paired samples t-tests were used to determine differences in ACV, PCV, and ROM between the between the FS and BS and between the CD and SD. **RESULTS:** Paired samples t-tests indicated no differences between the 1RM FS and BS for: ACV (0.24±0.06 vs 0.25±0.06 m/s; p=0.930), PCV (0.66±0.11 vs 0.66±0.16 m/s; p=0.969), or ROM (0.49±0.06 vs 0.51±0.11 m; p=0.819). For the SD and CD there were no differences in ACV (0.27±0.11 vs 0.26±0.08 m/s; p=0.691) or PCV (0.55±0.19 vs 0.51±0.13 m/s; p=0.445) but significant differences were observed in ROM (0.48±0.06 vs 0.53±0.05 m; p=0.015). **CONCLUSIONS:** Despite a lower ROM for the SD compared to the CD, bar velocity is similar at maximal loads (e.g. 1RM). If using velocity to determine training loads, these data suggest that the same velocity ranges for regulating training loads could be used for the SD and CD as well as for the FS and BS.

- 220** Board #58 May 29 11:00 AM - 12:30 PM
The Effects of Eccentric Duration on Squat and Bench Press Concentric Performance
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 (No relevant relationships reported)

Many resistance training exercises incorporate both eccentric and concentric phases of muscle contraction. Through the stretch shortening cycle, the velocity and magnitude in which the eccentric phase is completed directly affects performance during the concentric phase. **PURPOSE:** Therefore, the purpose of this research was to investigate the effects of eccentric phase duration on concentric outcomes at 60% and 80% of one-repetition maximum (1RM) in the back squat and bench press. **METHODS:** Sixteen resistance-trained males (Age: 23.25±2.57yrs, Height: 171.82±7.48cm, Body Mass: 81.96±12.16kg) completed four laboratory visits as follows: Day 1- 1RM testing; Day 2- establishment of normative eccentric durations; Days 3 and 4- randomized fast (0.75 times) or slow (2.0 times) eccentric duration conditions, which were controlled by visual and auditory metronomes. Outcome measures assessed during the concentric phase were: average concentric velocity (ACV), peak concentric velocity (PCV), rating of perceived exertion (RPE), range of motion (ROM), and barbell path. A one-way ANOVA and Pearson's Product Moment correlations were used for analysis with significance set at $p \leq 0.05$. **RESULTS:** Eccentric duration was significantly and inversely correlated with average concentric velocity (ACV) at 60% ($r = -0.408$) and 80% ($r = -0.477$) of 1RM squat and at 100% ($r = -0.604$) of 1RM bench press. At 60% of 1RM squat, both fast and slow eccentric conditions produced greater ($p < 0.001$) peak concentric velocity (PCV) than normative duration with fast also producing greater PCV than slow ($p = 0.044$). Eccentric duration had no impact on RPE, ROM, or barbell path. **CONCLUSIONS:** Therefore, our results show that well-trained athletes performing a deliberately faster eccentric phase may enhance squat and bench press performance. However, caution should be used when interpreting these results as athletes who already perform a fast eccentric duration may not benefit from deliberately increasing eccentric velocity.

- 221** Board #59 May 29 11:00 AM - 12:30 PM
Workout-Life Balance: How Psychological Stress Affects Force Production in Competitive Powerlifters and Healthy Controls
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 (No relevant relationships reported)

Powerlifters often focus more on physiological stresses of programming and performance than psychological stress. However, total allostatic load could influence the capacity to generate force. Understanding this relationship can give coaches and athletes tools to optimize workout-life balance. **PURPOSE:** To determine the effect of psychological stress on force production in distinct populations. **METHODS:** Competitive powerlifters (PL) and recreationally active college students (RA) were tested. The RA group consisted of 10 men and 13 who performed knee extension and flexion at 2 time points using a Cybex dynamometer. Once during an academic respite and once during exams. Psychological stress was assessed with a 10-Point Cohen Perceived Stress Scale Questionnaire. Linear regression measured the effect of psychological stress on peak force. The PL group consisted of 26 men and 8 women competing in the 2018 USAPL Raw Nationals. The day before the competition, all athletes were interviewed; peak and expected performances and 10-point stress were recorded. Linear regression tested the effect of stress on the difference between expected and achieved performances. **RESULTS:** In the RA group, between the 2 time points, men produced 257.5 ± 68.9 ft-lbs of torque for flexors and extensors summed; women produced 213.5 ± 26.6 ft-lbs ($p = 0.082$). Holding bodyweight constant, stress did not affect peak torque at time point 1 ($p = 0.217$) or 2 ($p = 0.506$), and change in stress did not affect change in force output ($p = 0.640$). Sex was insignificant in all analyses and no relationships emerged when evaluating flexors or extensors separately. In the PL group, the summation of bench press, squat, and deadlift was 625.4 ± 74.4 kg in men and 377.8 ± 79.5 kg in women ($p < 0.001$). In the regression analysis ($R^2 = 0.325$; $p = 0.003$), holding weight class constant, the deficit precipitated by psychological stress was 3.4 kg per point ($p = 0.006$; 95% CI: -5.69 to -1.06). Results were stronger for women ($R^2 = 0.824$; $p = 0.013$); holding weight class ($p = 0.032$) constant, each additional point of stress predicted a 4.8 kg reduction in performance ($p = 0.005$; 95% CI: -7.43 to -2.27). **CONCLUSION:** Psychological stress does not impair strength performance among untrained individuals. However, stress management may be critical for strength athletes, particularly women.

- 222** Board #60 May 29 11:00 AM - 12:30 PM
A Three-Dimensional Assessment of Push-Pull Power Ratios Across Various Loads
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 (No relevant relationships reported)

Capturing a true assessment of power in upper body motions is problematic owing to difficulty reproducing a testing environment that matches kinematic profiles performed in sport. New technology permits more accurate reflections of three-dimensional power in isotonic environments. **PURPOSE:** To quantify power ratios of single-arm press and pull exercises across various loads. **METHODS:** 64 subjects performed a total of 1,145 sets on Proteus (Boston Biomechanics, Inc.): 570 sets of single-arm horizontal presses and 575 sets of single-arm horizontal rows. All subjects performed both exercises. Three-dimensional magnetic resistance was applied at 5, 10, 15, 20 and 25lb. ANOVA tested the subjects' kinematic profile across loads. **RESULTS:** On average, across all sets, maximum power per set was 175.2 ± 103.0 for presses and 183.6 ± 108.5 for pulls. For mean power throughout a set, subjects achieved 159.5 ± 96.3 for presses and 168.2 ± 102.5 for pulls. The different loads had significant differences for maximum ($p < 0.001$) and mean ($p < 0.001$) power; the higher the load, the higher the value in each measurement. At a 5lb load, maximum power (presses and pulls combined) was 31.7 ± 10.8; at a 25lb load, it was 366.4 ± 96.0. Similarly, for mean power, at 5lb, subjects achieved 26.8 ± 10.2 while at 25lb, it was 335.1 ± 92.0. Dominant and non-dominant arms were similar in maximum ($p = 0.497$) and mean power ($p = 0.530$) although overall, pulling was stronger than pushing. Across all sets and loads, push-to-pull ratio was 0.95:1 for both maximum and mean power. This ratio changes at different loads. For peak power, at 5lb, the push-to-pull ratio was 1.22:1. At 10lb, it was 0.99:1. At 15lb, it was 0.98:1. At 20lb, it was 0.95:1. At 25lb, it was 0.94:1. For mean power, the same pattern, though slightly more extreme, was found. **CONCLUSIONS:** Numerous investigations have quantified ideal force ratios of the knee while similar assessments of the upper limbs have received relatively little attention. New technology provides a systematic approach to measure strength ratios of the shoulder and elbow in three-dimensional space. In this context, strength ratios change with load; push power exceeds pull power at low loads whereas the inverse is true at higher loads. These strength ratios may be considered for sport application and recognition of risk for upper limb injury.

- 223** Board #61 May 29 11:00 AM - 12:30 PM
Correlations Between Resistance Exercise Repetitions Achieved At 60% And 80% 1rm Load In Female Subjects
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To determine the appropriate load for resistance training (RT), exercise professionals (EPs) commonly have clients complete one repetition maximum testing (1RM). Then, submaximal loads can be easily calculated for RT sessions. A higher load (approximately 80% 1RM) is chosen if lower repetitions (reps) are desired (~10 reps) and a lower load (approximately 60% 1RM) is chosen if higher reps are desired (~20 reps). However, the number of reps generated (at both low and high loads) varies quite dramatically in standard populations. It is important to determine if there are strong relationships between the number of reps generated at lower and higher loads. The hypothesis is that individuals tend to perform similarly at different loads (i.e. generate above average reps at both loads or below average reps at both loads). However, this topic has not been thoroughly studied. **PURPOSE:** Determine correlations between RT reps achieved at 60% 1RM load and 80% 1RM load. This will help us understand if the number of reps generated at lower loads predicts the number or reps generated at higher loads. **METHODS:** Participants were 19 college-aged (25 ± 4.3 years) females with a minimum of 2 months RT experience. Three exercise sessions were completed under the supervision of certified EPs. For session one, 1RM testing was completed. For sessions two and three, participants completed as many reps as possible for 60% 1RM or 80% 1RM (load and order was randomized) for 8 cam-mediated variable resistance training exercises. For all 8 exercises, Pearson correlation was used to assess the strength of the relationship between the two loads. **RESULTS:** The reps generated at 60% 1RM and 80% 1RM and correlations between the two were determined for the following 8 exercises: bench press (8.2±3.4 reps to 18.3±4.2 reps; $r = 0.51$), leg press (17.9±5.0 reps to 37.3±15.9 reps; $r = 0.63$), shoulder press (7.8±2.5 reps to 13.6±3.5 reps; $r = 0.59$), pull-down (10.3±2.1 reps to 24.1±8.3 reps; $r = 0.05$), knee extension (11.4±4.7 reps to 17.3±5.8 reps; $r = 0.71$), knee flexion (12.4±4.5 reps to 23.4±6.7 reps; $r = 0.74$), elbow extension (12.5±5.0 reps to 23.0±10.3 reps; $r = 0.63$), and

elbow flexion (9.9±5.4 reps to 17.3±6.4 reps; $r = 0.86$). **CONCLUSIONS:** EPs should understand that correlations between repetitions achieved at different loads tend to be moderate.

224 Board #62 May 29 11:00 AM - 12:30 PM
Prioritization of Resistance Training In NCAA Division I Track and Field Athletes

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 (No relevant relationships reported)

PURPOSE: Resistance training is a powerful systemic stimulus known to improve a multitude of physiological variables. These include but are not limited to musculoskeletal strength, power, muscle mass, bone mass, and connective tissue. The sport of track and field is composed of many different events that focus on strength, power, and muscular endurance. Therefore resistance training is typically a vital part of athletic preparation for track and field athletes. The purpose of this study was to investigate specific manipulations of the acute program variables within the off-season resistance training program. **METHODS:** 34 NCAA Division I track and field student-athletes men participated in 12 week mesocycle of a non-linear periodized training program between the months of September and December. Groups were separated by needs of their athletic event and thus, performance primary goals (Group 1 (*Power*): $n=12$, age: 20.1±1.10, body mass: 87.8±13.3 kg; Group 2 (*Local Muscular Endurance*): $n=12$, age: 21.1±1.10, body mass: 82.9±10.4 kg; Group 3 (*General Strength*): $n=10$, age: 18.9±0.8, body mass: 80.4±8.1 kg). The training groups prioritized resistance loads and volume for development of power, local muscular endurance, and general strength, respectively. Performance variables were assessed at the beginning and end of this training program and consisted of counter movement vertical jump with arm swing, 1-repetition-maximum in the barbell bench press, and barbell back squat. **RESULTS:** The primary findings of this investigation are Group 1 saw significant ($p \leq 0.05$) statistical increases in vertical jump (4.4±1.1 cm), and back squat maximum (13.1±3.6 kg). Group 2 saw significant ($p \leq 0.05$) statistical increases in bench press maximum (14.2±0.5 kg), and back squat maximum (15.0±0.6 kg). Group 3 saw significant ($p \leq 0.05$) statistical increases in vertical jump (4.7±0.7 cm) and maximum back squat (20.0±5.0 kg). **CONCLUSIONS:** Our data indicate that the prioritization of strength within a 12 week mesocycle in the off-season training program had the best effect on the performance variables that were needed by each group. It appears that multiple stressors of the academic school year and athletic preparation are better mediated with a type of non-linear flexible program for competitive NCAA Division I track and field athletes.

225 Board #63 May 29 11:00 AM - 12:30 PM
Optimal Load Based on Body Mass: A Pilot Study with The Hang Power Clean

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A key factor for success in sports is the athletes' capacity of producing mechanical power output. Implementation of weightlifting derivatives such as the hang power clean (HPC) in training programs have been utilized and substantial increases in muscle power are reached when the athletes train at the load in which they produce the peak power output, also defined as the optimal load. The optimal load is commonly determined as a relative percentage of the maximum weight one can lift a single time during a specific exercise, defined as the 1-repetition maximum (1RM) for that exercise. Given the disadvantages of 1RM tests utilization such as risk of injuries and excessive amount of time required for those assessments, it has become apparent the need for alternative strategies for the optimal load identification. **PURPOSE:** To estimate the optimal load of the HPC from body mass (BM) percentages. **METHODS:** Nine healthy young men (age: 21.3 ± 1.8, height: 174.6 ± 6.8 cm, weight: 80.6 ± 6.2 kg, 1RM HPC: 90.8 ± 9.6 kg, 1RM to weight ratio: 1.13 ± 0.07) participated in this study. Subjects performed a 1RM in the HPC in the first session and during the second session the peak power was calculated across loads of 30, 40, 50, 60, 70, 80, and 90% of their BM in the HPC in a randomized order. **RESULTS:** Our results showed significant differences among the power output and the percentages of the BM. Briefly, power output at 30% of the BM was similar in relation to 40% and 50% of the BM, whilst significantly lower than 60%, 70%, 80% and 90% of the BM. For 40% of the BM, it was observed similar result in relation to 50% of the BM, whilst results significantly lower than 60%, 70%, 80% and 90% of the BM. For 50% of the BM, similar result it was observed only 60% of the BM, while lower power output it was observed in comparison to 70%, 80% and 90% of the BM. For 60% of the BM, lower

power output was observed when compared to 70%, 80% and 90% of the BM. Finally, no significant differences were observed between 70% and 80% and 90% of the BM, as well as 80% and 90% of the BM. **CONCLUSION:** Our results indicate that the optimal load based on BM for HPC exercise occurs at 70%, 80% and 90% of the BM.

226 Board #64 May 29 11:00 AM - 12:30 PM
Comparing Relative Attempt Progressions Of Elite Male And Female Raw Powerlifters

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 (No relevant relationships reported)

PURPOSE: In powerlifting, each lifter is given 3 attempts to contest the back squat (BS), bench press (BP), and deadlift (DL). The summation of the best valid attempt for each discipline constitutes a powerlifting total (PT). However, little information is available regarding attempt selection strategies to maximize PT. Therefore, the purpose of this study was to determine and compare the magnitude of load progression from one attempt to the next for each lift between elite raw male and female powerlifters. **METHODS:** Data used in this study was retrieved from the International Powerlifting Federation (IPF) online database for all Classic World Championships from 2012-2018. Males ($n=65$) and females ($n=41$) from all weight classes who completed 9 out of 9 lifts successfully were included in the analysis. A Welch's t -test was used to compare relative attempt progressions (percent increase from attempt 1 to 2 and 2 to 3) between males and females for all lifts with alpha level set at $p \leq 0.05$. **RESULTS:** Relative attempt progression was similar between females (6.08±2.11%) and males (5.59±1.80%) from attempt 1 and 2 on BS and from attempt 2 to 3 on DL (females: 4.33±2.01%; males: 3.75±1.84%). However, relative attempt progression was greater for females compared to males between attempt 1 and 2 on BP (6.50±2.10% vs 5.35±2.18%, $p=0.008$) and DL (6.76±4.19% vs 5.40±2.28%, $p=0.03$), and between attempt 2 and 3 on BP (4.28±1.74% vs 2.85±1.24%, $p<0.001$) and BS (4.04±1.89% vs 3.31±1.43%, $p=0.03$), respectively. **CONCLUSIONS:** These data indicate that successful elite male powerlifters are on average more conservative with their attempt progressions for each lift than females. This may be due to differences in opening attempt selection or perceived effort during subsequent attempts between males and females. Importantly, these findings provide general attempt progression guidelines for coaches working with elite raw (i.e., classic) male and female powerlifters.

A-41 Free Communication/Poster - Biomechanics of Resistance Training

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

227 Board #65 May 29 11:00 AM - 12:30 PM
Validity of the Two-Point Method for Estimating Squat and Bench Press One Repetition Maximums

Brandon W. Snyder, Dylan S. Zangakis, Gavin L. Moir, Shawn N. Munford, Shala E. Davis, FACSM. East Stroudsburg University, East Stroudsburg, PA. (Sponsor: Shala Davis, FACSM)
 (No relevant relationships reported)

PURPOSE: To assess the validity of the two-point method for estimating one repetition maximums (1RM) in the squat and bench press exercises with varied pairs of loads. **METHODS:** Thirteen resistance-trained men (age: 21.7±0.4 years; height 1.74±0.07 m; mass: 82.9±9.5 kg; 1-repetition maximum (1RM) back squat: 149.9±20.7 kg; 1RM bench press: 114.8±18.5 kg) performed three trials of squat and bench press using the following percentages of 1RM: 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz). Varied loading pairs (20% & 80%, 30% & 70%, 40% & 50%, 40% & 70%,) were selected and regressions were created to estimate 1RMs. Analysis of variance was used to compare differences between the measured and estimated 1RMs for the squat and bench press. **RESULTS:** No significant differences were found ($p>0.05$) between estimated and measured 1RMs despite large range of mean differences in the squat (MD: 6.45 kg-27.47kg) and bench press (MD: 1.09 kg-4.32kg). **CONCLUSION:** The two-point method represents a useful means of estimating 1RM during the back squat and bench press exercises without inducing the fatigue associated with directly measuring 1RM. However, individualized force-velocity characteristics should be considered when utilizing the two-point method for estimating a 1RM.

- 228** Board #66 May 29 11:00 AM - 12:30 PM
The Influence of Trunk and Tibia Orientation on the Hip/Knee Extensor Moment Ratio During Squatting
 Adam J. Barrack, Rachel Straub, Jordan Cannon, Christopher M. Powers, FACSM. *University of Southern California, Los Angeles, CA.* (Sponsor: Christopher M Powers, FACSM)
(No relevant relationships reported)

The squat is a common and versatile exercise in both the rehabilitation and sports performance settings. Sagittal plane trunk and shank orientations have been theorized to modulate extensor moments at the hip and knee during squatting. For example, increasing trunk inclination is thought to increase the extensor moment at the hip and decrease the extensor moment at the knee, while increasing shank inclination has been theorized to increase the knee extensor moment and decrease the hip extensor moment. Although the influence of sagittal plane tibia and trunk orientations on hip and knee extensor moments have been established in computational models, experimental validation in human subjects is lacking. **Purpose:** To determine the influence of sagittal plane trunk and shank orientations on hip and knee extensor moments during the lowering phase of a barbell back squat. **Methods:** Kinematic and kinetic data were obtained from 8 male and 8 female participants during the execution of 8 different squat conditions in which the tibia and trunk orientations were manipulated. Foot position, bar position, bar load, and stance width were controlled across subjects. Inverse dynamics equations were used to calculate the hip/knee extensor moment ratio at 60, 90, and 120 degrees of knee flexion. Linear regression was used to evaluate the association between the difference in the sagittal plane trunk and tibia angles and the hip/knee extensor moment ratio at each knee flexion angle of interest. **Results:** The difference between trunk and shank inclination explained 67%, 71%, and 67% of the variance in the hip/knee extensor moment ratio at 60 degrees ($p < 0.001$), 90 degrees ($p < 0.001$), and 120 degrees ($p < 0.001$) of knee flexion, respectively. Across all of the examined depths, the squat was deemed to be hip extensor biased (hip/knee extensor moment ratio > 1.0) when the sagittal plane trunk angle exceeded the sagittal plane shank angle. **Conclusion:** The relationship between sagittal plane trunk and shank orientation can function as an acceptable inference as to whether a particular squat technique is hip extensor biased or knee extensor biased.

- 229** Board #67 May 29 11:00 AM - 12:30 PM
Differences In Maximal Force Production Of The Squat And Knee Extension With Different Verbal Commands
 Micheal J. Luera, Jesus Hernandez-Sarabia, Carlos Estrada, Tyler Muddle, Jason DeFreitas. *Oklahoma State University, Stillwater, OK.*
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(No relevant relationships reported)

It is suggested that verbal commands influence the ability to produce peak force during maximal voluntary isometric contractions (MVC). When determining peak force capabilities during MVC it is recommended to use the verbal command, as "hard" as possible. Additionally, when instructing conditions to achieve maximal rate of force development (RFD), using the verbal command as "fast" as possible. **PURPOSE:** To examine the influence of two different verbal commands on peak force production during MVC's performed during the squat (SQ) and knee extension (KE) exercises. **METHODS:** Twenty-five lower-body resistance trained males ($n = 16$, mean \pm SD; 24 ± 3 yrs; 88.08 ± 11.09 kg; 175 ± 7 cm) and females ($n = 9$, 23 ± 4 yrs; 62.53 ± 6.84 kg; 164 ± 7 cm) performed two separate MVC during both SQ and KE exercises. Knee joint angles were set at 110° during both exercise conditions, and hip angle was $\sim 110^\circ$ during SQ and $\sim 105^\circ$ during KE. During both exercise conditions, peak force (N) was measured using an S-beam load cell. Throughout both exercise conditions, subjects performed MVCs under two different verbal command to; 1.) determine maximal force capabilities, subject were verbal instructed to push as "hard" as possible, and 2.) determine maximal RFD capabilities, subjects were instructed to push as "quick" as possible. **RESULTS:** One-way repeated measures analysis of variance indicated that, when instructed to push as "quick" as possible compared to as "hard" as possible, peak force was significantly higher during both the SQ (mean \pm SE; 2258.11 ± 131.01 N vs 2094.33 ± 123.58 N) and KE (785.90 ± 49.03 N vs 757.45 ± 47.04 N) conditions ($P < 0.05$). **CONCLUSION:** Contrary to previous recommendations, these findings indicate that during isometric SQ and KE exercises, performed at the same knee joint angle, peak force is greater when specifically instructed to produce maximal force MVCs as "quick" as possible vs as "hard" as possible.

- 230** Board #68 May 29 11:00 AM - 12:30 PM
Validity of Barbell Velocities Recorded from the GymAware Device during Squat and Bench Press Exercises
 Dylan S. Zangakis, Gavin Moir, Brandon Snyder, Shawn Munford. *East Stroudsburg University of Pennsylvania, East Stroudsburg, PA.* (Sponsor: Dr. Shala Davis, FACSM)
(No relevant relationships reported)

Purpose: To assess the validity of the GymAware linear position transducer (LTP) during the squat and bench press exercises. **Methods:** Thirteen resistance-trained men (age: 21.7 ± 0.4 years; height 1.74 ± 0.07 m; mass: 82.9 ± 9.5 kg; squat 1RM: 149.85 ± 20.68 kg; bench 1RM: 114.77 ± 18.47 kg.) performed three trials of squat and bench press using the following percentages of a one repetition maximum (1RM): 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz) and the GymAware LTP. Analysis of variance was used to assess the differences in the vertical velocities across the seven load conditions for each of the two exercises. **Results:** Mean velocities were significantly different between devices for both the squat and bench press exercises ($p < 0.05$). Specifically the GymAware LTP provided significantly greater velocities under the 20% 1RM and 40% 1RM load conditions in the squat exercise (mean differences: 0.05 ± 0.03 m/s; 0.02 ± 0.02 m/s; $p < 0.05$) in addition to the 30% 1RM load for the bench press exercise (mean difference: 0.04 ± 0.02 m/s; $p < 0.05$). **Conclusion:** The GymAware LTP had a tendency to overestimate barbell velocities during the squat and bench press exercises when compared to the Vicon 3-D motion analysis system, particularly at the lighter loads. Such differences may bring into question the validity of the force-velocity characteristics derived from the LTP device during these resistance exercises.

- 231** Board #69 May 29 11:00 AM - 12:30 PM
Influence of Heart Rate Variability Variables in Half Squat Performance in Female Athletes
 María Alejandra Sastoque Hernández¹, Diana Carolina Camacho Serna¹, Jorge Mario Cabrera Garavito¹, Jaime Alfredo Albarracín Trujillo², Camilo Ernesto Povea Combariza¹, Rodrigo Esteban Argotho Bucheli³, Natalia María Rodríguez Zárate⁴.
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(No relevant relationships reported)

The search of non-invasive and easy-to-monitor variables is essential to improve the athlete performance. The assessment of neuromuscular characteristics, such as velocity, with a lineal position transducer (LPT), allows training optimization and just like heart rate variability (HRV) guarantees an adequate athlete monitoring. The autonomic nervous system (ANS) and Sympathetic nervous system (SNS) exert an important influence on skeletal muscle functions. However, there are no studies that correlate the activity of SNS with current technologies such as LPT to calculate several neuromuscular performance variables. Otherwise, the results of HRV assessment could be related to a TLP strength test performance.

PURPOSE: The aim of this study is to find correlations between HRV variables and TLC variables during a half squat movement in young female soccer players. **METHODS:** Thirteen professional female soccer players were tested (Age 20.7 years ± 2.62 , Weight 60.9 kg ± 4.4), we analyzed HRV during standing, we also evaluated the velocity of a half squat movement with a LPT, during a maximal strength test, statistical analyses were performed to determine associations. **RESULTS:** Associations were found between Stress index during standing position and Mean acceleration to Maximal velocity (m/s) (R^2 0.3115 P 0.0381), Mean velocity (R^2 0.3284 P 0.0322), Propulsive mean velocity (R^2 0.3189 P 0.0354). **CONCLUSIONS:** Stress Index (SI) is a variable that reflects sympathetic activation and suggest autonomic reactivity to stress situations indicating an adequate response to confront the demands presented by the sport. Thus, an abnormal sympathetic predominance could result in chronic fatigue which would evince a SI higher elevation, giving the index greater value. According to our findings the SI during standing position correlated with velocity and acceleration variables during half squat, this suggests that adequate sympathetic reactivity could contribute to the improvement of neuromuscular variables. We hypothesized that SI could be a simple non-invasive way to measure sympathetic reactivity in sports, being part in assessment and monitoring of performance. We also suggest that interventions aimed to improve sympathetic reactivity could improve neuromuscular performance.

232 Board #70 May 29 11:00 AM - 12:30 PM
Reliability of Barbell Velocities Recorded from the GymAware Device during Squat and Bench Press Exercises

Shawn N. Munford, Dylan S. Zangakis, Gavin L. Moir, Brandon W. Snyder, Shala E. Davis, FACSM. *East Stroudsburg University, East Stroudsburg, PA.* (Sponsor: Shala E Davis, FACSM)

(No relevant relationships reported)

PURPOSE: To assess the reliability of velocities recorded with the GymAware linear position transducer (LTP) during the squat and bench press exercises. **METHODS:** Thirteen resistance-trained men (age: 21.7 ± 0.4 years; height 1.74 ± 0.07 m; mass: 82.9 ± 9.5 kg; 1-repetition maximum (1RM) back squat: 149.9 ± 20.7 kg; bench 1RM: 114.8 ± 18.5 kg.) performed three trials of squat and bench press using the following percentages of 1RM: 20, 30, 40, 50, 60, 70, 80%. The order of the loads was counterbalanced across the participants. The mean vertical velocity of the barbell during the concentric phase of each repetition was recorded using a 3-D motion analysis system (Vicon; 200 Hz) and the GymAware LTP. Reliability of the GymAware was determined using intraclass correlations (ICC) and coefficients of variance (CV%). **RESULTS:** The GymAware showed high inter-session reliability for both exercises with ICCs ranging from good to excellent (squat: 0.71-0.91; bench press: 0.83-0.91). CV% showed precision in the recorded velocities during both exercises (squat: 3.6%-5.8%; bench press: 4.9%-7.4%). **CONCLUSION:** The GymAware LTP shows high inter-session reliability for recorded velocities during the squat and bench press exercises.

233 Board #71 May 29 11:00 AM - 12:30 PM
Comparison of Pre-stretch and Reactive Strength Between Men and Women During Bench Press

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(No relevant relationships reported)

Pre-stretch augmentation (PAI) and reactive strength (RSI) indices have been used to assess the stretch-shortening cycle (SSC) contribution to vertical jumping. SSC activation is also a part of many upper extremity (UE) activities, however quantification of SSC contribution to UE function largely remains unknown. Furthermore, based on differences in UE muscle-tendon properties, the SSC effect is likely different between men and women

PURPOSE: To compare UE PAI and RSI indices between men and women. **METHODS:** 20 men (26 ± 2.4 yrs) and 17 women (21.4 ± 2.6 yrs) with >6 months of UE resistance training completed 3 bench press trials using 2 styles, pure concentric (PC) and rebound (RB) (no pause between eccentric the concentric phases), using 75% of their one repetition maximum. Participants were instructed to complete the concentric phase as quickly as possible. Concentric phase vertical average force (AF) and power (AP) were computed from barbell kinematic data and used to calculate PAI [(RB-PC)/PC*100] and RSI (RB-PC). Independent t tests, adjusted for unequal variances, were conducted to compare indexes between sexes

RESULTS: Except for one man and one woman, participants demonstrated greater AF and AP during the RB bench press compared to PC bench press. Men ($.49 \pm .38$) had significantly higher ($P=.004$, $d=.75$) AF PAI than the women ($.27 \pm .17$). There was no significant ($P=.068$, $d=.64$) sex difference for AP PAI. Men ($AF: 3.9 \pm 2.9$, $AP: 129.0 \pm 56.7$) demonstrated significantly higher RSI for both AF ($P<.001$, $d=1.5$) and AP ($P<.001$, $d=2.3$) than women ($AF: .76 \pm .54$, $AP: 29.6 \pm 18.1$).

CONCLUSIONS: Except for two participants, as expected, preceding the concentric phase with SSC resulted in greater average force and power production. With the exception of AP PAI, SSC augmentation was greater for the men. Consistent with the RSI reflecting the AP/AF difference between RB and PC bench press styles, the sex comparison effects sizes were larger for the RSI than the PAI, which expresses the difference relative to the PC. Further research is needed to determine the extent to which UE muscle-tendon properties explain the sex differences identified.

234 Board #72 May 29 11:00 AM - 12:30 PM
FEM Analysis of Lumbosacral Joints on the Lift Barbell Preparation Phase

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(No relevant relationships reported)

PURPOSE: The aim of this study was to analyze the stress characteristics of the lumbosacral segments of the preparation phase of barbell lifting using finite element method and to provide scientific and objective mechanical factors of lumbosacral joint injury in weightlifters for prevention and treatment of lumbar weightlifting injuries.

METHODS: The three-dimensional lumbosacral finite element model was established by reverse engineering method based on DICOM data (L5-S5 segments included). The Von Mises stress trends of lumbosacral bone, soft tissue such as intervertebral disc, ligament were analyzed between normal physiological activities during flexion, extension, left bend, right bend and preparation phase of barbell lifting.

RESULTS: The von Mises stress (mpa) of lifting weight condition respectively are 81.223, 199.099, 321.646, 99.058, 152.357, 156.882, 461.294, 699.506, 0.0, 104.414, 8.66, 74.9 9, 89.15 on posterior longitudinal ligament, left transverse process ligament, right lateral intercostal ligament, yellow ligament, interspinous ligament, spine on the ligament, left joint capsule ligament, right capsular ligament, left joint capsule contact stress, right joint capsule contact stress, end plate, nucleus, lumbar, sacrum.

CONCLUSIONS: The vertebral body is the main stress-bearing part during lifting and the intervertebral disc plays a major role in transmitting the load. Long-term repeated high-stress stimulation could cause slight fractures of cancellous bone and end-plate of vertebrae. Interspinous ligament bears more loads and is more likely to get injured compared to other ligaments. The imbalance of the left and right ligament force also reveals that minimizing spinal flexion and torsion compound action could reduce the possibility of ligament injury.

235 Board #73 May 29 11:00 AM - 12:30 PM
Muscle Excitation During A Weighted And Unweighted Supine Bridge (a Pilot Study)

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(No relevant relationships reported)

Previous studies have examined the relationship between muscle activities during a single leg bridge (SLB) without including the gluteus maximus muscle (Gmax). Similarly, few studies have evaluated the influence of additional loading during a SLB.

PURPOSE: To examine muscle activation levels of the Gmax, semitendinosus (ST), and the biceps femoris long-head (BFL) during SLB, and weighted single leg bridge (wSLB). **METHODS:** Two recreationally active college students (1 male; 1 female) were recruited for the study and were free of any muscle or orthopedic injuries. Surface electromyography (sEMG) were used to collect muscle activities. Maximal voluntary contractions (MVC) were collected for each muscle group prior to testing. Each participant performed three repetitions of both SLB and wSLB, following a pattern of 60 beats per minute (~2 beats up, ~3 beat hold, and ~2 beats down) which was verified using an electronic metronome. Data was collected and analyzed using a commercially available sEMG package. MVCs of each muscle were used to normalize the observed peak sEMG during the exercise. Peak root mean square (RMS) was obtained for each muscle and the peak RMS in SLB was set to 100% to provide a means of comparison. Burst threshold was defined as 10% of the observed peak value. This value determined the onset and offset of the muscle excitation. **RESULTS:** There was a 37.0 ± 1.7 average difference in magnitude between the two exercises. The duration of activity of the Gmax, BFL, and ST during the unweighted trials were 4.0 ± 1.25 seconds, 3.5 ± 0.75 s and 4.2 ± 0.45 s, respectively. Muscle activity duration remained unchanged in the wSLB in the Gmax and STN. However, there was an increase in BFL activity during the wSLB trials (4.0 ± 0.7 s). **CONCLUSION:** In the male participant, it was concluded that the main muscle activated during the original single leg bridge and the weighted single leg bridge was BFL. However, for the female participant, the main muscle was the STN. Muscle activation of the hamstring muscles increased as a whole from the unweighted exercises to the weighted exercise. As well as the duration of BFL activity. This study is preliminary and will be conducted at a larger scale in the future to enhance credibility and reliability.

236 Board #74 May 29 11:00 AM - 12:30 PM
The Influence of Menthol on Joint Range of Motion

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(No relevant relationships reported)

PURPOSE: To use the known topical analgesic menthol to explore the influence of one's perception of muscle tension on joint range of motion (ROM).

METHODS: This study received approval from the Salem State University Institutional Review Board. In a familiarization session, 15 participants first completed weight-bearing lunge (WBLT) and active ankle dorsiflexion (AADF) tests (Pre-test) to assess ROM in the soleus-gastrocnemius complex. Participants were always instructed to stretch to a 'maximal tolerable stretch'. They immediately then completed a 6x60s static stretching routine for the ankle plantarflexors, and again completed the WBLT and AADF tests (Post-test). These testing conditions established a control (CONTROL). On two separate occasions participants returned to complete the aforementioned pre-tests, immediately after which they had 5mL of a 4 % menthol gel (M) applied to their soleus-gastrocnemius complex on one visit, and on the other visit they had 5mL of a Placebo gel (P) spread over the same area. Participants then

underwent the stretching routine and post-tests as previously described. The following measures were made during each test: ROM, thermal sensation (TS), thermal comfort (TC), electromyography (EMG), and the Hoffman reflex (HR). A two-way RM ANOVA detected differences between time (Pre vs. Post), condition (CONTROL vs. M vs. P), and any interaction, with post-hoc testing used to indicate directionality ($\alpha=0.05$).

RESULTS: Menthol significantly improved AADF ROM by 2.67 degrees compared to P ($p<0.001$), coinciding with significantly cooler sensations ($p<0.01$) and a loss of thermal comfort ($p<0.05$) with menthol. Similarly, menthol improved WBLT ROM by 2.98 degrees compared to P ($p<0.01$), coinciding with a significant loss of thermal comfort ($p<0.05$) with menthol.

CONCLUSION: Menthol appears to improve active joint range of motion during stretches that are held to a maximal tolerable tension. This suggests that one's perception of tension per se, rather than actual muscle tension, may be more important in determining maximal active joint ROM. It is not clear whether menthol achieves this by specifically reducing one's perception of muscle tension during a maximal stretch, or whether other sensory inputs arising from menthol i.e. TS, TC, divert attention from it.

A-42 Free Communication/Poster - Cycling

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

237 Board #75 May 29 11:00 AM - 12:30 PM Effect Of Chamois Design on Rider Comfort And Saddle Pressure During Sub-Maximal Cycling

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(No relevant relationships reported)

Previous research on the link between saddle pressure, rider comfort and urological disorders have focused predominantly on saddle design, bicycle setup and workload. Yet, the effect of chamois design on saddle pressure and perceived comfort during cycling in both men and women remains unresolved.

PURPOSE: In this study we investigated the effects of chamois design on perceived comfort and peak saddle pressure during seated sub-maximal cycling in men and women. **METHODS:** Eighteen subjects (9 M; 9 F) participated in two separate protocols, one laboratory- and one field-based. The laboratory protocol required subjects to ride at 2.5 W.kg⁻¹ for 5 minutes using either a new (A) or old (B) chamois design. Saddle pressure was captured for 30 seconds during each trial. At the conclusion of each trial, subjects were asked to rate the chamois on seven different comfort categories (Overall Comfort, Genital Sensation, Genital Comfort, Sit Bone Comfort, Buttocks Comfort, Stability on the Saddle, Off Saddle Comfort). The field protocol required subjects to complete one week of regular cycling training in each chamois design and were asked to complete the same comfort questionnaire at the end of each week. A repeated measures, two-way ANOVA was performed to test for main and interaction effects (Chamois x Sex) on saddle pressure and each comfort category in both the laboratory and field study.

RESULTS: The laboratory protocol resulted in a significant main effect of chamois design on 'Overall Comfort' (A>B, $p<0.05$). The field protocol also resulted in a significant main effect of chamois design on 'Overall Comfort' (A>B, $p<0.05$) as well as 'Buttocks Comfort' (A>B, $p<0.05$). Peak saddle pressures were significantly higher in Chamois B than Chamois A (B=24.5±3.54 psi vs. A=23.06±3.53 psi, $p<0.05$). There was a significant main effect of Sex on Genital Sensation and Genital Comfort (Males>Females, $p<0.05$) under both laboratory and field conditions.

CONCLUSIONS: Chamois design is an important factor that affects both peak saddle pressure and perceived comfort for males and females during cycling. Innovation of future chamois designs should focus on providing individualized comfort for males and females. Further research is needed to investigate the possible link between chamois design and the development of urological disorders.

238 Board #76 May 29 11:00 AM - 12:30 PM Effects of Bicycle Crank Length on Gross Efficiency, Power, and Joint Kinematics During Cycling Ergometry

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(No relevant relationships reported)

PURPOSE: To determine the effects of six different crank lengths (150, 165, 170, 172.5, 175, and 180 mm) on gross efficiency, maximum power, optimal pedaling rate (cadence at maximum power), and joint kinematics of the hip and knee.

METHODS: Elite level cyclists ($n=18$) participated in two visits to the Cal Poly Cycling Lab. The purpose of the first lab session was to measure $\dot{V}O_2$ peak ($60.6 \pm 7.6 \text{ mL} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$), participant characteristics ($28.2 \pm 5.3 \text{ yrs}$; $175.6 \pm 7.4 \text{ cm}$; $70.5 \pm 5.3 \text{ kg}$; $255 \pm 105 \text{ km/week}$), and complete familiarization trials with four different crank lengths. These practice trials consisted of 4 second seated maximal sprints on the participant's original crank length (170, 172.5, or 175 mm) and three other crank lengths (150, 165, and 180 mm). The second test session was a single-blind randomized crossover design with the six different crank lengths. After a 5 minute warm up, participants performed a 3 minute steady state effort at 65% $\dot{V}O_2$ peak and 90 rpm. This was followed by two maximum effort 4 second seated sprints with 90 seconds rest prior to each sprint. Participants rested for 5 minutes before the next crank length trial. **RESULTS:** During steady state cycling, shorter cranks had a higher gross efficiency (150 mm: 22.1% compared to longer cranks (180 mm: 21.6%), ($p < 0.001$). No significant differences were found between crank lengths for maximum power output during the 4 second sprints. There was an increase in optimal pedaling rate between 150 mm cranks (130 rpm) and all other lengths (180 mm: 120 rpm) ($p < 0.001$). 150 mm cranks have a significantly smaller hip (45°) and knee (67°) range of motion than all other cranks measured (180 mm: hip 51° , knee 75°) ($p < 0.001$). **CONCLUSIONS:** Shorter cranks resulted in a significantly higher gross efficiency, smaller knee and hip range of motion, and a higher optimal pedaling rate.

239 Board #77 May 29 11:00 AM - 12:30 PM Analysis of Kinematics And Electromyography of Cyclists In the Length of Handling

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(No relevant relationships reported)

PURPOSE: The cyclist's accommodation on the bicycle is essential to avoid injuries and improve performance. The adjustment of the handlebar range of the bicycle can have similar or contrary effects to the horizontal adjustment of the saddle. The backward position generates pelvic anteversion, decreased hip angle, greater activation of the hamstring muscles, plantar flexors and greater tibio-femoral shearing force. On the other hand, the forward position of the saddle generates retroversion of the hip, increase in the angle of the knee, decrease in the activation of the hamstrings and increase of the strength in the quadriceps and can generate patello-femoral pain.

PROPOSITION: Evaluate the variations in muscular activity and joint ranges of the lower extremities in the cycle of pedaling, by changing the length of the handlebar reach in amateur cyclists

METHODS: Eight male cyclists (Age: $41.75 \pm 10.08 \text{ years}$; Weight: $72.56 \pm 5.53 \text{ Kg}$) of right predominance were measured. The hip, knee and ankle joint angles (three-dimensional kinematics) and muscle activity of the Biceps Femoral, Lateral Gastrocnemius, Lateral and Medial muscles (surface electromyography) and the adjustment of their bicycles in three handlebar lengths were recorded: a) preferred. b) advanced (preferred + 3 centimeters) and c) delayed (preferred - 3 centimeters). It was carried out two stress tests one of incremental load of maximum power and another of constant load to 57% of the maximum power at 90 rpm

RESULTS: A variance analysis (ANOVA) finding differences in the activation units of the left lateral gastrocnemius muscle in the preferred position vs. back ($0.34 \text{ vs. } 0.18$, $p = 0.042$) and between the position of the left hip at 150° between the forward vs. back position ($96.64 \text{ vs. } 101.20$, $P = 0.05$).

CONCLUSIONS: The modification of the handlebar ranges of the bicycle from the preferred position to the backward one, produces an increase in the angle of the hip generating pelvic anteversion. This variation is presented at 150° degrees of the cycle of pedaling in the transition from maximum power to that of the bottom dead center, with the decrease in the activation of the left lateral gastrocnemius muscle.

240 Board #78 May 29 11:00 AM - 12:30 PM
Effects of Saddle Height and Workrate on Frontal Plane Knee Joint Biomechanics

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Cycling is one of the most popular exercises for knee osteoarthritis (OA) or total knee replacement (TKR) rehabilitation. It is known for reduced loading to lower extremity joints compared to walking. One way to fit a bicycle to an individual is adjusting saddle height. There have been limited studies on effects of saddle height on frontal-plane knee joint loading.

PURPOSE: To determine the effects of saddle height and workrate on the knee joint biomechanics. **METHODS:** Fourteen experienced cyclists (age 50-70 years) were recruited from bicycle shops and clubs. Subjects participated in a single testing session that included six test conditions of three saddle heights at two workrates. Saddle heights were set at 20°, 30°, and 40° of knee flexion while the crank was at the bottom position. Workrate was electronically controlled at 80 and 120 watts. Three-dimensional kinematic (240 Hz, Vicon) and pedal reaction force (1200 Hz, Customized instrumented pedal) data were recorded for five successful cycles in each condition. Joint kinematics and kinetics were calculated and compared using a 3x2 ANOVA and paired t-tests with a Bonferroni correction. **RESULTS:** There were no significant interactions or saddle height main effect for peak knee abduction moment. There was a significant effect of saddle height on knee extension ROM, peak knee extension moment, and peak knee flexion moment (all $p < 0.012$). The post hoc comparisons showed that the knee extension ROM was different from one another between 20°, 30°, and 40° saddle heights (80.1° vs. 73.7° vs. 67.6°, respectively). The peak knee extension moment for 20° saddle height (19.9 Nm) was different from 30° and 40° saddle heights (22.6 Nm and 23.6 Nm, respectively). Additionally, the peak knee flexion moment was different between all three saddle heights (-33.4 Nm vs. -23.4 Nm vs. -18.9 Nm). There was a significant workrate main effect on knee extension ROM, peak knee extension moment, and peak knee abduction moment (all $p < 0.008$). **CONCLUSIONS:** Although decreased saddle height increased the knee extension moment, the knee abduction moment was not affected. These results suggest that saddle height adjustment could be a potential and safe method to modulate knee joint loading without concern of impacting frontal-plane knee loading in rehabilitation for patients with knee OA or TKR.

241 Board #79 May 29 11:00 AM - 12:30 PM
Determining If A Bike-mounted Aerodynamic Sensor Can Detect Changes In Wheel Rolling Resistance During Cycling With Different Tire Pressures Outdoors

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Rolling resistance represents a key resistance force to overcome during cycling. This resistance force is calculated as the product of the coefficient of rolling resistance (Crr) and rider+bike system weight. Crr is influenced by a number of factors including tire pressure. Typically, Crr is measured in a laboratory situation but more recently, bike-mounted instruments have been developed that are mounted on a bike to measure Crr in the field. **Purpose** To determine if a bike-mounted aerodynamic sensor is able to measure changes in Crr with changes in tire pressure while cycling outdoors. **Methods** A cyclist rode a road bike (combined mass 80.45 kg) equipped with an aerodynamic sensor to measure Crr (Aerolab). The bike-mounted sensor measures a number of parameters such as wind speed, global position system (GPS) data, cycling power, and air temperature, for example. Processing algorithms are used to generate Crr. For this experiment, tire pressure was manipulated in a manner that changes in Crr were expected. Specifically, three tire pressures were tested: 100, 70, and 40 PSI. Tire pressure was measured using a custom made valve system connected to a digital pressure gauge (Ashcroft Digital Gauge, 0.05% terminal point accuracy, 0-200 PSI range). The rider completed 2 trials per pressure condition with each trial consisting of a coast-down test. The rider reached a target velocity and then stopped pedaling. Data were recorded for at least 60 seconds for each trial. The rider maintained the same ride position for each trial. Data were processed using custom software to yield Crr per trial using an iterative algorithm that calculates Crr multiple times using different sections of data with corrections for air temperature. The research team member processing data was not aware of the conditions. Crr values were normalized such that the Crr during the 100 psi condition was set to 100%. **Results** Relative Crr values were 100±2.7% at 100 psi, 95.7±1.8% at 70 psi, and 119.6±2.7% at 40 psi. **Conclusions** Using a bike-mounted aerodynamic sensor, changes in rolling resistance were detected when

tire pressure was manipulated. However, confounding factors that could influence the calculation of Crr include the influence of subtle changes in rider position, yaw angle, and tire temperature, for example.

A-43 Free Communication/Poster - Sports Biomechanics

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

242 Board #80 May 29 9:30 AM - 11:00 AM
A Comparison of Forehand Swing Biomechanics between Male and Female Tennis Players

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(No relevant relationships reported)

The forehand is a central component in modern tennis, being the most frequently used swing. However, in comparison to the serve, it has not been analyzed to the same degree under the focus of kinematics. Our study is the first to compare joint angular displacement between male and female athletes during the forehand swing. We selected the shoulder and knee joint as the areas of interest. **PURPOSE:** To compare shoulder and knee joint angular position of the forehand between male and female tennis players. **METHODS:** 7 male and 11 female NCAA tennis athletes participated. Subjects had retroreflective markers placed over bony landmarks. Data collection trials were recorded using an 8-camera motion analysis system. The first set of trials consisted of 7 topspin forehands struck at submaximal (sM) ball velocities, and the second set of trials consisted of 7 topspin forehands struck at maximal (M) ball velocities. A custom-made software was used to obtain the angular position of the shoulder and knee joint at the following 5 time points: 1) end of back swing; 2) lowest point; 3) ball contact; 4) midpoint of follow-through; 5) end swing. The four outcomes measured at each time point are: a) shoulder elevation; b) shoulder abduction; c) shoulder internal rotation (SIR); d) knee flexion (KF). A multilevel multivariate model was used and included fixed effects for the between-subjects factor sex, and the interaction between sex and velocity.

RESULTS: No significant effects for sex were found. For outcomes regarding interaction between sex and velocity: 1) during the end of back swing phase, men showed a greater change in KF from sM to M compared to women (-49.5 to -59.5 vs -47.1 to -51.2 degrees, $p < 0.05$); 2) during ball contact phase, females showed greater change in SIR from sM to M (-56.3 to -66.9 vs -85.9 to -87.5 degrees, $p < 0.01$); 3) during ball contact phase, males showed less change in KF from sM to M (-26.5 to -26.7 vs -35.4 to -42.7 degrees, $p < 0.01$); 4) during midpoint of follow-through phase, men showed less change in KF from sM to M (17.7 to -20.0 vs -25.1 to -39.2 degrees, $p < 0.01$).

CONCLUSION: At similar velocities, shoulder and knee angular position do not vary significantly between male and female athletes. When transitioning from low to high velocity swings, significant change is found between sex during knee flexion and shoulder internal rotation.

243 Board #81 May 29 9:30 AM - 11:00 AM
Evaluation Of Shoulder Muscle Activity Patterns While Swimming In Triathlon Wetsuits

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(No relevant relationships reported)

During the swimming portion of a triathlon, athletes can use a wetsuit if water temperature is below a threshold value. There are two general categories of wetsuits: Full sleeve (FSW) and sleeveless (SLW). It is not known if the type of wetsuit worn influences muscle activity patterns. **Purpose** Compare shoulder muscle activity patterns while wearing different wetsuit designs. **Methods** Subjects ($n=7$; 45.7±8.0 yrs, 174.8±10.5 cm, 70.1±9.4 kg) completed three swim conditions on the same day: no wetsuit (NWS), FSW, or SLW. Rest was provided between conditions as needed. Muscle activity (posterior deltoid (PD), anterior deltoid (AD)) was measured (2000 Hz) using a water proofed electromyography (EMG) system (Cometa). After a self-directed warm-up, subjects swam a length of the pool at a 'somewhat hard' pace (25 m or 50 m depending on pool set up). EMG data were processed by removing any zero offset, calculating the absolute value, and smoothing (low-pass, cutoff frequency = 4 Hz). PD smoothed data were used to identify the beginning and ending points of five consecutive stroke cycles with extracted data time normalized. Pearson correlation coefficients (r) were calculated between NWS-FSW, NWS-SLW, and FSW-SLW for each extracted pattern data set per muscle with each r transformed to a Z-score. Z-scores and r were each compared between conditions using a 1 x 3 (wetsuit condition) repeated measures ANOVA ($\alpha=0.05$). **Results** Neither r nor Z-score

for either muscle was influenced by wetsuit condition ($p>0.05$). PD EMG patterns were moderately correlated between conditions (NWS-FSW NWS-SLW FSW-SLW: $r=0.66\pm0.16$, 0.65 ± 0.16 , 0.62 ± 0.20) whereas strength of AD correlations were weak ($r=0.37\pm0.33$, 0.42 ± 0.19 , 0.39 ± 0.21). **Conclusion** Muscle activity patterns of PD were more strongly similar than AD between swimming without a wetsuit then with a wetsuit as well as between wetsuit conditions. The weaker AD correlations between conditions may be influenced by horizontal position due to buoyancy force and/or possible resistance to shoulder movements of the wetsuit.

244 Board #82 May 29 9:30 AM - 11:00 AM
Comparison Of Torques And Positions Of The Half And Full Golf Swing - A Pilot Study

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(No relevant relationships reported)

PURPOSE: A concern for healthcare workers is how to advise individuals wishing to return to golf following lower extremity (LE) injury or surgery. A common recommendation is to use a half swing, however, it is not known whether this truly reduces the motion or muscular torque for the LE. The purpose of this study was to examine the peak torques and positions of the hip during a half swing versus a full golf. **METHODS:** Five recreational golfers with handicaps ≤ 20 , both male and female participated. Participants completed 10 full swings and 10 half swings. A 10-camera motion analysis system, with force plates, was used to record swing data. Data was reduced using a 3-D modeling program and standard inverse dynamics were used to determine internal net joint torques. Peak torques are presented as $\text{Nm}/\% \text{BW} \cdot \text{Ht}$ and peak position in degrees. Differences were considered significant at the .05 level of probability. **RESULTS:** Subjects average age was 33 ± 17 SD years. The highest torques for the full swing were produced for extension of the trail leg (10.32 ± 1.48), while the half swing trail hip extension torques averaged 8.62 ± 1.84 . This was followed by lead hip abduction, with means of 9.9 ± 2.81 and 7.55 ± 2.45 for the full vs half swing respectively. Significant differences for torques between the full and half swing included trail hip extension, internal rotation, and flexion, along with lead hip extension and abduction. The greatest peak positions were in trail and lead hip flexion, with values of $44.2 \pm 17.8^\circ$ and $40.4 \pm 17.3^\circ$ for trail hip flexion, and $47.8 \pm 20.3^\circ$ and $44.6 \pm 18.8^\circ$ for lead hip flexion. There were significant differences for the positions of trail hip flexion, internal rotation, extension, abduction.

CONCLUSIONS: The preliminary data show that using a half swing does reduce the amount of internal torque around the hip, as compared to a full swing. Interestingly, the changes in peak position of the hip joint and the torques do not appear to be consistent. Our findings showed a great deal of variability in the amount of movement at the joint both for the full and half swing, thus this may be a source of concern for clinicians. In addition, while some of the hip joint torques were reduced with the half swing, some of the torques were still much higher than previously reported torques for walking and activities of daily living.

245 Board #83 May 29 9:30 AM - 11:00 AM
Comparison of Single-Leg Hopping Parameters Across Different Artificial Turf Systems and Natural Turfgrass

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(No relevant relationships reported)

During locomotion, leg spring parameters are adjusted to maximize efficiency and reduce injury risk based on the stiffness of the surface. **PURPOSE:** This study compared leg spring parameters during single-leg hopping on different modern sports turfs, including three artificial turf systems with different structural components and a natural turfgrass surface. **METHODS:** Seven participants (ages 19-30 yrs; height = 1.79 ± 0.08 m; mass = 75.9 ± 10.1 kg) were recruited for this study. Each participant performed three trials of single-leg hopping in place on each of the four surfaces at a self-selected pace. Kinematics were collected using the Xsens MVN Awinda inertial motion capture system. Data were then imported into Visual3D where estimated ground reaction force and subsequent leg spring parameters were computed. For each participant, vertical stiffness and hopping frequency data from three trials for each of the four surface conditions were included in the statistical analysis. **RESULTS:** A repeated-measures MANOVA indicated significant differences present between surface conditions for vertical stiffness ($F(6,15) = 3.48$, $p=.023$, $\eta^2 = .582$), with pairwise comparisons revealing vertical stiffness on turf 3 (18.3 ± 6.3 kN/m) to be significantly less than on turf 2 (20.6 ± 6.2 kN/m; $p=.023$) and natural turfgrass (21.6 ± 6.2 kN/m; $p<.01$). Hopping frequency was not significantly different between surface conditions. **CONCLUSIONS:** Modern artificial turf system innovations continue to utilize various structural components in an effort to reduce the overall stiffness of synthetic surface. However, it appears that individuals still interpret some artificial turfs to be stiffer than alternatives and therefore lessen the vertical stiffness of their leg spring while maintaining their preferred self-selected hopping frequency.

Funded by Shaw Industries Group, Inc.

246 Board #84 May 29 9:30 AM - 11:00 AM
Injuries In Lower Legs Related To The Unipodal Dynamic Stabilization

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(No relevant relationships reported)

PURPOSE: The instability of the knee and ankle joints are the main risk factors for injuries of the musculoskeletal system and soft tissues when they are subjected to high training loads, as is the case of the military in initial training. The lower train is subjected to accelerations, decelerations, changes of direction and jumps that involve high loads that must support the most distal and intermediate joints in order to absorb the impacts. The measurement of stability is routinely used to measure the risk factors of injury to the ankles and knee, being the most frequent in military training. **PURPOSE:** To determine the risk of lower train injury in Colombian military personnel by analyzing the dynamic stability

METHODS: cross-sectional study in a cohort of 124 cadets. Of the participants in the study 87 (70.2%) were men and 37 women (29.8%), with an average weight of 62 ± 9.2 kg, age 18 ± 1 years, height of 1.70 ± 0.08 meters, which was admitted in the military school in 2017. The measurement of the unipodal dynamic stability was made by using uniaxial force platform. The variables were measured as a percentage of asymmetry of the dynamic stabilization time ($26.24 \pm 18.86\%$) and percentage of asymmetry of the force peak in the landing ($28.59 \pm 17.62\%$).

RESULTS: Of the total number of subjects, 41 presented lesions in the lower limbs during follow-up, corresponding to 33.1%. The logistic regression model developed to determine the risk factors associated with injuries in lower limbs, presented a significance of the model of $P = 0.017$, with a probability of success of 70%. The variables: Body mass index (OR 1.001, 95% CI 0.843 - 1.181), gender (OR 2.709, 95% CI 1.15 - 6.37), the difference of the right-left stabilization time (OR 6.66, 95% CI 1.33 - 32.14), the percentage of asymmetry of the stabilization time (OR 1.021, 95% CI 0.999 - 1.043), the percentage of asymmetry of the peak force (OR 1.015, 95% CI 0.977 - 1.055), are those that best predict the model.

CONCLUSIONS: The stabilization time is a strong predictor of risk factors for lower train injuries. Likewise, gender and dominance of the lower limb are determining factors in the development of injuries under military training. Based on the results, it is considered a tool that can help to measure the risk factors in the military population in training and the controls throughout their training.

247 Board #85 May 29 9:30 AM - 11:00 AM
Changes In Complexity At Maximal Speeds May Not Influence Functional Performance Immediately After: Pilot Study

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(No relevant relationships reported)

Regulatory statistics have been previously used to quantify nonlinear characteristics of gait and infer changes in central regulation of movement. Evaluating changes in movement complexity under varying running conditions is essential as alterations in central regulation may influence performance. However, few studies have characterized movement complexity during functional performance tests. **PURPOSE:** To quantify changes in complexity during an incremental running test to max speed, and during a single leg hop (SLH) test performed immediately before and after.

METHODS: Seven healthy runners (25.8 ± 4.9 yrs) performed a 30s SLH test before and after an incremental running test on a motorized treadmill using 4-minute stages (preferred, 10, 12, 14, 16, 18km/h) until volitional exhaustion. Three-dimensional accelerations of the pelvis were recorded using a triaxial accelerometer (100Hz, G-Walk, BTS Bioengineering, Milan, IT) fixed to the pelvis. The last 30s of each running speed and SLH were analyzed using multiscale entropy (MSE) across 5 time scales. Sample entropy estimates ($m=2$, $r=.2$) for each scaled time series were summed across all scales to compute complexity index (CI). Paired t-test were employed to compare CI measured from SLH tests and repeated measures ANOVAs with a Bonferroni correction were employed to compare differences in CI between stages for each participant. If significant, Dunnett's test was employed to compare fastest and slowest stages with preferred. Vertical accelerations are reported. **RESULTS:** Testing was completed by runners as follows: stage 4 N=7, stage 5 N=5, stage 6 N=3. Mean differences in CI were significant for 4 of 7 runners ($p<0.007$). Post hoc analyses revealed greater CI in the final stage versus preferred ($\Delta 0.62 \pm 0.1$; $\Delta 1.11 \pm 0.01$; $\Delta 0.35 \pm 0.03$; $\Delta 0.49 \pm 0.07$, $p<0.01$) while no differences were observed in the slowest stage. No change in SLH CI was found between pre- vs post-run tests ($p=0.33$,

2.25±0.9 vs 2.14±0.7). **CONCLUSION:** At maximal speeds, an increase in system adaptability was observed compared to preferred running, however, this increase was not transferred to functional performance immediately after. An increase in complexity during perturbed running and not hopping may be due to dissimilarities in task difficulty and constraint type experienced by the runners.

248 Board #86 May 29 9:30 AM - 11:00 AM
Muscle Activity Magnitude and Patterns During Plyometric Exercise on Land and in Shallow Water
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 (No relevant relationships reported)

PURPOSE: The aim of this study was to compare muscle magnitude and patterns of key lower extremity muscles while performing plyometrics on land and in shallow water. **METHODS:** 10 Subjects (7 males; age:28.6±6.3 yrs, height:69.4±2.9 in, mass:82.1±8.4 kg, 3 females; age:45.7±6.8 yrs, ht:69.6±3.2 in, mass:84.2±8.3 kg) performed two plyometric exercises (countermovement jump (CMJ), drop jump (DJ)) while in two different environments (on land, in shallow water). A water proof electromyography (EMG) system (Cometa Miniwave Infinity, 2000 Hz) was used to record the signals of the muscle activity. Each sensor measured EMG as well as accelerations (3 dimensions). Four muscles (rectus femoris (RF), biceps femoris (BF), gastrocnemius (GA) and tibialis anterior (TA)) were used to capture EMG data. DJ trials were initiated from a 30.5 cm platform and order of conditions was always land followed by water. Depth of water was set to be no higher than xiphoid process level and no lower than the navel while standing. **DATA ANALYSIS:** Resultant acceleration was calculated for each sensor with a composite score calculated as the sum of the resultant acceleration for all sensors. This signal contained a peak upon initiating movement and a peak upon landing to end the movement. These peaks were identified, and EMG data were extracted 0.25 s before and after these discrete events to represent beginning and ending of analysis. Average (AVG), root mean square (RMS) and movement time were each calculated between the two extraction points. AVG, RMS, and movement time were each analyzed using a 2 (jump type) x 2 (environment) repeated measures ANOVA ($\alpha=0.05$). **RESULTS:** EMG (AVG or RMS) was not influenced by the interaction of environment and jump type ($p>0.05$); nor was there a main effect for jump type or environment for any muscle that was measured ($p>0.05$). However, BF_{AVG} was different for jumps regardless of environment ($p>0.05$). **CONCLUSION:** Muscle activity magnitudes appears to not be influenced between environments for CMJ and DJ for any of the four muscles measured.

249 Board #87 May 29 9:30 AM - 11:00 AM
Influence of Testing Position on Hip Torque and Relationships with Frontal Plane Kinematics in Females
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 (No relevant relationships reported)

The relationship between hip extension, abduction, and external rotation torque has been correlated to frontal plane biomechanics during functional tasks like the single leg squat. Altering testing position has been identified to influence torque output for hip extension, abduction, and external rotation. However, comparing the relationship between hip torque at different testing positions and frontal plane hip and knee squatting kinematics has yet to be evaluated.

Purpose: To assess the influence of testing position on hip extension, abduction, and external rotation torque in females and relationships to frontal plane squatting kinematics. **Methods:** Isometric hip torque was assessed in 19 college aged females at varying degrees of hip flexion. Torque was assessed with hand-held dynamometry for hip extension (0, 45, and 90 degrees of hip flexion); hip abduction (-5, 0, and 45 degrees of hip flexion); and hip external rotation (0, 45 and 90 degrees of hip flexion). Five single leg squats were also completed for 2-dimensional analysis of frontal plane hip and knee kinematics. Repeated measures ANOVAs were used to evaluate differences in hip torque across testing positions. Relationships between hip torque and frontal plane hip and knee kinematics during a single leg squat were explored with correlations. Significance was set at $p<0.05$. **Result:** Greater torque was seen during hip extension at 90 degrees of hip flexion ($0.74\pm0.25\text{Nm/kg}\cdot\text{m}$) compared to both 0 ($0.43\pm0.14\text{Nm/kg}\cdot\text{m}$) and 45 ($0.50\pm0.19\text{Nm/kg}\cdot\text{m}$) degrees of flexion ($p<0.001$). A significant decrease in hip abduction torque was seen at 45 degrees of hip flexion ($0.44\pm0.15\text{Nm/kg}\cdot\text{m}$) compared to both -5 ($0.58\pm0.21\text{Nm/kg}\cdot\text{m}$) and 0 ($0.63\pm0.24\text{Nm/kg}\cdot\text{m}$) degree testing position ($p<0.001$). No differences in torque were seen for hip external rotation. Significant, positive, and moderate correlations were seen with hip extension torque and hip adduction kinematics at 90 degrees of hip flexion ($r=.544$, $p=.016$) compared to 0 ($r=.490$, $p=.033$) and 45 ($r=.477$, $p=.039$) degrees of hip flexion. No significant correlations were seen between squatting kinematics and hip

abduction or external rotation torque. **Conclusion:** Testing position alters hip torque in healthy aged females but does not influence the relationship between torque and lower extremity kinematics of a single leg squat.

250 Board #88 May 29 9:30 AM - 11:00 AM
Descriptive Kinetics on Unique Skills Performed by a Professional Acrobatic Artist
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 (No relevant relationships reported)

Acrobatic performers are in essence professional athletes who are employed in the entertainment industry for a vast amount of time. However, there is limited research examining skills through a biomechanical lens. Challenges with analyzing these skills include that the movements can be quite unique to an artist and/or highly complex movement patterns. There may be some insight gained by examining certain basic components of a skill (e.g., landing) that may give some relevance to overall performance. However, there is limited research describing the entirety of a specific movement skill. **PURPOSE:** To describe peak forces during certain acrobatic skills performed by a professional artist. **METHODS:** A professionally trained male subject (age: 24 yo; mass: 65.8 kg) participated in this study. The subject visited the laboratory on one occasion where he performed eight different acrobatic skills. Data collection consisted of the subject performing the movements on top of two force platforms (Kistler) and recording full body kinematics using a 3D motion capture system (Vicon). Each movement was performed twice with some movements including multiple repetitions of a skill (e.g., one-hand hops). In movements that included at least four repetitions, peak forces were identified and averaged. In movements where only two repetitions were recorded, maximum peak force of the repetitions was described. Kinematic data were used to identify which body part was in contact with the ground that corresponded to a particular force peak. **RESULTS:** Average peak forces were: one hand hop hand 3.60 ± 0.10 BW, air chair (hand) 1.92 ± 0.13 BW, air chair (head) 3.64 ± 0.57 BW, and flare 2.54 ± 0.43 BW. Peak forces for jump/land tasks for jump and landing phases: maximum vertical jump 3.08 BW (jump), 5.80 BW (land), front flip 2.22 BW (jump), 10.97 BW (land), back flip 2.88 BW (jump) 11.94 BW (land), single leg jump right leg 2.29 BW (jump) 4.07 BW (land), and single leg jump left leg 2.27 BW (jump) 4.20 BW (land). **CONCLUSION:** Interestingly, peak forces during movements where the hand or head were in contact with the ground were similar in magnitude with landing on the feet from a vertical jump. The collection of these data could be helpful for these types of athletes for injury prevention, enhance performance of these skills or overall performance.

251 Board #89 May 29 9:30 AM - 11:00 AM
The Analysis Of The Neuromuscular Performance Of The Colombian Military Leap
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PURPOSE: Musculoskeletal system injuries associated with military training are one of the major problems that military institutions must confront, due to the high costs. The training programs that are carried out during the initiation of the military, prove the increase in injuries that occur in the first six (6) months of admission. In which the risk factors that provoke it, are not yet clear. As a matter of fact, asymmetries are one of the main risk factors that alter the mechanics of the neuromuscular system. These changes affect the performance and favor the appearance of musculoskeletal injuries that can be acquired by training, or that could have been present in the military before incorporation. Aim, to determine the relationship between the asymmetries and the countermovement jump test with the performance of the lower train. **METHODS:** First, a cross-sectional study in a cohort of 124 cadets (94 men and 32 women) with an average weight of 61.6 ± 10.1 kg, through ages 18 ± 1 years all of whom entered the military school in year 2017. Second, a measurement of the countermovement jump test was performed using uniaxial force platforms. Specifically, variables including peak power (43.74 ± 7.8 watts), jump height (28.29 ± 6 cm), asymmetry of the landing peak ($17.9 \pm 14\%$), percentage of the asymmetry of the concentric average force ($7.1 \pm 5.3\%$) and finally, the asymmetry of the Rate of Force Development (RFD) in the eccentric deceleration ($15.9 \pm 11.5\%$).

RESULTS: Over a comparison of genders, differences in weight 64 vs 54 kg, $p = 0.05$ and jump height (30.7 vs 21.07 cm, $p = 0.001$) were found. By segmenting the database into terciles in the percentage of asymmetry of the Rate of Force Development (RFD) of the eccentric deceleration, differences were found in the personnel. Explicitly, asymmetries bigger than 21% ($\chi^2 p = 0.05$), among the subjects that presented injuries in legs.

CONCLUSIONS: An association was found between the performance variables of the countermovement jump that determine the baseline status of the incoming soldiers,

leading to the findings of reference values of the asymmetries in the Colombian military population. Particularly, the eccentric deceleration TDF was used as a reference marker to evaluate injury risk factors and neuromuscular performance in Colombian military.

252 Board #90 May 29 9:30 AM - 11:00 AM
Gender Differences Between Muscle Activation during Star Excursion Balance Test on Stable Versus Unstable Surfaces

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(No relevant relationships reported)

Anterior (A), posteromedial (PM), and posterolateral (PL) directions of Star Excursion Balance Test (SEBT) are used for rehabilitation. Adding unstable surface to the task has been reported to change electromyographic (EMG) activity. Studies have also reported differences in EMG between males and females. **PURPOSE:** To compare EMG of lower extremity (LE) muscles between males and females during SEBT on stable and unstable surfaces. **METHODS:** Surface EMG was collected on 10 male and 10 female healthy adults for gluteus maximus, gluteus medius (GMED), medial hamstrings, biceps femoris (BF), vastus medialis (VM), rectus femoris (RF), vastus lateralis (VL), anterior tibialis (AT), and medial gastrocnemius (MG) on the stance leg during SEBT. Unstable surface was introduced using Theraband™ stability trainer. Independent t test assessed differences in EMG between males and females for each direction and each muscle during SEBT for both stable and unstable. Paired t tests were run separately for males and females to determine difference in each direction for each muscle between stable and unstable surface with α at 0.05. EMG were reported as the percentage of the maximal voluntary isometric contraction (%MVIC). **RESULTS:** Females showed significantly higher EMG than males for AT in PL direction (63 ± 14 vs 47 ± 12 %MVIC; $P=0.01$) on stable surface and A (63 ± 14 vs 47 ± 12 %MVIC; $P=0.01$) and PL (64 ± 15 vs 47 ± 14 %MVIC; $P=0.02$) directions on the unstable surface and MG in PM (44 ± 17 vs 25 ± 17 %MVIC; $P=0.02$) direction on stable surface and A (62 ± 23 vs 37 ± 20 %MVIC; $P=0.02$), PL (76 ± 29 vs 45 ± 25 %MVIC; $P=0.02$), and PM (58 ± 26 vs 36 ± 20 %MVIC; $P=0.04$) directions on unstable surface. EMG was higher for unstable surface in females for VM, RF, and VL in the A direction ($p \leq 0.05$) and MG in all three directions ($p \leq 0.05$) and in males for GMED, VM, RF, VL in the A direction ($p \leq 0.05$) and BF and MG in the PM direction ($p \leq 0.05$). **CONCLUSION:** Females produced higher muscle activation than males for ankle muscles. Adding unstable surface increased LE muscle activation during SEBT. Due to gender differences and surface variability in EMG during SEBT clinicians could consider incorporating both stable and unstable surfaces during rehabilitation especially for women to reduce ankle injuries.

253 Board #91 May 29 9:30 AM - 11:00 AM
Influence of Turf Surface on Change of Direction Parameters

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(No relevant relationships reported)

The surface over which people complete sports tasks can influence body posture and performance outcomes. **PURPOSE:** This study compared time to complete a change of direction agility drill and stopping strategies during this drill on different modern sports turfs, including three different artificial turf systems (AS1, AS2, AS3) and a natural grass surface (NS). **METHODS:** Six participants (ages 19-30 yrs; height = 1.79 ± 0.08 m; mass = 75.9 ± 10.1 kg) were recruited and provided voluntary consent. Each participant performed three trials of a 5-10-5 agility drill on each of the four surfaces, as quickly as possible. A Fitlight® timing tool was used to collect the performance measure of time to complete the task. The segment positions were collected using the Xsens MVN Awinda inertial motion capture system and the variable of angle between sacrum, heel and ground (SHAng) was determined through Visual3D for the plant leg. **RESULTS:** The data from three trials for each participant, for each surface, was included in the statistical analysis. The repeated measures ANOVA for each variable yielded significant differences between surfaces. Pairwise comparisons indicated that change of direction time on AS1 (4.70 ± 0.14 s) was significantly less than on AS3 (4.83 ± 0.28 s; $p=0.007$) and NS (4.83 ± 0.30 s; $p=0.014$). In addition, SHAng 5 on NS (39.0 ± 4.7 deg) was significantly larger than on all artificial surfaces (AS1: 35.1 ± 3.8 deg, $p=0.014$; AS2: 34.9 ± 2.5 deg, $p=0.002$; AS3: 35.4 ± 3.6 deg, $p=0.019$). Last, SHAng 10 on NS (38.5 ± 4.5 deg) was significantly larger than on all artificial surfaces (AS1: 35.7 ± 2.9 deg, $p=0.024$; AS2: 35.7 ± 2.4 deg, $p=0.022$; AS3: 36.1 ± 2.5 deg, $p=0.028$). **CONCLUSION:** This project indicates that these participants adopted a different stopping strategy on the natural surface than the artificial surfaces. To mitigate the lower resistance to shear forces offered by natural grass, the participants adopted a more upright body position, presumably increasing the normal force as well

as the friction utilized at the foot-to-ground interface. Assuming adequate friction is maintained, a smaller SHAng and thus lower body position will provide for an increase in propulsive forces resulting in a faster change in direction and better performance outcome.

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254 Board #92 May 29 9:30 AM - 11:00 AM
Kinetic Strategies during Single-Leg Hopping in Individuals With and Without Chronic Ankle Instability

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(Sponsor: David Thomas, FACSM)

(No relevant relationships reported)

Adaptability of the motor system indicates successful management of chronic ankle instability (CAI). Research shows that individuals who do not exhibit residual symptoms following an ankle sprain (i.e. copers) exhibit greater adaptability during walking compared to individuals with CAI. However, questions remain surrounding systemic differences exhibited by coper groups, particularly when higher movement demands are imposed on the system. Analysis of load acceptance patterns during single-leg hopping could provide an indication of the systemic movement adaptations between the groups during higher demands of movement tasks.

PURPOSE: Examine percent contribution (%C) to support moment (MS) during single-leg hopping in healthy, coper, and CAI groups.

METHODS: 48 individuals (16 per group) participated in the study. Participants performed 15 trials of single-leg hopping. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of the ankle (A), knee (K), and (H) moments in the sagittal plane. The %C of the A, K, and H moment to MS was calculated at 15 percent of stance phase. A one-way ANOVA was conducted to assess group effects for each dependent measure.

RESULTS: No significant differences in %C to MS were found between the healthy (A $81.87 \pm 18.37\%$, K $23.81 \pm 16.96\%$, H $2.22 \pm 27.19\%$), coper (A $73.78 \pm 23.33\%$, K $28.28 \pm 21.05\%$, H $-6.51 \pm 33.17\%$), and CAI groups (A $83.76 \pm 17.91\%$, K $16.48 \pm 12.58\%$, H $0.78 \pm 19.71\%$) during the initial loading phase of single-leg hopping.

CONCLUSIONS: Copers did not exhibit distinct kinetic patterns during single-leg hopping. This finding suggests that adaptation of movement is less likely to occur with higher demands of movement tasks following ankle injury. It is also possible that low amplitude COM displacement associated with the hopping task may not have placed adequate constraint on the subjects to elicit adaptive strategies. More research is needed to explore how individual joint kinetic adaptations contribute to dynamic tasks across groups.

255 Board #93 May 29 9:30 AM - 11:00 AM
Biomechanics of Pitching: Horizontal Abduction Predicts Power; Power Predicts Strikeouts and Wins

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(No relevant relationships reported)

Traditional strength training for pitchers focuses on compound lifts, predominantly of the lower extremity, to increase pitching power. Though widely employed, this approach has not been sufficiently validated. **PURPOSE:** To evaluate both predictors and consequences of increased mechanical power in collegiate pitching. **METHODS:** 10 pitchers from a D1 baseball program underwent 4 days of assessment separated by at least 3 days of rest: 1) Squat max was performed and recorded. 2) Sparta force plate (Sparta Science, USA) captured load, explode, and drive. 3) Proteus (Boston Biomotion, USA) measured power and endurance in 10 movements: Left and right core rotation, internal and external rotation, shoulder flexion and extension, elbow flexion and extension, and horizontal adduction and abduction. 4) Proteus recorded throwing mechanics via 5 sets of pitches (4 reps per set) at varying loads of magnetic resistance, ranging from 1-5lbs. For all movements, Proteus calculated and exported power and endurance in 3D space. Linear regressions identified predictors of pitching power and the effect of power on pitching performance. Owing to the small sample and novel technology, trends ($p < 0.08$) were considered. **RESULTS:** Mean pitching endurance did not significantly predict strikeouts or wins. Mean pitching power predicted greater win percentage ($R=0.734$; $p=0.024$), total strikeouts ($R=0.662$; $p=0.052$), and strikeouts per game ($R=0.656$; $p=0.055$). No associations were found between Sparta data or squat max and win percentage or strikeouts. Pitching power had no relationship with Sparta data, squat max, height, weight, class year, or arm length. The strongest predictors of pitching power were horizontal abduction endurance in the dominant arm ($R=0.941$; $p=0.002$) and non-dominant arm ($R=0.934$; $p=0.002$). Strikeouts per game was related to win percentage ($R=0.680$; $p=0.044$). **CONCLUSION:** Power was the most important predictor of on-field pitching performance. It was unrelated to anthropometric variables and showed no association with minor differences in maturation (e.g., freshman to sophomore). There was also

no association with force plate and squat performance. These preliminary data suggest training horizontal shoulder abduction may correspond to power; in turn, power appears to increase strikeouts and win percentage.

256 Board #94 May 29 9:30 AM - 11:00 AM

Knee Injury Risk Stratification With The Less-rmc

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(No relevant relationships reported)

The Landing Error Scoring System (LESS) is a protocol designed to assess ACL injury risk, and the LESS-RMC (Rocky Mountain Consortium) is a modified version of the LESS designed to be a more objective approach to scoring, and an easier tool to implement for the rater. **PURPOSE:** The purpose of this study was to determine the relationship between the LESS and LESS-RMC and develop an injury risk stratification for the LESS-RMC. **METHODS:** One hundred seventy-eight elite female soccer athletes (14.1 ± 1.5 y, 77.3 ± 33.2 in, 107.6 ± 27.2 lbs), performed three drop-jumps from a height of 30 cm. Front and side views of the landing were recorded with digital video cameras. Movement quality was rated by one researcher evaluating 17 components of the landing with the LESS and a modified, 11 component version of the LESS (LESS-RMC). Each system had a maximum of 17 landing errors and the rater was considered an expert after training with the LESS and LESS-RMC protocols. To accomplish the objectification of the LESS items, cut off points were defined more explicitly for line items: symmetry in feet, joint displacement, and overall impression. These changes, combined with a differentiating score of knee valgus severity/medial knee position (MKP) and its contribution to a new line item, overall asymmetry, added a new component to the LESS's approach to scoring movement quality and assessing injury risk. A one-way ANOVA was used to contrast the number of landing errors determined from the LESS and LESS-RMC. A linear regression was used to determine the relationship between the two scoring system and a LESS value of 5 was used as input to calculate a predicted risk stratification for the LESS-RMC. The alpha level was set at $p=.05$.

RESULTS: The number of identified landing errors captured with the LESS-RMC (6.9 ± 2.2) was statistically greater than the LESS (5.6 ± 2.1) ($p<.001$). A significant linear relationship was found between the LESS and LESS-RMC ($R=0.811$, Adj $R^2=.656$, $SEE=1.59$, $p<.001$). A LESS-RMC cut-off score for the stratification of low and high knee injury risk was calculated to be 6.79.

CONCLUSIONS: The bi-lateral assessment of MKP and overall asymmetry were significant variables that contributed to higher risk stratification scores with the LESS-RMC.

257 Board #95 May 29 9:30 AM - 11:00 AM

Association Between Lower Extremity Functional Tests and Injury in Division I Female Collegiate Athletes

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(No relevant relationships reported)

The Landing Error Scoring System (LESS) and Single Leg Squat (SLS) are two clinical tools that have been used for screening of injury risk in athletic populations. Prior scoring of these tests was time intensive and required subjective judgement whereas new technology has allowed for automatic scoring and additional objective data. To date, we are unaware of any studies that have examined the association between LESS and SLS performance, as measured with a markerless motion-capture system, and future injury risk in athletes. **PURPOSE:** To examine the association between LESS and SLS performance and risk of lower extremity musculoskeletal injury (LE-MSKI) in female collegiate athletes. **METHODS:** Fifty-six collegiate female athletes ($n=31$ lacrosse; $n=25$ field hockey; 19.5 ± 1.4 y; 165.6 ± 8.1 cm; 67.1 ± 9.6 kg) underwent LESS and SLS testing before the start of their 2017-18 competitive seasons. Incidence of LE-MSKI was tracked throughout the season. Participants completed 3 jump landing tasks followed by 3 consecutive SLSs on each leg. A Microsoft Kinect sensor using Athletic Movement Assessment software (PhysiMax®) was used to automatically score the LESS and SLS. The LESS consisted of 22 items while the SLS was comprised of 14 items. The highest scores possible for the LESS and SLS were 22 and 10, respectively. Independent t -tests were used to compare LESS and SLS total scores between injured and non-injured participants. Chi-square statistics were used to examine the association between injury risk and presence of medial knee displacement (MKD R/L side errors) during performance of the SLS and LESS. **RESULTS:** No differences were found between injured and non-injured participants in total LESS (5.1 ± 2.2 vs. 5.2 ± 2.1 ; $p=0.900$) and right-legged (4.0 ± 2.1 vs. 3.4 ± 1.2 ; $p=0.273$) or left-legged (3.4 ± 1.2 vs. 3.9 ± 0.9 ; $p=0.107$) SLS scores. Participants displaying an error for MKD during a right-legged SLS were roughly twice as likely to suffer a LE-MSKI as those with no error ($\chi^2=1.27$; $p=0.260$, OR=1.9,

$95\%CI=0.62-5.83$). Similar results were found for participants who displayed MKD on their right leg during performance of the LESS compared to those with no error ($\chi^2=0.58$; $p=0.444$, OR=1.8, $95\%CI=0.39-8.51$). **CONCLUSION:** SLS and LESS performance was not associated with incidence of LE-MSKI in this cohort of female collegiate athletes.

258 Board #96 May 29 9:30 AM - 11:00 AM

Predicting Scapular Dynamic Alignment During Throwing From The Scapular Dynamic Alignment During Shoulder Abduction

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(No relevant relationships reported)

Observing the resting and dynamic scapular alignments during basic shoulder motion is a common clinical evaluation for a throwing athlete. However, how much of the dynamic scapular alignment during throwing motion can be predicted from resting and dynamic scapular alignments during basic shoulder motion is unknown. **Purpose:** To investigate the relationship between dynamic scapular alignment during throwing motion and shoulder abduction and resting alignment. **Methods:** Ten baseball players without a history of shoulder pathology participated in this study. Scapular alignment was measured with a three-dimensional motion-capture system (VICON System) under three conditions: static standing position, abduction, and throwing motion. Scapular Cluster attached to the acromion was used to track the movement of the scapula. Multiple linear regression analysis was used to investigate the relationship between dynamic scapular alignment during throwing motion and shoulder abduction and resting alignment. **Results:** There was no relationship between dynamic scapular alignment during throwing motion and resting alignment. However, there was a relationship between several inclination variables of dynamic scapular alignment during throwing motion and shoulder abduction. The scapular posterior tilting angle at maximum external rotation (MER) of the shoulder during throwing motion decreased significantly with an increase in the scapular internal rotation angle during shoulder abduction ($R^2 = 0.426$; $p = .034$). In the same manner, the scapular internal rotation angle at MER and ball release during throwing motion increased significantly with an increase in the scapular internal rotation angle during shoulder abduction ($R^2 = 0.4$; $p = 0.04$, $R^2 = 0.415$; $p = 0.036$, respectively). **Conclusions:** Our results indicate that approximately 40% of the dynamic scapular alignment during throwing motion can be predicted by the dynamic scapular alignment during shoulder abduction. The dynamic scapular alignment during shoulder abduction should be given greater consideration when assessing a throwing athlete.

259 Board #97 May 29 9:30 AM - 11:00 AM

The Influence of Medial Knee Position Asymmetry on the LESS

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine the prevalence and effects of knee valgus asymmetry on the LESS score in young female soccer athletes.

METHODS: A total of 178 elite youth female soccer athletes (14.1 ± 1.5 y, 77.3 ± 33.2 in, 107.6 ± 27.2 lbs) performed three drop-jump maneuvers from a height of 30 cm. Digital video cameras recorded (60 Hz) front and side views of the landing task. An expert rater evaluated 17 components of each recorded landing according to the LESS protocol. In addition, maximum medial knee position (MKP) was evaluated for each leg based on a straight line projection from the center of the patella to the ground. The MKP was scored as none (0), small (1) or large (2) if the line was lateral to the midfoot, between the mid-foot and great toe, and medial to the great toe, respectively. The LESS was calculated for dominant (DOM) and non-dominant (NON) legs for each landing trial. The DOM leg was defined as the leg used to kick a ball for greatest distance. Side-to-side MKP symmetry for each trial was calculated as the difference between the MKP category of the DOM versus the NON legs (dMKP). Negative dMKP values indicated larger MKP on the NON leg and were classified as small (dMKP = -1; -dMKP_s) and large (dMKP = -2; -dMKP_l), whereas positive dMKP values indicated larger MKP on the DOM leg and were classified as small (dMKP = +1; +dMKP_s) and large (dMKP = +2; +dMKP_l). The LESS scores for DOM and NON legs were grouped according to each non-zero dMKP category (-2, -1, +1, +2) and contrasted using independent t -tests with a Bonferroni adjustment ($p=.0125$).

RESULTS: Asymmetrical MKP was found in 50.9% of the trials but the LESS scores were on average not different between legs (DOM, 5.6 ± 2.6 ; NON, 5.5 ± 2.7 , $p=.73$). However, the LESS scores for the DOM leg were on average 1.3 ± 0.5 (-dMKP small: DOM, 4.9 ± 2.2 ; NON, 6.2 ± 2.0 , $p<.001$) and 2.7 ± 0.5 (-dMKP_l: DOM, 3.4 ± 2.2 ;

NON, 6.2 ± 1.9 , $p < .001$) landing errors lower when MKP was lower for the DOM leg; whereas landing errors were 1.2 ± 0.6 (+DMKP_s: DOM, 6.0 ± 2.1 ; NON, 4.8 ± 2.5 , $p < .001$) and 2.9 ± 0.3 . (+DMKP_l: DOM, 6.0 ± 1.9 ; NON, 3.1 ± 2.1 , $p < .001$) higher when MKP was higher.

CONCLUSIONS: The asymmetry in MKP influenced the LESS scores by 1 to 3 landing errors and has the potential to miss-classify an athlete's injury risk stratification.

260 Board #98 May 29 9:30 AM - 11:00 AM
The Effect of Direct Head Impact in Judo on Internal of Cervical Spine

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PURPOSE: Judo is one of the popular combat sports, which is played worldwide and organized even in the Olympic Games. Serious neck injuries, however, have been occasionally noted in judo trainings and/or competitions. Since the pattern and severity of neck injuries largely depend on the kinematic motion of the thrown player, it is essential to investigate the mechanisms of neck injury from biomechanical view point in various different throwing techniques. Thus, the aim of this study was to evaluate a predictive indicator of cervical spine injury, neck injury criterion (Nij) with direct head impact by Judo throwing techniques using an anthropomorphic test device (ATD).

METHODS: Two male judo experts (thrower) repeatedly threw the ATD for 5 times by *Seoi-nage* (*Seoi*), *Osoto-gari* (*Osoto*) and *Ouchi-gari* (*Ouchi*) techniques to make ATD's head hit directly to the mat. A 6-axis load cell (force transducer), mounted in the ATD's cervical spine, assessed neck axial force and bending moment in each trial. To evaluate the the ATD's neck load quantitatively, we calculated the Nij value from the neck axial force and bending moment. Kinematic data of the ATD's whole body were also recorded during trials, using high-speed digital video cameras.

RESULTS: In all trials, the largest neck loads were observed at the phase of the head contact to the mat. The peak Nij values of ATD ranged from 0.63 to 1.60 (*Seoi*), 0.54 to 0.58 (*Osoto*) and 0.19 to 0.29 (*Ouchi*). The average Nij value in *Seoi* (1.03 ± 0.19 , mean \pm S.E.) trials was significantly higher than those in *Osoto* (0.56 ± 0.01) and *Ouchi* (0.24 ± 0.02) trials ($p < .05$, respectively). In three out of five tests, Nij value in *Seoi* trial exceeded 1.0 implying the real human tolerance limit for neck loading. However, in other two trials (*Osoto* and *Ouchi*), Nij values were less than 1.0.

CONCLUSIONS: When thrown forward, the judo player might be accompanied with a direct contact of parietal and/or frontal regions of the head to the mat and suffered from neck injuries. Judo throwing technique, *Seoi*, has higher risk of serious neck injuries than the other techniques thrown backward including *Osoto* and *Ouchi*.

261 Board #99 May 29 9:30 AM - 11:00 AM
Comparison of Maximal Forces Produced During Different Chokehold Techniques

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 (No relevant relationships reported)

Mixed martial arts (MMA) has become increasingly popular in recent years, with some Pay-Per-View events gaining more than 1.6mil viewers (mmafighting.com). However, with its ever-growing popularity, little is known about kinetics involved with certain movements. **PURPOSE:** The purpose of this study was to compare maximal force production during three different types of MMA chokeholds. We hypothesized that each technique will have a different maximal force associated with it. **METHODS:** Elite MMA fighters ($n=8$; 1.77 ± 0.12 m; 83.70 ± 15.73 kg; 31.22 ± 4.21 yr) completed three chokehold technique conditions: Rear-Naked Choke (RNC), Armbar (AB), and Guillotine (G). Subjects completed 5 repetitions per technique and held each hold for at least 5 s. Each choke was performed on a grappling dummy commonly used in MMA training. A 30 s rest period was required between each repetition, and a 5 minute recovery period was required between conditions. The order of conditions was randomized. Force data were measured at the neck level of the dummy and were collected for the entire application of the choke. Force was measured using a 10cm x 10cm instrument (Loadpad, Novel Electronics USA, St.Paul, MN) secured to the neck portion of the training dummy using elastic bandages. The greatest 1 s average for each repetition was used for analysis. Within each condition, the 5 repetitions were averaged per subject. A repeated-measures ANOVA was used to compare force between conditions ($\alpha=0.05$). Planned comparisons were performed to assess which conditions were significantly different from the others. **RESULTS:** Maximal force was different between chokehold techniques ($F=6.20$, $p=0.012$). Maximal force was different between the RNC ($\text{avg}=457.37 \pm 220.51$ N) which produced a higher maximal force than AB chokehold ($\text{avg}=192.73 \pm 80.05$ N) ($p < 0.015$). No other

significant differences were found between these chokehold techniques and the G chokehold ($\text{avg}=265.37 \pm 164.25$ N) ($p > 0.05$). **CONCLUSIONS:** It is apparent that different chokehold techniques involve different force application. MMA fighters may need to train specific technique to increase force production or to resist forces when experiencing these chokeholds.

262 Board #100 May 29 9:30 AM - 11:00 AM
A Kinematic, Kinetic, and Electromyographic Comparison of "New" And "Dead" Pointe Shoes in Professional Ballet Dancers

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 (No relevant relationships reported)

Ballet dancers wear pointe shoes. As these pointe shoes gain more wear, the shoes may lose structural integrity, potentially altering the normal biomechanics of dancers while performing ballet movements. These alterations may negatively affect the ballet dancer, possibly resulting in harmful compensations and overall decreasing dancers' performance and increasing dancers' injury risks. Even so, little research exists examining pointe shoes.

PURPOSE: To compare lower body biomechanics and muscle activity between "new" and "dead" pointe shoes in professional female ballet dancers. **METHODS:** Nine professional female ballet dancers (age: 22 ± 2 yrs; height: 163 ± 6 cm; weight: 51 ± 7 kg), with at least 10 years of pointe shoe training and no limiting pain or injuries, performed three complete relevé and arabesques in "New" (3-36 training hours) pointe shoes and "Dead" (108-144 training hours) pointe shoes. Data were collected using force plate and 3D cameras. Separate ANOVAs compared (1) sway area during quiet stance, (2) peak net ankle joint moments, and (3) the average root mean square (RMS) muscle activity (%MVC) of the gastrocnemius and the tibialis anterior muscles between the shoe conditions. **RESULTS:** Dancers showed significantly higher sway area in the "dead" pointe shoes during both relevé (146 ± 115 mm² vs. 94 ± 58 mm², $p < .05$) and arabesque (191 ± 159 mm² vs. 112 ± 48 mm², $p < .05$). Dancers showed significantly higher tibialis anterior activation during arabesque in "dead" pointe shoes ($39 \pm 13\%$ vs. $33 \pm 7\%$, $p < .05$). No significant differences were observed in muscle activation for tibialis anterior during relevé and for gastrocnemius during relevé and arabesque ($p > .05$). No significant differences were observed in plantarflexion and dorsiflexion moments during relevé and arabesque ($p > .05$). **CONCLUSION:** Overall, we found that the biomechanical profiles presented by the dancers when wearing "dead" pointe shoes have been previously linked to increased risk for ankle instability, lateral ankle sprains, and earlier onset of muscle fatigue. Understanding how pointe shoe biomechanics changes over time may inform dancers, educator, researchers, clinicians, and pointe shoe designers how extended training in "dead" pointe shoes may potentially harm dancers' health.

263 Board #101 May 29 9:30 AM - 11:00 AM
Evaluating Segmental Contribution To Whole-body Center Of Mass Movement In Sub-maximal Overhand Throwing.

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 (No relevant relationships reported)

Recent advancements in wearable technology have allowed kinematic data collection in field-based settings, improving the ecological validity of research investigations. The wrench notation and quaternion algebra inverse dynamics technique does not require the integration of force platform data, therefore may allow field-based computation of joint kinetics for various sport movements, including overhand throwing. In order to apply this technique efficiently, it is important to understand segmental contributions to whole-body center of mass (CoM) movement. **PURPOSE:** Evaluate segmental contribution to the estimation of whole-body CoM movement both proximal and distal to the throwing elbow. **METHODS:** Three right-handed, male club baseball players performed forty trials of sub-maximal overhand throwing. Position data for each trial were acquired using a 3-d optical motion capture system and infrared reflective markers placed according to standard body segment parameter recommendations. From position data, segmental and whole-body CoM were computed for body mass positioned proximal and distal to the throwing elbow. Root Mean Squared Error (RMSE) values were computed using time-series position data between each segment CoM and whole-body CoM. Two one-way ANOVAs were performed on RMSE values in the x (direction of throw), y (perpendicular to the throw), and z (vertical) directions. To evaluate the movement of mass proximal to the throwing elbow, twelve body segments were included as levels within a single segment factor. To evaluate the movement of mass distal to the throwing elbow, two segments were included as levels within a single segment factor. **RESULTS:** Main effects of segment were observed for RMSE in the x, y, and z directions ($p < 0.001 - 0.001$). Trunk RMSE in the x, y, and z directions ($x: 40.5 \pm 7.4$ mm, $y: 28.9 \pm 5.2$ mm, $z: 9.5 \pm 4.0$ mm) was significantly

lower versus all other segments proximal to the throwing elbow ($p < 0.001 - 0.028$). Right forearm RMSE in the x, y, and z directions (x: 28.9 ± 3.3 mm, y: 22.6 ± 2.3 mm, z: 31.7 ± 1.0 mm) was significantly lower versus the right hand ($p < 0.001 - 0.001$). **CONCLUSION:** During an overhand throwing task, the results suggest that CoM movement of the trunk and throwing forearm pattern closely with the movement of whole-body CoM located proximal and distal to the throwing elbow.

264 Board #102 May 29 9:30 AM - 11:00 AM
Ankle Bracing Effects on Contributions to the Support Moment during Hopping

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Ankle Bracing Effects on Contributions to the Support Moment during Hopping
 Carlos Santillan, Adam E. Jagodinsky, Mohammed Zaman, Christopher Wilburn, Wendi H. Weimar
 Illinois State University, Normal, IL, Auburn University, Auburn, AL
INTRODUCTION: Ankle bracing is commonly implemented to prevent ankle sprain injuries. However, research shows ankle bracing can alter joint kinetics during a variety of dynamic tasks. Analysis of the support moment (Ms) characteristics in response to bracing could provide insight into possible global motor strategies adopted when an ankle brace is applied. **PURPOSE:** Examine bracing effects on lower extremity contributions to the Ms during hopping. **METHODS:** 16 healthy individuals participated in the study. Participants performed 15 trials of single-leg hopping during no brace (NB) and brace (B) conditions. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Data from the stance phase of hopping was extracted and time normalized to 0-100% of stance phase. The percentage contribution (%C) of ankle (A), knee (K), and hip (H) moment to Ms was calculated at 15, 30, 45, 60, and 75 percent of stance phase. Comparisons of percentage contribution between conditions were made at each time point using paired-samples t-tests. **RESULTS:** Analysis revealed that for K, %C was significantly lower during B ($19.5 \pm 4.06\%$) compared to NB ($21.76 \pm 4.42\%$) ($t = 2.228$, $p = .041$). Additionally, for K, %C was significantly lower during B (34.025 ± 9.14) compared to NB (35.26 ± 10.23) ($t = 2.306$, $p = .035$). No other significant differences for the study were observed. **CONCLUSION:** Bracing significantly decreased the contribution of the knee to the MS during single-leg hopping. Changes in the knee contribution to the MS suggests that ankle bracing invokes adaptations to motor control strategies during the landing phase of single-leg hopping.

265 Board #103 May 29 9:30 AM - 11:00 AM
Support Moment Dynamics Are Similar in Individuals With and Without Chronic Ankle Instability During Hopping

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 (Sponsor: Dr. Dale Brown, FACSM)
 (No relevant relationships reported)

It has been proposed that the development of chronic ankle instability (CAI) is related to a maladaptive cascade stemming from mechanical and/or neuromotor impairments following an initial ankle sprain injury. Contrarily, individuals who do not exhibit recurring instability following initial ankle injury (copers) may benefit from adaptive movement strategies that allow for healthy functioning, yet the mechanisms surrounding this theory remain in question. Previous investigations have found that copers exhibit significantly greater variability in the support moment (Ms) and lower extremity joint moments compared to individuals with CAI during walking, which could indicate a mechanism by which copers adapt to both mechanical and/or neuromotor constraints relating to initial injury. However, these measures have not been explored in tasks that place greater demand on the previously injured limb. **PURPOSE:** The purpose of this study was to compare the Ms variability characteristics between healthy, coper and CAI individuals during a single-leg hopping task. **METHODS:** 48 individuals (16 per group) participated in the study. Participants performed 15 trials of continuous single-leg hopping. Position data were collected using a motion capture system, and reaction forces were obtained from force platforms. Joint kinetics were calculated using inverse dynamics, and the MS was calculated as the sum of ankle, knee, and hip moments in the sagittal plane. Variability of the MS was expressed as the percent coefficient of variation (%CV) across stance phase. A one-way ANOVA was conducted to compare %CV across groups. **RESULTS:** No differences in %CV were found between healthy ($13.27 \pm 6.014\%$), Coper ($16.14 \pm 10.6145\%$) and CAI ($14 \pm 10.61\%$) groups. **DISCUSSION:** Individuals had no change in %CV compared with the previous study of walking. The contrast in findings may be attributed to the nature of task demands placed on subjects. Specifically, the

rapid and cyclic transition of loading-propulsion-loading, and low amplitude COM displacement associated with the hopping task performed in this study may not have placed an adequate constraint on the subjects to elicit adaptive strategies. Future studies investigating Ms variability characteristic should consider implementing tasks that will stress motor system adaptability.

266 Board #104 May 29 9:30 AM - 11:00 AM
Test-Retest Reliability of Performance Scores Using a Markerless Motion Capture System

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PURPOSES: This investigation examined the test-retest reliability of a markerless motion capture system (MCS) for six performance (PERF) scoring scales using a performance motion analysis protocol (PMA) across multiple visits. **METHODS:** Healthy, recreationally active men ($n=11$; \pm SD; age=23.0 \pm 2.6 yrs, height=180.3 \pm 4.8 cm, weight=80.4 \pm 7.3 kg) and women ($n=11$; age=20.8 \pm 1.1 yrs, height=172.2 \pm 7.4 cm, weight=68.0 \pm 7.3 kg) were screened once a week for 4 weeks using the PMA protocol, consisting of 19 motions. These include shoulder ranges of motions, trunk rotation, five types of squatting motions, single leg balances, and six types of vertical jumps and depth jumps. A three-dimensional markerless MCS using the DARI Motion Software (Scientific Analytics, Lincoln, NE) was used to analyze the kinetic and kinematic data, from which 192 variables were calculated to determine the PERF scores. The PERF scores evaluated included Composite, Power, Functional Strength, Dysfunction, Vulnerability, and Exercise Readiness. One-way repeated measures ANOVAs (performance scores x visit) ($p \leq 0.05$), and intraclass correlation coefficients (ICCs) were determined to compare performance scores. **RESULTS:** Results are shown in the table. Excellent test-retest reliability was observed for composite, power, functional strength, and exercise readiness scores (ICCs > 0.8) across all 4 visits. The vulnerability scores displayed fair test-retest reliability, while the dysfunction score exhibited poor reliability. No significant differences were observed for any performance scores on any visits. **CONCLUSION:** These results indicated excellent reliability for all PERF scores except vulnerability and dysfunction scores. It is possible that the vulnerability and dysfunction scales require several visits to establish a consistent baseline and may require 1-2 familiarization visits. Further study is needed to determine the magnitude of change for any score that is meaningful.

Table 1.

Visit	Composite	Power	Functional Strength	Dysfunction	Vulnerability	Exercise Readiness
1	1611.3 \pm 307.8	836.6 \pm 216.9	907.3 \pm 114.9	132.8 \pm 56.6	42.2 \pm 12.3	18.7 \pm 3.9
2	1611.9 \pm 271.4	836.4 \pm 196.5	900.8 \pm 106.8	125.5 \pm 45.4	40.5 \pm 7.7	18.8 \pm 3.6
3	1602.7 \pm 270.9	825.7 \pm 197.9	885.6 \pm 117.9	108.6 \pm 42.8	39.3 \pm 9.4	18.6 \pm 3.6
4	1601.6 \pm 270.5	833.6 \pm 207.6	879.6 \pm 100.5	111.7 \pm 46.6	39.0 \pm 9.3	18.7 \pm 3.4
p	0.96	0.91	0.83	0.17	0.07	0.92
ICC	0.92	0.93	0.83	0.27	0.54	0.89
95% CI	0.85 - 0.96	0.87 - 0.98	0.71 - 0.91	0.08 - 0.52	0.34 - 0.74	0.81 - 0.95
CV%	0.4	0.6	1.4	9.6	5.5	0.5

n=22; Performance Scores (X \pm SD); intraclass correlation coefficients (ICCs) were determined using the following criteria: two-way mixed model, absolute agreement, 95% confidence interval (CI), coefficient of variance (CV%)

267 Board #105 May 29 9:30 AM - 11:00 AM
Identification of Risk Factors Associated with Groin Injury in an Upright Standing Position

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 (No relevant relationships reported)

Groin injury is a common injury in sports such as soccer. This type of injury is associated with quick change of direction or acceleration, and kicking. Several studies have identified decrease in hip internal (Int) and external (Ext) rotations or decrease in hip adduction (Add) and abduction (Abd) torques ratio as risk factors for groin injury. However, it is still unclear what relationship exists between these variables, specifically performed in upright position which is more functional. **PURPOSE:** To explore the relation between low hip Add and Abd torque ratio and hip Int and Ext rotations, performed in upright position, in college students. **METHODS:** Fourteen college students participated in the study, Eight males (21 ± 1 yrs, 81 ± 11 kg, 176 ± 6 cm) and Six females (22 ± 2 yrs, 62 ± 5 kg, 163 ± 6 cm). Data were collected in two different sessions. Hip isokinetic maximal Add and Abd torques were captured using isokinetic dynamometer at two speeds, 30°/s and 60°/s. Participants performed five trials of continuous Add and Abd at each speed and the averages of the highest

three peaks and their corresponding angles were calculated. Add and Abd torques ratio were calculated and the data were categorized as high risk (HR), if ratio was <1 , or low risk (LR), if ratio was >1 . Hip 3D Int and Ext rotations were captured using 3D cameras at 240 Hz. Participants performed three separate trials of maximal Int and Ext rotations using sliding disk and highest lower leg Int and Ext rotations were analyzed. T-tests assuming unequal variance were performed. **RESULTS:** Mean Add and Abd torque ratios were 0.72 ± 0.13 in HR group and 1.30 ± 0.19 in LR group. Lower peak Add torque was observed in the HR group (48 ± 15 Nm vs. 86 ± 27 Nm, $p < 0.01$). No significant difference was observed in peak Abd torque between the groups (67 ± 19 Nm vs. 66 ± 18 Nm, $p > 0.05$). Hip Ext rotations were lower in the HR group, however not significant ($17 \pm 7^\circ$ vs. $20 \pm 9^\circ$, $p = 0.07$), same was observed for hip Int rotations ($13 \pm 5^\circ$ vs. $15 \pm 4^\circ$, $p = 0.08$). The total hip Int and Ext rotations range of motion was significantly lower in the HR group ($30 \pm 9^\circ$ vs. $34 \pm 10^\circ$, $p < 0.05$). **CONCLUSION:** Decrease in hip Int and Ext range of motion was related to lower hip Add and Abd peak torque ratio. Future research should further investigate the association between these variables in athletes to better predict and prevent groin injuries.

A-44 Free Communication/Poster - Team Sports

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

- 268** Board #106 May 29 9:30 AM - 11:00 AM
Effects Of Stroboscopic Vision On Reactive Strength Index Scores In Female Ncaa Division I Volleyball Players.
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(No relevant relationships reported)

It is believed that ACL injury risk is multifaceted and includes structural, biomechanical, and cognitive factors. Recently, it is observed that overreliance on exteroception (visual stimuli) following ACL rehabilitation may increase the risk of re-rupture. There may be utility in using stroboscopic vision as an enhancement to plyometric movements and neuromuscular ACL-prevention programs. **PURPOSE:** To evaluate the effects of stroboscopic vision on Reactive Strength Index (RSI) scores in female NCAA Division I volleyball players. **METHODS:** Thirteen female NCAA Division I volleyball players performed three trials of depth jumping across five conditions: (1) 0.38 m - no visual restriction, (2) 0.53 m - no visual restriction, (3) 0.69 m - no visual restriction, (4) 0.38 m - high-frequency stroboscopic vision (H-f), and (5) 0.38 m - low-frequency stroboscopic vision (L-f). For all trials, the RSI, rebound jump height (RJH; m), and ground contact time (GCT; s) were computed from vertical ground reaction force data acquired via a tri-axial force platform. To evaluate the statistical significance of results, a Multivariate General Linear Model Analysis of Variance (GLM ANOVA) was performed using RSI, RJH (m), and GCT (s) as dependent measures. The five depth jump conditions were included as levels within a single condition factor. Statistical significance was set at an alpha level of 0.05. **RESULTS:** Main effects of depth jump condition were observed for RSI and GCT (s) ($p = 0.001$), but not for RJH (m) ($p = 0.101$). Post-hoc comparisons revealed that RSI scores were lower for stroboscopic conditions (H-f: 0.75 ± 0.16 ; L-f: 0.72 ± 0.16) versus no visual restriction (0.38 m: 0.80 ± 0.17 ; 0.53 m: 0.79 ± 0.17 ; 0.69 m: 0.79 ± 0.16). Post-hoc comparisons revealed that GCT (s) was greater for stroboscopic conditions (H-f: 0.47 ± 0.07 s; L-f: 0.49 ± 0.07 s) versus no visual restriction (0.38 m: 0.46 ± 0.07 s; 0.53 m: 0.45 ± 0.07 s; 0.69 m: 0.45 ± 0.07 s). **CONCLUSION:** Integrating stroboscopic vision into the depth jump movement reduced RSI scores in a sample of female NCAA Division I volleyball players, which was attributable to longer GCTs (s). The results suggest that adding stroboscopic vision to plyometric movements may increase the difficulty of the task from either a cognitive or biophysical perspective.

- 269** Board #107 May 29 9:30 AM - 11:00 AM
Women's Collegiate Volleyball Players Exhibit Kinetic Asymmetries during Sport-Specific Tasks
Jenna D. Smith, Kevin R. Ford, FACSM, Audrey E. Westbrook, Rachel A. Kordonow, Jeffrey B. Taylor. *High Point University, High Point, NC.* (Sponsor: Kevin R. Ford, FACSM)
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Women's volleyball demands frequent lateral movements and vertical jumps. Repetitive lateral movements in the same direction could lead to biomechanical asymmetries and a potential increased risk of lower extremity injury. **PURPOSE:** To identify and analyze biomechanical asymmetries in collegiate women's volleyball players during sport-specific lateral and vertical jumping tasks.

METHODS: Nineteen female collegiate volleyball players were analyzed using standard 3D motion capture techniques during a drop vertical jump (DVJ) from a 30-cm box and a reactive jump (REACT) task. For the REACT, participants began in an athletic stance awaiting a directional cue on a screen placed in front of them. Once directed, participants were instructed to jump laterally and then vertically as high and fast as possible to mimic a volleyball block. Repeated measures MANOVA models were used to identify asymmetries in kinematic and kinetic measures in the DVJ and REACT task ($\alpha = 0.05$). Paired t-tests identified asymmetries in reaction time during the REACT task. Limb symmetry indices (LSI) were calculated for significant findings. **RESULTS:** Significant kinetic asymmetries were identified for both the DVJ ($p = 0.01$) and REACT ($p = 0.003$) tasks, but no kinematic asymmetries were found in either task ($p > 0.05$). During the DVJ, participants exhibited asymmetrical knee abduction (LSI=81%, $p = 0.03$), ankle dorsiflexion (LSI=94%, $p = 0.03$), and ankle inversion (LSI=30%, $p = 0.001$) external joint moments and vertical ground reaction forces (LSI=93%, $p = 0.04$). During the REACT task, participants exhibited asymmetrical ankle dorsiflexion (LSI=85%, $p = 0.03$), and ankle inversion (LSI=73%, $p = 0.001$) external joint moments. There were no differences in reaction times between the two limbs ($p > 0.05$). **CONCLUSIONS:** Collegiate women's volleyball players exhibit significant asymmetry in the knee and ankle during jumping and landing tasks. Interestingly, asymmetries were identified in kinetic variables but not kinematic variables. These findings indicate that screening, injury prevention and rehabilitation practices cannot solely rely on visual observation to identify lower extremity asymmetry in this athletic population.

- 270** Board #108 May 29 9:30 AM - 11:00 AM
Differences in Lower-Extremity Kinematics Among Female Collegiate Soccer and Volleyball Players
Anjali Gairola, Dustin Malandra, Marisa J. Christensen. *Cabrini University, Radnor, PA.*
(No relevant relationships reported)

Joint angles and leg stiffness play a role in an athlete's Reactive Strength Index (RSI). RSI is a variable that can quantify the elasticity and stiffness capacity of muscle during rapid changes from eccentric to concentric contraction. **PURPOSE:** To evaluate the differences in RSI, joint absorption strategies for knee joint displacement (KD), and ankle joint displacement (AD) among soccer and volleyball female athletes during a landing task. **METHODS:** A total of 30 (Soccer=21, Volleyball=9) healthy, NCAA Division III female athletes (19.76 ± 1.24 years) volunteered for this study. The subjects jumped over a hurdle with subsequent maximal vertical jump measured on EZE jump mat (swift performance). The maximal vertical jump landing was video recorded and joint angle displacements (KD and AD) analyzed using Hudl technique application on iPhone. Of three jump trials, highest (RSI_H) and lowest RSI (RSI_L) were recorded. A one-way ANOVA was used to determine differences among soccer and volleyball athletes for RSI_H. Further, two-way ANOVA with replication was used to examine the differences between joint angular displacements (KD and AD) at RSI_H and RSI_L. **RESULTS:** There was no significant difference ($p = 0.178$) between soccer (1.9 ± 0.44) and volleyball (1.67 ± 0.39) athletes for RSI_H. There was a statistically significant interaction ($p = 0.043$) between the effects of levels of RSI on joint angular displacements.

n=30	RSI _H (mean \pm SD)	RSI _L (mean \pm SD)
KD	32.9 ± 11.3^0	35.2 ± 11.5^0
AD	36.5 ± 10.4^0	33.9 ± 8.6^0

CONCLUSION: The power production and dynamic stability of leg during jump landing involves the coordination between the hip, knee, and ankle joints. In current study, RSI_H was associated with knee stiffness and elasticity of ankle joint. It was observed that there was no observable difference in ground force attenuation strategies by sport. Future studies should explore lower-extremity absorption strategies using bigger sample size, NCAA Division I or II athletes, and comparing genders during sport-specific tasks.

- 271** Board #109 May 29 9:30 AM - 11:00 AM
Age and Knee Confidence Effects on LESS and LESS-RMC Scores in Female Youth Soccer Players
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(No relevant relationships reported)

INTRODUCTION: Anterior Crucial Ligament (ACL) injuries are common in female soccer players and can have serious, even lifelong consequences. The Landing Error Scoring System (LESS) and a modification of the LESS, the LESS-RMC, have been useful tools in screening athletes and identifying individuals at "high-risk" so appropriate interventions could be provided. However, it is unclear

how knee confidence and age influences these screening tools in female soccer athletes. **PURPOSE:** The aim of this study was to investigate the effects of age and knee confidence on ACL injury risk classification in female youth soccer players. **METHODS:** 178 healthy female youth soccer players (ht: 1.63 ± 0.07 m, mass: 48.8 ± 4.9 kg, age: 14.1 ± 1.5 yrs) participated in this study. Participants were asked to jump from a 30cm box a distance 50% of their height where they immediately performed a maximum vertical jump and landing upon initial ground contact. Two HD cameras were used to record (60 Hz) this motion in the frontal and sagittal planes. The video of the task was then used to assess the participant's ACL injury risk by evaluating these landings using the LESS and LESS-RMC procedures. Knee confidence was evaluated by using a 5-point Likert scale in response to an item asking "How much do you trust your knee" from the knee-related quality of life subscale in the KOOS knee questionnaire. The participants were classified as confident if they answered "completely" and not confident for all other responses. Two-way ANOVAs were used to investigate the effects of age group (11-12, 13-14, 15-16 and 17-18 y) and knee confidence on the LESS and LESS-RMC scores. **RESULTS:** There was a statistically significant main effect of age on the LESS score, $[F(3, 167) = 2.667, p = 0.049]$. Post-hoc tests revealed that the age group of 11-12 years displayed significantly higher LESS scores (6.43 ± 2.14) than the 17-18 group (4.49 ± 2.11) ($p = 0.029$). There was no significant main effect for knee confidence ($p = 0.501$). **CONCLUSION:** The results reveal that female soccer players in the 11-12 age range are at a greater risk of ACL injury than the 17-18 age range. Further research should be conducted to examine the mechanical contribution to this risk and methods to reduce injury risk across age ranges.

272 Board #110 May 29 9:30 AM - 11:00 AM

Lower Extremity Force Production And Postural Stability Changes With Age In Young Male Soccer Players

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Optimizing lower extremity force production is key for elite soccer players (SP). Additionally, improved postural stability (PS) is generally associated with a decreased risk of injury. However, it is not well understood, in elite youth SP, how force production during explosive movements and PS during quiet stance differ among typical age categories.

PURPOSE: To compare lower extremity force production and PS performance in four different age categories in youth SP.

METHODS: A total of 73 elite youth SP from four age categories (U12: n = 18, U13: n = 20, U14: n = 16, U15: n = 19) were tested using a force platform (KISTLER AG, Switzerland) during different types of jumps (countermovement jump free arms (CMJFA), countermovement jump (CMJ), squat (SJ) and depth jump (DJ)). PS was assessed on a pressure platform (RS SCAN, Belgium) during narrow standing, with (NSW) and without (NSN) visual control, and single limb stance on preferred (SLSP) and non-preferred leg (SLSN). We calculated: jump height (JH), maximum force, force asymmetry between legs (FA), absolute (FI) and relative force impulses and total center of pressure distance. Statistical analyses ($p < 0.05$) consisted of MANOVA, Bonferroni post-hoc test and partial eta square (η_p^2).

RESULTS: A significant age effect was found on JH in all jump tests (CMJFA: $F_{3,69} = 13.92, p = 0.00$, CMJ: $F_{3,69} = 14.44, p = 0.00$, SJ: $F_{3,69} = 19.82, p = 0.00$, DJ: $F_{3,69} = 19.04, p = 0.00$,) and PS performance (NSN: $F_{3,69} = 3.93, p = 0.01$, FLP: $F_{3,69} = 7.88, p = 0.00$, FLN: $F_{3,69} = 3.22, p = 0.03$,). Older players (U15) had a higher performance in CMJFA (JH = 37.59 ± 5.32 cm) and force impulse (FI = 166.26 ± 32.42 N.s) compared to younger (U12: JH = 30.36 ± 2.63 cm, FI = 111.89 ± 25.14 N.s, U13: JH = 30.15 ± 3.31 cm, FI = 126.35 ± 20.01 N.s). Age had non-significant effects on FA ($p > 0.05$). Decreased postural control (NSN) was found in U15 players (204.58 ± 64.83 mm) compared to U13 (140.25 ± 35.01 mm). Younger players (U12) had lower performance in SLSP (1956.06 ± 822.70 mm) compared to older players (U13 = 1437.30 ± 370.13 mm, U14 = 1157.94 ± 316.85 mm, U15 = 1304.05 ± 404.12 mm). **CONCLUSIONS:** Explosiveness and PS are different by ages in youth elite SP. The results indicate that CMJFA and CMJ had different neuromuscular strategies compare to SJQ and DJ. Findings of this study are beneficial to develop age specific training program in youth SP.

273 Board #111 May 29 9:30 AM - 11:00 AM

Evaluation Of A Novel Acl Injury Prevention Technique:can Martial Arts Fall Training (break-falling And Rolling) Alter The Lower Extremity At-risk Biomechanics In Soccer Athletes?

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Purpose We propose that by introducing martial arts fall training (specifically break-falling and rolling), the neuromuscular pathways in these athletes will be trained to recognize and avoid at risk postures by having an alternative response. Given the absence of research utilizing martial arts falling techniques in other sports, this study aims to compare lower extremity biomechanics and risk factors in soccer athletes with fall training compared to those without. **Methods:** 5 youth premier soccer athletes between the ages of 9 and 16 were recruited for participation. Subjects were randomly divided into a control group and an intervention group. All subjects continued their usual soccer training. The intervention group completed a twice weekly 10-week training program in addition to their usual training, taught by a karate and aikido expert at the level of 3rd degree black belt. At baseline and after the 10 week program was completed, all subjects underwent a biomechanical evaluation that measured hip and knee movement/position in frontal, transverse, and sagittal planes at 4 different time points during a drop fall. A mixed factorial ANOVA model was used to determine the effects of the intervention training on the kinematic variables of interest. The between subjects' factor was treatment group (intervention and control) and the within subjects factor was time point (pre-intervention and post-intervention). The test of the interaction between group and time point was used to determine if the intervention produced change in the variables of interest. The alpha level of significance for this study is set at the 0.05 level. **Summary of Results:** There was a significant decrease in knee flexion in the sagittal plane at initial contact when comparing pre and post-intervention (-4.802 degrees, $P < 0.001$). There was also a significant decrease in knee flexion in the sagittal plane at heel strike 33ms (-7.384 degrees, $P < 0.001$). There was no significant change in any of the other motion points examined. **Conclusion:** There was a statistically significant change in body mechanics when comparing pre and post-break falling intervention. Prior research has shown that neuromuscular programs decrease ACL injury rates when they are started at an early age and continued with strong compliance.

274 Board #112 May 29 9:30 AM - 11:00 AM

Isokinetic Strength and Strength Asymmetries of Lower Extremities in Professional Soccer Players

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Muscle strength (MS) is an important component of physical fitness in soccer players (SP). Side-to-side differences may be developed due to the unilateral nature of certain soccer skills and movement patterns. Constant loading on one side of the body over time may lead to strength asymmetry and imbalances in tissue adaptation.

PURPOSE: To investigate isokinetic strength asymmetry (SA) and magnitude in professional male SP.

METHODS: Professional male SP from the first division of Czech Republic (n = 148, age 25.1 ± 4.8 years) volunteered to participate in the study. SP performed isokinetic strength testing (Humac Norm, CYBEX, USA) concentrically at angular velocities of 60, 180 and 300°·s⁻¹. The peak muscle torque of knee extensors (PT_E) and flexors (PT_F) in both legs, hamstrings and quadriceps strength ratio of muscle torque for both preferred and non-preferred extremities (H:Qp and H:Qn respectively), bilateral ratio between the exerted strength of knee extensors (Q:Q) and flexors (H:H) were calculated. Mixed-design RM ANOVA, Bonferroni's post hoc tests and partial eta square (η_p^2) were used for statistical assessment.

RESULTS: Knee flexors showed significantly higher SA (H:H = $9.77 \pm 0.40\%$) compared to the extensors (Q:Q = $7.24 \pm 0.40\%$) ($F_{1,294} = 20.49, p = 0.00, \eta^2 = 0.07$). Greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Qp = 59.89%) compare to non-preferred (H:Qn = $58.10 \pm 0.63\%$) ($F_{2,588} = 4.01, p = 0.04, \eta^2 = 0.01$). Contraction velocity speed did not have a significant difference on SA ($p > 0.05$). MS of knee extensors reached the highest value at the lowest velocity for both legs (PT_{E60} = 2.94 ± 0.36 N·m·kg⁻¹). Exerted MS significantly decreased with

increasing velocity in both: extensors ($F_{2.588}=4218.92$, $p=0.00$, $\eta^2=0.94$) and flexors ($F_{2.588}=2932.69$, $p=0.00$, $\eta^2=0.91$). At the highest velocity (300°s^{-1}), MS achieved ~55% (PT_e) respectively ~53% (PTF) of MS exerted at the lowest velocity (300°s^{-1}). **CONCLUSIONS:** Greater SA was found in knee flexion (H:H) rather than knee extension (Q:Q) in a group of professional male SP. Also, greater hamstrings and quadriceps strength ratio was found in preferred leg (H:Qp) compared to non-preferred leg (H:Qn). The findings of this study will be useful in the design of injury prevention and performance enhancement programs.

275 Board #113 May 29 9:30 AM - 11:00 AM
Effect of Previous Groin Pain on Sagittal Plane Joint Moments During Soccer Instep Kicks

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Previous groin pain is common in male soccer players, often results in re-injury,^{1,2} has been linked to maximal instep kicks.^{3,4} Research has shown aberrant kinematics during the instep kick in players with previous groin pain.⁵

PURPOSE: To quantify differences in sagittal plane joint moments during maximal instep kicks between players with and without previous groin pain.

METHODS: Data were collected from 12 experienced male soccer players who reported nonspecific groin pain in the last 12 months, and 11 controls who each performed six maximal instep kicks. A 10-camera Qualisys motion capture system (500 Hz) and two Bertec force platforms (2000Hz) collected data that were then processed using standard software (Visual 3D). Bilateral normalized joint moments of the hip, knee, and ankle were quantified at stance limb plant (PL), swing limb peak knee flexion (PKF) and at ball contact (BC). The foot speed of the swing limb at impact was considered an indication of kicking performance. The two-tailed alpha level was set to 0.05 and Cohen's d was used to quantify the magnitude of differences between groups.

RESULTS: A moderate difference in foot velocity existed between the groups (C: $15.5\text{ m}\cdot\text{s}^{-1}$, PGP $14.8\text{ m}\cdot\text{s}^{-1}$, $p=0.087$, $D=0.77$). Differences in stance limb joint moments were evident throughout the kick, while the swing limb only displayed differences at BC (Figure 1).

CONCLUSION: The PGP group often utilized lower sagittal plane joint moments about the hip, knee, and ankle of the stance limb but without evidence of a matching decrease in foot velocity at BC. This suggests that compensations occurred elsewhere in the kinetic chain to make up for the reduced joint moments. The stance hip flexion moment in the PGP group at PL is atypical and further supports the presence of aberrant motor patterns.

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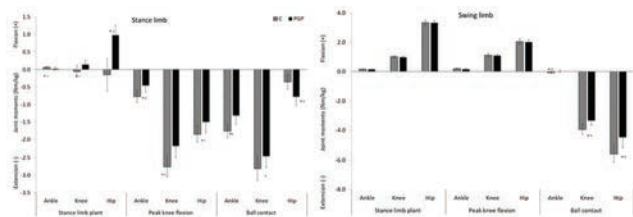


Figure 1. Graphs of joint moments of the limbs during the phases of the kick for C (black) and PGP (grey) groups. * indicates $P<0.05$, ** indicate $D>0.5$, *** indicate $D>0.5$, and **** indicate $D>0.5$.

276 Board #114 May 29 9:30 AM - 11:00 AM
Using Isokinetic Strength Assessment to Predict Performance and Prevent Injuries in Indian Cricket Fast Bowlers

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Cricket is the most commonly played & followed sport in India. It demands a high level of performance from the fast bowler. The fast bowling action involves a run up, leap and landing onto the lower limbs, followed by ball release. The large ground reaction forces generated during landing put fast bowlers at high risk of lower limb and lumbar spine injury. Precise dynamic coordination of lower body segments is needed to absorb these forces and transfer the energy via the core to the upper limb

to propel the ball at faster speeds. Thus, knowledge of lower quadrant strength can be very useful for injury prevention and better performance in fast bowlers. Dynamic Knee Strength in the front limb is critical during the leap phase of bowling for optimal performance. There is a lack of literature in this subject in Indian fast bowlers despite the popularity of the sport.

PURPOSE: To evaluate the Isokinetic knee strength, determine the relevant asymmetries and strength imbalances & their relationship with performance and injury risk in Cricket Fast Bowlers. **METHODS:** 42 male Indian State Level fast bowlers underwent Isokinetic knee strength testing. Quadriceps concentric (Qconc), Quadriceps eccentric (Qecc), Hamstring concentric (Hconc) & Hamstring eccentric (Hecc) Peak Torques normalized to body weight (PT/BW) were obtained. Bilateral Strength Asymmetries (BSA) and Dynamic Control Ratios (Hamstring DCR= Hecc/Qconc & Quadriceps DCR=Qecc/Hconc) were evaluated. Vertical Jump Height (VJ) & Standing Broad Jump (SBJ) distance were used as indicators of jump performance. Descriptive statistical analysis of data & Pearson correlation was done to obtain relationship between Isokinetic parameters & jump performance. **RESULTS:** A significant correlation was found between Qconc Strength and VJ ($r=0.67$, $p=0.04$) & SBJ ($r=0.39$, $p=0.04$). 67% of bowlers had significant Qecc strength asymmetry. 40% had poor Hamstrings DCR & 19% had poor Quadriceps DCR on the front limb. **CONCLUSION:** A significant proportion of fast bowlers have unfavorable strength asymmetry & DCR and thus are at risk of injury. Improving Dynamic Knee Strength through plyometric training could help optimize performance and reduce injury risk.

277 Board #115 May 29 9:30 AM - 11:00 AM
Biceps and Triceps Contribute to Pitching Performance in College Baseball

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 (No relevant relationships reported)

Training for pitching traditionally focuses on core and leg work, but there may be justification for isolated arm muscle training to enhance performance. **PURPOSE:** To evaluate the influence of biceps and triceps function during pitching. **METHODS:** Pitchers ($n=10$) from a Division-I collegiate team were recruited. Throwing mechanics and isolated arm movements were assessed using Proteus technology (Boston Biomechanics Inc). A single set of biceps and triceps movements (with 12 and 10 lbs respective resistance) and biomechanical assessment of a throwing movement were collected. All movements completed on Proteus result in seven variables: power, explosiveness, braking, consistency, endurance, velocity, and range of motion (ROM). Pearson correlation coefficients were employed to analyze relationships between the Proteus variables for biceps curls and triceps extensions, throw mechanics, and statistics from in-game performances from the 2017 season. **RESULTS:** The strongest relationship among all comparisons was biceps curl endurance and ERA ($r=-0.959$; $p=0.001$). The biceps curl ROM was also weakly related to throw power ($r=0.429$; $p=0.076$). Throw endurance corresponded with positive trends for biceps curl power ($r=0.419$; $p=0.089$), explosiveness ($r=0.452$; $p=0.060$), velocity ($r=0.417$; $p=0.085$), and ROM ($r=0.429$; $p=0.075$). A strong positive relationship was observed between throw endurance and biceps curl braking ($r=0.535$; $p=0.022$) and a positive trend between biceps curl ROM and throw velocity ($r=0.429$; $p=0.075$). Triceps extensions corresponded closely with throwing mechanics and in-game statistics; trends were found between triceps explosiveness and strikeouts per nine innings ($r=0.728$; $p=0.064$) and Proteus throw velocity ($r=0.462$; $p=0.053$). Throw endurance was related to triceps extension braking ($r=0.496$; $p=0.037$) and it displayed a trend with triceps extension endurance ($r=0.435$; $p=0.071$). **CONCLUSIONS:** New technology permits advanced biomechanical analysis of baseball pitching. Preliminary testing reveals the importance of arm conditioning for a pitcher's ability to maintain power output. As more players are tested, we may further our understanding of the role of biceps and triceps function in throwing mechanics.

278 Board #116 May 29 9:30 AM - 11:00 AM
Biomechanical Predictors of Fastball Velocity in Collegiate Pitching

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Recent pitching analyses indicate development programs should emphasize ball speed to optimize performance on the mound. Proper training is likely to increase velocity, but pitch delivery involves complex motions in all cardinal planes. Until recently, accurate analyses were encumbered by technological limitations. For example, isokinetic torque assessment measures fundamentally different phenomena from isotonic pitch delivery. New technology permits more accurate analysis. **PURPOSE:** To evaluate kinematic predictors of fastball velocity in collegiate

pitchers. **METHODS:** We tested all pitchers ($n=10$) from a private D1 baseball team in the West Coast Conference. Velocity was recorded as the mean speed of the three fastest in-game pitches. We used Proteus (Boston Biomotion, USA) to conduct three-dimensional isotonic assessments of pitching form, dominant and non-dominant core rotation, dominant arm internal and external shoulder rotation, and anterior flexion and extension of the dominant shoulder. Proteus software calculated power, explosiveness, velocity, and endurance. Non-mechanical predictors of fastball velocity were class year, height, weight, and limb lengths. Simple linear regressions quantified mechanical predictors of fastball velocity and the effect of fastball velocity on in-game pitching performance. **RESULTS:** Pitchers with a higher fastball speed had more appearances ($r=0.763$; $p=0.028$), pitched more innings ($r=0.715$; $p=0.046$), had more wins per appearance ($r=0.524$; $p=0.183$), and more total strikeouts in the season ($r=0.829$; $p=0.011$) but not per appearance ($r=0.566$; $p=0.143$) or per inning ($r=0.074$; $p=0.861$). Anthropometric variables were unrelated to fastball velocity. Internal rotation explosiveness ($p=0.031$) and endurance ($p=0.030$) of the dominant arm predicted fastball velocity. For each additional point of endurance, fastball speed increased 0.7 mph ($p=0.030$); for each additional 10 points of explosiveness, fastball velocity increased 0.4 mph ($p=0.031$). There was a positive relationship associated with explosiveness in straight-arm anterior shoulder raises ($r=0.898$; $p=0.015$); trends were found in the non-dominant arm. **CONCLUSION:** Increased fastball velocity may be facilitated by training internal shoulder rotation and shoulder flexion.

279 Board #117 May 29 9:30 AM - 11:00 AM
Match Acceleration and Deceleration Patterns in Female Collegiate Soccer Players

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Non-contact anterior cruciate ligament (ACL) sprains are becoming increasingly problematic for athletes, especially females. Running performance factors like acceleration and deceleration are often underestimated when examining fatigue in soccer players, but may be useful for prophylactic training to counter dysfunctional lower body mechanics under fatigued conditions. Currently no study exists that characterizes these factors in match play in female collegiate soccer players. **PURPOSE:** To describe match acceleration and deceleration patterns in female collegiate soccer players and compare positional influence. **METHODS:** 24 female NCAA Division I soccer players (11 defenders, 5 midfielders, 8 strikers) underwent global positioning system (GPS, 10Hz) monitoring throughout a 16-game competitive season. A custom written Matlab script processed GPS data and computed the amount of low (<1 m/s², <1 m/s²) and high (>2 m/s², <2 m/s²) acceleration-efforts (AE) and deceleration-efforts (DE), distance covered per effort, and starting speed of efforts. A Kruskal-Wallis H test and two separate paired t-tests were used to compare variables by position and by halves of matches, respectively. A significance level of $p < .05$ was used for all analyses. **RESULTS:** Strikers performed significantly more high-intensity AE (1st half: 0.97 efforts/min; 2nd half: 1.07 efforts/min) and DE (1st half: 1.15 efforts/min; 2nd half: 1.24 efforts/min) when compared to defenders (AE: 0.76 efforts/min; 0.75 efforts/min; DE: 0.90 efforts/min; 0.87 efforts/min) ($p = 0.00$, $p = 0.00$, $p = 0.00$, $p = 0.00$) and midfielders (AE: 0.73 efforts/min; 0.86 efforts/min; DE: 0.91 efforts/min; 0.80 efforts/min) ($p = 0.00$, $p = 0.00$, $p = 0.00$, $p = 0.00$). Significant decreases occurred in the second half across all matches in distance covered in low-intensity AE (1.9 ± 0.2 m, $p = .01$) and low-intensity DE (0.9 ± 0.1 m, $p = .01$), and starting speed in low-intensity AE (6.9 ± 0.3 m/s, $p = .01$) and DE (3.9 ± 0.2 m/s, $p = 0.00$). **CONCLUSION:** Strikers performed more high-intensity AE and DE than other positions, and may be at greater risk of lower body injury. Transient decreases in AE and DE occurred between halves of match play, and may relate to an increased risk of lower body injury in female soccer players.

TOPICAL GROUP #103
TOPICAL GROUP #402
TOPICAL GROUP #404

280 Board #118 May 29 9:30 AM - 11:00 AM
The Kick Motion Analysis Of Adolescent Male Soccer Player With Osgood-schlatter Disease

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Osgood-Schlatter disease(OSD) is an epiphyseal disease of tibial tubercle by repeated traction of patellar tendon, especially on epiphyseal or apophyseal stage. OSD is associated with sports that involve kicking, and running, but none have analyzed the kick motion of adolescent soccer players who experienced the OSD.

PURPOSE: The purpose of this study was to compare the kick motion in adolescent soccer players with and without OSD using three-dimensional motion analysis system. **METHODS:** We recruited 112 adolescent soccer players (13 ± 1 years old) All players went through the medical examination including the ultrasonography of tibial tubercle, and the muscle tightness test of lower limbs. We included only whose tibial tubercle stage was epiphyseal or apophyseal stage for this study and made two groups: presence of OSD on kicking leg (OSD group; $n = 10$) and absence of OSD or any other injuries (NP group; $n = 30$).

We measured real-time kick motion using a three-dimensional motion analysis system (Qualisys track manager, Qualisys AB., Sweden). We placed 65 spherical markers on each anatomical landmark and calculated the angle of the lumbar spine, pelvis, hips, knees and ankles. We collected data for the following six events of kicking leg: foot contact (FC), toe off (TO), max hip extension (HE), max knee flexion (KF), ball impact (BI), and max hip flexion (HF). We used unpaired t-test to compare all the factors we measured between OSD group and NP group.

RESULTS: The anthropometric index, muscle tightness, ball speed of OSD group were not different from NP group. In HE, the supporting leg's ankle flexion angle in OSD group was smaller in OSD group (14.9 ± 3.7 vs. 18.9 ± 5.0 °, $p=0.024$). In KF, the hip abduction angle of the kicking leg was smaller (24.5 ± 5.9 vs. 28.6 ± 5.1 °, $p=0.041$) in OSD group. In HF, the lateral bending angle of pelvis toward the supporting side was significantly smaller in OSD group (-2.6 ± 16.4 vs. 7.4 ± 11.3 °, $p=0.037$) In HF, supporting leg's ankle was more dorsal flexion (0.4 ± 14.9 vs. -14.1 ± 14.5 °, $p=0.010$), more valgus (26.3 ± 12.4 vs. 11.5 ± 11.1 °, $p=0.001$) compared to NP group. **CONCLUSION:** OSD group had smaller dorsal flexion angle of supporting leg before and after BI. They also had smaller hip abduction angle of kicking leg before BI, and lateral bending angle of pelvis toward the supporting leg side was smaller after BI.

281 Board #119 May 29 9:30 AM - 11:00 AM
Relationship Between Core Endurance and the Landing Error Scoring System in Youth Soccer Players

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Lower extremity injuries in youth soccer players continue to rise and have been related to poor landing mechanics. Identifying modifiable factors that influence at-risk landing mechanics is crucial toward the development of effective injury prevention programs. Dynamic core stability is needed to control lower extremity motion and decrease the risk of lower extremity injury. However, there is limited research that has examined the relationship between core stability and landing mechanics in youth athletes. Furthermore, understanding this relationship using screening methods that are readily accessible to clinicians is necessary as participation and injuries in youth soccer programs continue to increase. **PURPOSE:** To investigate the relationship between core endurance and the Landing Error Scoring System (LESS). **METHODS:** One hundred and ninety-two youth soccer players (M 108, F 84, 11.9 ± 1.0 yrs, 153.2 ± 11.1 cm, 43.2 ± 8.8 kg) participated. Core endurance was assessed using a validated sport-specific endurance plank test. Two-dimensional kinematics were collected during three trials of a 30cm drop-jump landing task and scored using an automated LESS scoring system (PhysiMax Technologies Ltd. Tel Aviv, Israel). Separate Pearson correlations (r) examined the relationship between time to exhaustion during the plank test and total LESS scores for males and females. **RESULTS:** In males, core endurance time to exhaustion (73.6 ± 15.1 s) was negatively correlated ($r = -0.210$, $P=0.030$) to total LESS scores (5.6 ± 1.8). In females, core endurance time to exhaustion (72.5 ± 15.3 s) was not correlated ($r = -0.061$, $P=0.578$) to total LESS scores (6.4 ± 1.9). **DISCUSSION:** Decreased core endurance was related to increased landing errors in male, but not female, youth athletes. These data suggest that prevention programs should incorporate core endurance exercises to improve at-risk landing patterns known to increase the risk of lower extremity injuries in youth male soccer players. More work is needed to identify the modifiable factors that increase the risk of injury in youth female soccer players.

282 Board #120 May 29 9:30 AM - 11:00 AM
Using Functional Movement Screen To Predict Injuries in Soccer Players

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Purpose: The aim of this study was to evaluate the predictive capacity of the Functional Movement Screen (FMS) to predict injuries in under 17 soccer players. In this study we tested the model in its original form, which will be called T7, with

an alternative model, proposed here, based on only 4 of the 7 evaluated in its original form. The choice of the four items considered the fact that they are movements that more directly evaluate balance and lower limb movement pattern, which are more related to musculoskeletal injuries in soccer.

Methods: The sample was selected from 33 under 17 players of a Brazilian soccer team. The evaluation of the functional movement pattern was performed by 2 evaluators and when there was conflict in the athletes' score, a third evaluator was called for the final decision. The evaluations were all made in the preseason. As predicted by the method, each one of the 7 analyzed items were rated with 1 (worst), 2 or 3 (best). The items evaluated were: deep squat (1), hurdle step (2), in-line lunge (3), active straight-leg raise (4), shoulder mobility stability (7). The complete index (T7) is what is normally used in this type of work. What we have suggested is T4, in which evaluations 1, 2, 3 and 4 come in.

Summary of Results: In 31 athletes selected, 7 had some type of skeletal muscle injury throughout the season (22.58% of the total). Through the analysis of effect size (Hedge's g) it can be verified that when the injured athletes are compared with the complete index T7 in relation to the proposed T4, the effect size is 0.854, which can be considered a significant difference, in a clinical way. Regarding those who were not injured, the power of explanation is even greater, with an ES of -1.104. The most relevant finding of the present study was when comparing the predictive power of T7 and T4 to predict injuries. While the T7 ES stood at 0.276, the T4 ES stood at 2.698.

Effect Size (ES)	ES (hedges g)	IC 95%	
ES T7Injury x ES T4Injury	0,854	0,757	0,950
ES T7Notinjury x ES T4Notinjury	-1,104	-1,150	-1,059
ES T7Injury x ES T7Notinjury	0,276	0,214	0,338
ES T4Injury X ES T4Notinjury	2,698	2,632	2,764

Conclusion: The present study showed that FMS can be used for the prediction of musculoskeletal injuries in soccer players.

A-45 Free Communication/Poster - Rehabilitation & Disability

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

283 Board #121 May 29 11:00 AM - 12:30 PM Different Exercise Regimens On Rehabilitation Of Patients With Stable Coronary Heart Disease

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(No relevant relationships reported)

PURPOSE: To investigate the efficacy and safety of different exercise regimens in the rehabilitation of patients with stable coronary heart disease.

METHODS: This study was a randomized controlled trial to screen 112 patients with stable coronary heart disease who were admitted to General Administration of Sport of China Sports Medical Science Institute from March 2017 to June 2018. They were randomly divided into aerobic resistance training group for 12 weeks (ART group, 36 cases) and traditional Chinese medicine training group 12 weeks (TCMT group 2, 37 cases) and control group (CON group, 39 cases). We analyzed the baseline parameters of all participants and the 12-week exercise plate test parameters and related physical and body parameters.

RESULTS: After 12 weeks of intervention, VO₂, VO₂/Kg, METS, VO₂/HR, SV, peaked grip strength and flexibility parameters of ART group and TCMT group were significantly higher than those of the control group (P<0.05). Resting heart rate (RHR) of TCMT Group was significantly lower than CON group, but there was no significant difference between groups ART and CON (P>0.05). VE/VO₂ of TCMT group was significantly higher than that of CON group. Body mass index (BMI) of ART group was significantly lower than that of TCMT group and CON group, and BMF of TCMT group was significantly smaller than that of ART group, but there was no difference between TCMT group and CON group for BMI and Body fat mass (BFM).

CONCLUSIONS: Both ART and TCMT can improve the cardiopulmonary aerobic exercise capacity and physical fitness of patients with stable coronary heart disease. Although the degree of improvement is different, they all have certain curative effect on the rehabilitation of patients with stable coronary heart disease and the application is safe.

284 Board #122 May 29 11:00 AM - 12:30 PM Effect of Walking Exercise on Metabolic and Pulmonary Health in Non-ambulatory Stroke Survivors, Pilot Data

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PURPOSE: Most of rehabilitation interventions in stroke rehabilitation have focused on improving the impaired sensorimotor function. However, up to 75% of stroke survivors are prone to have cardiovascular disease, which is the main cause of death in people after stroke. Diabetes mellitus is one of the major risk factors for developing cardiovascular diseases. Stroke survivors are prone to have diabetes mellitus due to increased fat tissue in their affected limbs. In addition, lung function is compromised in stroke survivors, which may cause fatigue and exercise intolerance. Furthermore, past studies of aerobic exercise have involved only stroke survivors who could walk independently. Stroke survivors who were unable to walk were not included in previous research investigating changes in risk factors of cardiovascular diseases and lung function from walking exercise interventions. In this project, we examined the effect of aerobic walking exercise on blood glycemic control and lung function in non-ambulatory stroke survivors using a treadmill, body weight support system, and a gait training device.

METHODS: In this on-going project, we have completed a low intensity walking exercise program (30 minutes/session; three sessions/week for eight weeks) in 5 ischemic stroke survivors (4 males, mean age 63.8±14.8 years). Before and after the intervention, a glycated hemoglobin (HbA1c) was measured using A1CNow+™ Systems, and vital capacity (VC) and forced vital capacity (FVC) were measured using a spirometer according to the guideline from American Thoracic Society/European Respiratory Society.

RESULTS: HbA1c decreased from 5.7±0.2% to 5.4%±0.2% from before to after the intervention. Pre- and post-intervention VC increased from 2.69±1.01 L to 2.85±0.82 L; FVC increased from 2.65±1.08 L to 2.72±0.97 L, respectively.

CONCLUSIONS: The results are promising and suggest that the low intensity aerobic walking exercise may improve blood glycemic control by decreasing HbA1c in non-ambulatory stroke survivors. Also, the results suggest that the low intensity aerobic walking exercise may improve lung function by increasing VC and FVC. This is an ongoing study; we anticipate recruiting 20 study participants for the study.

285 Board #123 May 29 11:00 AM - 12:30 PM Effects Of Intra-dialytic Exercises On Physical Fitness And Health Related Quality Of Life (HRQOL).

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PURPOSE: Patients undergoing dialysis have low levels of physical activity compared to their age matched healthy sedentary adults (*Kidney International*, Vol. 57 (2000), 2564-2570). It is observed that there is continuous decline in physical function and associated increased mortality and morbidity, in these patients. In 2016, the *American College of Sports Medicine* stated that intradialytic exercise is medicine for haemodialysis patients. Exercise during haemodialysis has been shown to benefit muscle strength and bone demineralization, reducing cardiovascular risk dialysis related symptoms and improving physical fitness and HRQOL. Exercise during haemodialysis has higher adherence compared to out-patient exercise in a rehab center. Therefore, this study was conducted to see the effects of intra-dialytic exercises on fitness and quality of life. **METHODS:** Before enrolling the patients (N=50), a general history was taken. Physical fitness was assessed by 6-minute walk test with telemetry ECG monitoring and health-related quality of life assessment was done using DSI Scale (Dialysis symptom index). Patients were given breathing exercises, active movements of extremities, strengthening and specific therapies for other issues during each dialysis session (2-3 days/week). After completion of the dialysis, patients performed aerobic exercise on a stationary bicycle. At the end of 12 sessions, the 6-minute walk test (N=17) and DSI questionnaire (N=25) were repeated. **RESULTS:** There was an average 40 meters (13.88%) improvement in 6-minute walk test distance after 12 sessions of rehabilitation (p<0.0001, t=5.935). The number of symptoms patients suffered related to dialysis went down by 2.44 points (21.40%) after rehabilitation (p=0.0015, t=3.584). The Dialysis symptom Index score improved by 10 points (27.80%) (p<0.0001, t=4.798). **CONCLUSIONS:** An intradialytic aerobic and strengthening exercise program showed significant health benefits by reducing dialysis related symptoms, improved physical fitness and improved health related quality of life.

- 286** Board #124 May 29 11:00 AM - 12:30 PM
Diabetes Impairs Walking Capacity And Autonomic Function In Patients With Peripheral Artery Disease
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Diabetes is a high prevalent comorbid condition in patients with peripheral arterial disease (PAD). Previous studies showed that diabetes impair physical function in PAD patients. However, whether cardiovascular function is also affected by diabetes is unknown.

PURPOSE: To compare walking capacity and cardiovascular function in PAD patients with and without diabetes. A total of 80 patients (n=41 non-diabetic and n=39 diabetic) with PAD were recruited. Six-minute walk test (total walking capacity), 4-meter test, walking impairment questionnaire (WIQ) and the walking estimated-limitation calculated by history (WELCH) were used to assess walking capacity. Cardiovascular function was assessed by blood pressure, arterial stiffness, heart rate variability and flow-mediated dilation. Mann-Whitney U test were performed, and data are presented in median and interquartile range. **RESULTS:** Diabetic PAD patients presented lower total walking capacity (308 ± 120 m vs. 370 ± 125m, p=0.025), WIQ distance score (10 ± 23 vs. 30 ± 46, p=0.002), WIQ speed score (17 ± 21 vs. 28 ± 27, p=0.001), WIQ stairs score (21 ± 42 vs. 42 ± 42, p=0.024), WELCH total score (20 ± 26 vs. 40 ± 42, p=0.006) compared to non-diabetic PAD patients. In addition, diabetic PAD patients had lower SDNN (22 ± 21 vs. 29 ± 36, p=0.030), and a trend to have lower RMSSD (13 ± 19 vs. 19 ± 32, p=0.061), and PNN50 (0.4 ± 3.7 vs. 1.6 ± 21.0, p=0.072). The remaining variables were similar between PAD patients with and without diabetes.

CONCLUSION: Diabetes impairs walking capacity and cardiac autonomic modulation in patients with PAD. Therefore, interventions to improve these parameters should be emphasized in diabetic PAD patients. Supported by FAPESP (# 2016/16425-9) and CNPq (#310508/2017-7)

- 287** Board #125 May 29 11:00 AM - 12:30 PM
High Intensity Interval Versus Moderate Intensity Training In Heart Failure Patients: Systematic Review And Meta-analysis
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Studies examining high intensity interval training (HIIT) and moderate intensity continuous training (MICT) have yielded conflicting findings regarding changes in left ventricular ejection fraction (LVEF) in heart failure (HF) patients with reduced ejection fraction (EF). **Purpose:** Use the meta-analytic approach to compare the effects of HIIT versus MICT on LVEF in HF patients with reduced EF. **Methods:** A search for studies published up to July 2018 was conducted using four electronic databases: PubMed, Academic Search Complete, SportDiscus and ScienceDirect. Studies were included if they met the following criteria: (1) clinical trials, (2) studies that reported means and standard deviations for LVEF, (3) adult men and women 18 years of age and older with a previous diagnosis of HF and an ejection fraction <55%, and (4) studies published in English or Spanish. Change outcome effect sizes (ES) using the original metric were calculated from each study. Results were pooled using random-effects models. A two-tailed alpha value <0.05 was considered statistically significant. Heterogeneity was assessed using the Q statistic and inconsistency using I². Small-study effects was examined using funnel plots and influence analysis was conducted with each study deleted once. **Results:** Of the 235 studies screened, 12 trials representing 418 HF patients met the criteria for inclusion. The number of sessions ranged from 24-48 and duration from 28-47 minutes per session. Overall, HIIT significantly increased LVEF (ES = 6.4%, 95% CI = 3.7% to 9.1%; p < 0.001). No statistically significant changes were found for either MICT (ES = 3.1%, 95% CI = -0.4% to 6.7%; p = 0.08) or Controls (ES = -0.8%, 95% CI = -1.8% to 0.2%; p = 0.11). Statistically significant heterogeneity and a moderate amount of inconsistency was found for HIIT (Q = 18.4, p = 0.02; I² = 56.5%), statistically significant heterogeneity and a large amount of inconsistency for MICT (Q = 42.9, p < .001; I² = 79.0%), but no statistically significant heterogeneity or inconsistency for Controls (Q = 0.42, p = 0.81; I² = 0%). Small-study effects were observed for both HIIT and MICT but not Controls. With each study deleted from the models once, changes ranged from 5.5% to 7.9% for HIIT, 1.9% to 3.6% for MICT, and -3.0% to 0.4% for Controls. **Conclusion:** HIIT increases LVEF in HF patients with reduced EF.

- 288** Board #126 May 29 11:00 AM - 12:30 PM
Evaluation of a Community Based Cardiac Rehabilitation Programme
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The transition from hospital-based (phase II) to community-based (phase III) cardiac rehabilitation (CR) is an important step in the long-term maintenance of positive health behaviour change.

PURPOSE: To evaluate the effect of participation in a phase III, community-based CR (CBCR) programme on selected fitness indices in comparison to a control group that received usual care advice and to explore participant experiences and perceived benefits in transitioning from hospital-based phase II CR to CBCR. **METHODS:** Following completion of phase-II CR, 95 individuals were referred to a 10-week CBCR exercise programme (intervention). A total of 22 (73% male) participants were unable to attend CBCR classes and were assigned to the control group. The remaining 73 (67% male) were assigned to the CBCR exercise program. Aerobic fitness (6MWT), functional upper (hand grip) and lower (timed sit to stand) limb strength, flexibility (sit and reach test) and body composition (waist & hip girth and BMI) were measured pre and post the intervention. All participants from the intervention group were invited to attend a focus group on completion and a thematic analysis was conducted. **RESULTS:** A total of 51 participants (69% male) completed the 10-week program (70% compliance). There was a significant improvement (p<0.05) in the timed sit to stand (26.5±7.21 v 21.4±5.65sec), 6MWT (505±66.6 v 534±71.9m), and waist circumference (100.9±13.09 v 98.5±13.37cm) in the intervention group. There was no significant change in any of the fitness indices in the control group. The focus groups were attended by 20 participants (60% male). The main themes identified included the strong sense of need for CBCR programmes and the reassurance provided by the link between the hospital and community provider. Physical, psychological and social benefits were described including moving from fear to confidence in their ability to exercise. **CONCLUSION:** Participation in a 10-week CBCR programme resulted in improved lower limb strength, aerobic fitness and waist circumference with maintenance of all other measured fitness components. Participants self-reported an increased ability and motivation to undertake exercise. This study provides an important insight into the experience and benefits, both perceived and actual, in the early transition to CBCR.

- 289** Board #127 May 29 11:00 AM - 12:30 PM
Effect Of Supervised Physical Training In Patients With Univentricular Physiology After Fontan Operation
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PURPOSE: The advances in the clinical and surgical management of patients with univentricular physiology after Fontan operation have allowed many patients to reach adulthood with a good quality of life. Nevertheless, most of these patients show a lower functional capacity compared to their healthy peers. Controlled data on supervised physical training in the Fontan patients are lacking, thus further studies are needed. The aim of this study was to evaluate the effect supervised exercise training on functional capacity (FC) in Fontan patients (FP).

METHODS: Randomized controlled trial with fifteen FP divided in two groups: supervised exercise training (ET) and no exercise training (NET). The ET group was submitted an incremental cardiopulmonary exercise test (CPX) before and after the intervention. The NET group was submitted to the CPX at baseline condition and after four months, maintaining their habitual activities. The training protocol consisted of three 60-minute exercise sessions per week for 4 months. The session was 40 minutes of aerobic exercise, 15 minutes of local strengthening exercises. The exercise intensity was monitored by heart rate between the anaerobic threshold and respiratory compensation point, obtained by a progressive maximal CPX.

RESULTS: There were no significant differences in baseline data between groups (age, gender, weight, medications, variables of CPX). There was an improvement in the FC as demonstrated by peak VO2 L/min, VO2 ml/kg/min and % predicted peak VO2 ml/kg/min in ETG [1,35 (1,27-1,95) vs 1,50 (1,40-2,55) L/min p=0,044; 26,9 (22,5-30,5) vs 30,6 (25,5-37,0) ml/kg/min p=0,021 and 69 (57-80) vs 79 (69-89) % p=0,018] respectively. In the NETG there was a mild decrease in FC and no significant. [1,57 (1,30-2,20) vs 1,55 (1,24-2,27) L/min p=0,753; 30,3 (25,9-38,6) vs 28,5 (23,8-

41.2) ml/kg/min, $p=0.600$; 79 (61-89) vs 69 (61-91) % $p=0.599$]. We also observed an improvement in peak ventilation and oxygen uptake efficiency slope (OUES) in ETG [54.7 (42.6-68.3) vs 67.6 (57.6-100.8) L/min $p=0.028$; 1.80 (1.52-2.63) vs 2.11 (1.65-2.88) $p=0.028$] respectively.

CONCLUSIONS: Our results demonstrate that the supervised exercise training based on CPX was able to improve FC in patients with univentricular physiology after Fontan operation

290 Board #128 May 29 11:00 AM - 12:30 PM
Inertial Flywheel Resistance Exercise in Veterans with Chronic Kidney Disease Predialysis: A Case Series

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(No relevant relationships reported)

Chronic kidney disease (CKD) is associated with skeletal muscle loss and neuromuscular dysfunction, resulting in reduced physical performance. Inertial flywheel resistance exercise (RE) has been shown to be an effective training option for improving neuromuscular outcomes in healthy adults. However, evidence supporting its application in patients with CKD is limited. **PURPOSE:** To determine the effects of inertial flywheel RE on neuromuscular measures and physical function in Veterans with CKD predialysis. **METHODS:** Two adult men with stage 3 or 4 CKD (age: 70±7.1 yrs; eGFR: 41.5±19.5 mL/min/1.73 m²; weight: 111.3±16 kg; height: 178.2±9.9 cm) were enrolled to perform 12-weeks of inertial flywheel RE for the squat movement (3 sets x 12 repetitions). RE emphasized maximizing power output and was progressed by manipulating inertial load and contraction velocity. Knee extensor peak isometric and isokinetic torque (180°/s) and rate of torque development (RTD) were assessed using dynamometry. Muscle thickness (MT) and echo intensity (EI) of the rectus femoris and vastus lateralis muscles were determined via B-mode diagnostic ultrasound. Physical function was assessed as time to complete five chair stands (STS-5). **RESULTS:** Both subjects improved similarly after RE, thus data are presented as Mean ± SD. Peak isometric and isokinetic torque increased from 106.7±8.5 to 122.4±9.7 ft-lbs (+14.7%) and 67.5±3.2 to 80.9±8.4 ft-lbs (+19.9%). RTD at time intervals of 50, 100, 200, and 300 ms increased after RE from 0.14±0.13 to 0.49±0.46 ft-lbs/s (+255.4%), 0.19±0.17 to 0.41±0.34 ft-lbs/s (+119.7%), 0.19±0.13 to 0.27±0.27 ft-lbs/s (+44.3%), and 0.18±0.09 to 0.24±0.06 ft-lbs/s (+32.3%), respectively. STS-5 was reduced from 16.2±3.3 to 13.5±2.8 s (-16.4%). No changes were observed in MT or EI. **CONCLUSIONS:** Our initial findings support the notion that inertial flywheel RE was safe and feasible in these Veterans with CKD predialysis. Improvements were observed in peak isometric and isokinetic knee extensor torque, RTD, and STS-5. Lack of change in MT and EI suggest increases in torque generation may have, in part, been due to neurological adaptations. Larger-scale studies are required to determine the potential efficacy of inertial flywheel RE for enhancing neuromuscular health and physical function in persons with CKD.

291 Board #129 May 29 11:00 AM - 12:30 PM
Cardiovascular Rehabilitation: New Indications For Old Entities.

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Introduction: The first Argentine Consensus of Cardiovascular rehabilitation (CR) is on the eve of publication. This adds new populations not included in other consensus, on pathologies that the Argentine Society of Cardiology (ASC) has updated through others published in recent years. **Purpose:** To highlight the interest to include pathologies that are increasingly underestimated and require greater focus. Although there are individual experiences that have not been published in Argentina so far. **Methods:** The consensus director, working together with two coordinators, and 35 editors, completed the task force of medical doctors with relevant experience in CR. In addition, had also participated an external evaluation committee comprised of four members, two of them international. The new candidate populations for CR programs are hypertrophic cardiomyopathy (HCM), pulmonary hypertension (PH) and chronic atrial fibrillation (CAF). **Results:** Individuals with these entities tend to over-demand what could trigger undesirable interferences. We focus on brief recommendations on each of them. Table. Synthesis of protocols in the considered pathologies

	PH	HCM	CAF
Inclusion criterions	Stable patient and with optimal pharmacological treatment.	Asymptomatic (finding).	1) isolated, or only episode 2) chronic stable.
Exclusion criterions		Symptomatic (intolerance to effort) or with demonstrable associated pathology.	paroxysmal, or repeated
Patient training	+	+	+
Elongation	yes	yes	Yes
Balance	yes	yes	Yes
Coordination	Yes	Yes	yes
Aerobic power	yes	no	Yes
Aerobic resistance	yes	yes	Yes
Strength	Yes	no	yes
Cool down	yes	yes	yes
Nutrition	+	+	+
Psychology	+	+	+

Conclusion: 1) The valuable contribution that will constitute the consensus on CR next to be published by the ASC stands out. 2) It focuses on the value it will have on three pathologies previously not sufficiently considered. 3) It also inferred the value it will generate when inducing the registry during its implementation, since there is not data enough in Argentina in this regard. 4) It proposes the integration and interaction of the different regions of the country in the same, which will stimulate the valuable integral contribution of the community of specialists in cardiology of Argentina. 5) It should be noted that at the last meeting of the ASC, in October 2018, 10,000 attendees were registered.

292 Board #130 May 29 11:00 AM - 12:30 PM
Low-health Literate Patients With Heart Failure Are At An Increased Risk Of Readmission

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PURPOSE: Health literacy (HL) is the degree to which individuals can obtain, process, and understand basic health information and services needed to make proper health decisions. Low-HL is associated with reduced adherence to exercise, medications, healthy nutrition, and low utilization of preventive health services. Cardiac Rehabilitation (CR) is a secondary prevention program that targets risk factor education and reduction, to associated improvements in health status. Heart failure (HF) has recently been added as an eligible diagnosis for CR, and it is associated with particularly high rates of readmission. We hypothesized that that low-HL may contribute to high hospital readmission among HF patients. To evaluate differences in hospital readmission rates for HF patients who did and did not attend CR. To compare rehospitalization in relation to low- versus (vs) high-HL in the HF patients who attended CR. **METHODS:** Retrospective quality improvement analysis. Comparison of matched HF patients who did versus did not attend CR. We then assessed HL in those who attended CR to compare 30-day and 90-day readmissions in patients with low-HL (less than 9th grade reading level) vs high-HL (greater than 9th grade reading level). HL was evaluated using the REALM-SF. **RESULTS:** Readmissions in 104 HF patients who attended CR were significantly lower than in the HF patients who did not attend CR (17.44% vs 21% at 30 days, and 22.62 vs. 39.3% at 90 days). Among the 104 HF patients who attended CR, 67 who categorized as high-HL had significantly lower readmission than the 37 who categorized as low-HL at both 30 (8.96% vs 29.73, $p=0.0061$) and 90 days (22.39% vs. 40.54%, $p=0.05$). **CONCLUSIONS:** CR enrollment was associated with reduced readmission in HF patients. Among HF patients who attend CR, low-HL was associated with relatively greater risks of rehospitalization compared to patients with high-HL, suggesting that refinements to address low-HL might improve the efficacy of CR.

Readmission rates in HF patients who participated in VA Pittsburgh Cardiac Rehab (N=109)							
	Low health literacy <9 th grade (N=37)		High Health literacy ≥9 th grade (N=67)				
	Frequency (n)	Percent	Frequency (n)	Percent	OR	95% CL	P-value
≥1 hospital readmission within 30 days	11	29.73	6	8.96	4.30	(1.44, 2.86)	0.0061
≥1 hospital readmission within 90 days	15	40.54	15	15	22.39	(0.98, 5.65)	.05

293 Board #131 May 29 11:00 AM - 12:30 PM

Feasibility Of Overground High-intensity Interval Training (hit) In Persons With Chronic Stroke

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(No relevant relationships reported)

Evidence suggests that treadmill (TM) HIT can be safe and effective as a rehabilitation tool in persons with stroke. However, translation to overground walking can be limited and no studies have tested overground (OG) HIT. **PURPOSE:** To compare training speeds and HR responses for TM HIT and OG HIT in persons with chronic stroke. **METHODS:** Ten subjects (mean ± SD) 59.8 ± 6.8 years old and 2.4 ± 1.7 years post stroke with comfortable gait speed of 0.41 ± 0.35 m/s and fast gait speed of 0.56 ± 0.56 m/s participated and passed a symptom-limited GXT. Subjects performed 12 sessions of HIT over 4 weeks, alternating short and long interval HIT sessions. Both HIT protocols included 10 minutes of overground HIT (OG1), then 20 minutes of treadmill HIT, followed by another 10 minutes of overground HIT (OG2). Short interval HIT involved 30s bursts at maximum safe speed and 30-60s rest periods. Long interval HIT involved 4-min bursts at ~90% of peak heart rate (HR_{peak}) from the GXT and 3-min recovery periods at ~70% HR_{peak}. Variables recorded included gait training speeds and mean and max heart rate. OG1 and OG2 data were combined to control for warm up and cardiovascular drift effects. Mixed effects models were used to compare TM and OG exercise responses, while accounting for repeated measures from the same participant.

RESULTS: All participants completed 12 sessions and no serious adverse events occurred. With the short interval protocol, OG HIT elicited significantly slower gait training speeds than TM HIT (0.75 vs. 0.90 m/s, p<0.0001), with lower mean HR (78.4 vs 82.9 %HR_{peak}, p<0.0001) and max HR (89.2 vs. 97.0 %HR_{peak}, p<0.0001). With the long interval protocol, OG HIT elicited significantly faster gait training speeds than TM HIT (0.66 vs. 0.51 m/s, p<0.0001) with similar mean HR (81.2 vs 81.9 %HR_{peak}, p=0.10) and lower max HR (92.7 vs. 95.8 %HR_{peak}, p<0.0001).

CONCLUSIONS: OG HIT appears to be reasonably feasible and safe in chronic stroke. Mean OG HIT speeds were 34% and 18% faster than baseline fastest gait speed for short and long interval HIT, respectively. For short interval HIT, it may be optimal to combine the task specificity of overground training with the higher speeds and intensity of treadmill training. For long interval HIT, treadmill training does not appear to provide the same intensity benefit and overground training alone may be superior.

294 Board #132 May 29 11:00 AM - 12:30 PM

Cardiorespiratory Differences Between Knee Scooter and Crutch Use for Mobility.

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(No relevant relationships reported)

PURPOSE: In recent years, use of knee scooters (KS) have increased as a modality for moving around with a foot or ankle injury. There is a paucity of research examining the physiological demands of the knee scooter. Therefore, the purpose of this study was to compare moving on a knee scooter with moving using crutches (C). **METHODS:** Nineteen (13 females, 6 males) apparently healthy young adults were recruited. The participants had one day of practice then another day of testing. Participants completed a figure eight hallway route (196 m) under three conditions: first with walking, then (order randomized) using C and KS. The speed was self-paced with six minutes of sitting rest between conditions. Heart rate and oxygen consumption were monitored

with a mobile metabolic system. With alphas = 0.05, One-Way Repeated Measures ANOVA with paired t-Testing (Bonferroni with Holm's sequential adjustment) for post hoc testing were done. **RESULTS:** The average VO₂ (1223 ± 321 mL/min) of C was significantly 27% higher than the average VO₂ (992 ± 177; 221 mL/min) for the KS. In addition, the average heart rate (164 ± 177; 17 bpm) for the C was significantly 12% higher than the average heart rate (146 ± 177; 24 bpm) for C. Crutch use speed was on average non-significantly 4.2% (2.9 m/min) slower than the KS speed. **CONCLUSIONS:** The KS caused less cardiorespiratory stress than the C. This indicates that the KS be recommended over C especially for those with poor fitness levels. Supported in part by an Oakland University Honors College Grant.

295 Board #133 May 29 11:00 AM - 12:30 PM

Feasibility of Stroke Volume Measurement during Treadmill Exercise in Adults with Down syndrome.

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Individuals with Down syndrome (DS) exhibit reduced peak aerobic capacity (VO_{2peak}) compared to those without DS. Lower VO_{2peak} is partly due to impaired autonomic function, resulting in lower peak heart rate, thus altering cardiac output (CO). Autonomic dysfunction may also impact stroke volume (SV), further affecting CO. SV can be determined during exercise by measuring blood flow velocity in the ascending aorta with continuous wave (CW) Doppler echocardiography. It is unknown whether individuals with DS will tolerate the method or if it is feasible due to their specific physical features and gait abnormalities. **PURPOSE:** To determine the feasibility of SV measurement during exercise using CW Doppler in adults with and without DS. **METHODS:** Adults with DS (n= 6, 25 ± 2 yrs, 31.7 ± 4.6 kg/m², 24.2 ± 4.2 mL/kg/min) and without DS (n= 5, 26 ± 4 yrs, 24.9 ± 4.8 kg/m², 32.5 ± 6.4 mL/kg/min) performed a maximal incremental treadmill test to assess VO_{2peak}. Images were obtained at rest and every 2 min, until 8 min, of the treadmill test. Success rate of CW Doppler was expressed as a percent of acquired images vs total potential images. The method was feasible if success rate was ≥80%, and if obtained values for SV indexed to body surface area (SVI) were physiologically plausible. **RESULTS:** Resting measures were equally feasible with both groups at 100% success rate. As exercise progressed, the ability to obtain clear images was compromised, however, feasibility remained ≥ 80% in both groups. Further, percent change of SVI from rest to 8 min was within expected range (DS: 24.4%, Control: 22.7%). **CONCLUSIONS:** This pilot data indicates that SV measures during exercise with CW Doppler are feasible in adults with DS similar to that in controls, even with the DS-specific physical characteristics and gait pattern. Future research with more subjects should compare the SVI and CO with increasing exercise intensity between groups to better understand what limits exercise capacity in persons with DS.

		DS (n=6)	Control (n=5)
Seated Rest	Success rate	100% (6)	100% (4)
	SVI	42.5 ± 6.5	34.3 ± 10.7
Standing Rest	Success rate	100% (6)	100% (4)
	SVI	36.9 ± 11.0	32.4 ± 12.8
2 minutes exercise	Success rate	83% (6)	100% (4)
	SVI	54.0 ± 8.8	43.6 ± 14.2
4 minutes exercise	Success rate	83% (6)	100% (5)
	SVI	56.2 ± 16.0	46.9 ± 16.4
6 minutes exercise	Success rate	100% (6)	80% (5)
	SVI	54.2 ± 18.4	45.8 ± 17.2
8 minutes exercise	Success rate	100% (6)	80% (5)
	SVI	52.9 ± 17.4	42.1 ± 18.8
Success rate in % (total potential measurements)			
SVI: Stroke volume index in mean ± SD			

- 296** Board #134 May 29 11:00 AM - 12:30 PM
Exercise Preconditioning Reduces Brain Damage and Accelerates Physical Rehabilitation in Rats with Cerebral Ischemia
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Stroke has become one of the major causes of disability and mortality worldwide. There is increasing evidence that exercise training is associated with reduced risk of stroke. However, the effects of exercise training on protection of brain damage and subsequent motor and vestibular functions have not been fully understood.

PURPOSE: To determine the effects of exercise training prior to brain ischemia on protection against brain damage and subsequent motor and vestibular functions following transient cerebral ischemia/reperfusion injury in rats.

METHODS: Male Sprague-Dawley rats were either endurance exercise trained (N=10, ET, treadmill running at 16 m/min, 0° incline, 60 mins/day, 5 day/week, 4 weeks), resistance exercise trained (N=10, RT, climbing vertical ladder start load at 75% bodyweight with an additional 15% bodyweight added every 2 sets of climb until exhaustion, 10 sets/day, 5 day/week, 4 weeks) or remained sedentary (N=20) for 4 weeks. Brain ischemia induced by transient middle cerebral artery occlusion (MCAO) or sham surgery (sham) were then performed on these rats, which results in four groups: sham, MCAO, ET+MCAO, and RT+MCAO. 24 hours after the induction of brain ischemia, motor and vestibular functions were evaluated by various scoring methods. Ischemic infarct volume was measured by triphenyltetrazolium chloride (TTC) staining. One-way ANOVA followed by post-hoc Bonferroni test were used for data analysis.

RESULTS: Rats in both ET+MCAO and RT+MCAO group had significantly lower cerebral infarct volumes when compared to those in MCAO group ($31.97 \pm 8.65\%$ vs. $37.85 \pm 10.45\%$ and $33.13 \pm 7.82\%$ vs. $37.85 \pm 10.45\%$, respectively $p < 0.05$). Consistently, the coordinated locomotor function and vestibular function were also significantly improved in ET+MCAO (2.33 ± 0.52 vs. 3.40 ± 0.89 , 1.77 ± 0.97 vs. 2.56 ± 1.23) and RT+MCAO (2.40 ± 0.55 vs. 3.40 ± 0.89 ; 1.78 ± 1.09 vs. 2.56 ± 1.23) in comparison to MCAO group ($p < 0.05$), while the rats in the sham group did not exhibit any cerebral injury and functional impairment. There were no difference between the two exercise training groups.

CONCLUSIONS: Exercise preconditioning prior to brain ischemia induction effectively reduced cerebral infarct volumes and protected against the decline in motor and vestibular functions in a rat model of brain ischemia.

A-46 Free Communication/Poster - Renal

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

- 297** Board #135 May 29 11:00 AM - 12:30 PM
The Effect of Physical Activity on Hemodynamic Response to Angiotensin Converting Enzyme Inhibition in Hypertension
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 (No relevant relationships reported)

PURPOSE: Physical activity (PA) can reduce blood pressure (BP) in hypertensive populations. Although underlying mechanisms remain unclear, an interaction with the renin-angiotensin-aldosterone system (RAAS) is a logical focus of exploration. We conducted a nested cohort analysis to determine if reported level of PA was associated with vascular responsiveness to acute angiotensin converting enzyme inhibition (ACEi).

METHODS: Data were extracted from the HyperPATH dataset, which is an ongoing program to identify genetic mechanisms underlying cardiometabolic risk. Individuals with hypertension who completed a physical activity self-assessment and who had completed hormonal assessment (serum aldosterone [ALDO] and plasma renin activity [PRA]) and vascular response (BP) to a single dose of an ACEi (captopril 25mg) were included for analysis. All participants (n=144) were studied in a clinical research center after overnight, supine, fasting status and on a sodium, potassium, and calcium controlled diet for 7 days. PA was reported as 1) no additional PA, 2) little, 3) moderate, or 4) high amounts of exercise. The response to ACEi was evaluated by ANOVA or multivariate regression when appropriate, with all analyses adjusted for age, sex, race, and BMI.

RESULTS: As expected, both acute ACEi and increased PA levels were significantly associated with reduced systolic BP ($p < 0.05$). However, individuals who reported

high amounts of exercise displayed a greater BP lowering effect from ACEi compared to those who reported moderate (-14.8 ± 8.1 mmHg vs -8.4 ± 9.9 mmHg, $p < 0.01$) or no additional PA (-14.8 ± 8.1 mmHg vs -2.6 ± 9.9 mmHg, $p < 0.001$). Exploratory analyses indicated high amounts of PA were associated with: a reduced heart rate when compared to no PA (54.2 ± 7.7 bpm vs 66.4 ± 9.8 bpm, $p < 0.001$), reductions in PRA (0.42 ± 0.48 ng/ml/hr vs 0.59 ± 0.52 ng/ml/hr, $p < 0.05$), and reductions in ALDO ($\beta = -0.44$, $CI = 0.19 - 0.70$, $p = 0.001$).

CONCLUSIONS: Higher levels of self-reported PA are associated with decreased BP, and acute ACEi resulted in an augmented BP lowering effect in hypertensive subjects. PA is inversely correlated with RAAS activity. These data shed light on how physical activity interacts with vascular function in RAAS activity and suggest that PA and ACEi medications may act synergistically.

- 298** Board #136 May 29 11:00 AM - 12:30 PM
Previous Aerobic Exercise Increase Vo2 Peak And Improves Renal Protective Effects In Chronic Kidney Disease
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INTRODUCTION: Patients with chronic kidney disease (CKD) have lower physical and when compared to the general population. It is common for patients with chronic diseases to be physically inactive, therefore patients with CKD in their different stages, present reduced physical capacity around 60% to 70% of the level expected for the age. **OBJECTIVE:** Evaluate the effects of previous aerobic exercise on oxygen consumption (peak VO₂), renal function and glomerulus sclerosis index in rats with CKD due to nephrectomy 5/6 (Nx5/6). **METHODS:** Adult Wistar rats were divided into groups (n = 8): Sedentary+Nx5/6+Sedentary (Sed), Sedentary + Nx5/6 + Exercise (Sed-Exe), Exercise + Nx5/6 + Sedentary (Exe-Sed) and Exercise + Nx5/6 + Exercise (Exe). The exercise was performed on treadmill, the intensity of 40 to 60% of the maximum load test, 60 minutes a day and 5 times a week, during the total period of 8 weeks of training. Nx5/6 was performed in the 4th week of the training protocol. Blood pressure (BP), oxygen consumption (Vo₂ peak), proteinuria, nitrogen urea base (BUN), and glomerulus sclerosis index were evaluated in the hematoxylin-Eosin staining.

RESULTS: There was an increase in the Sed-Exe and Exe groups in relation to the Sed group (34.2 ± 2.1 ; and 37.9 ± 1.7 vs. 24.8 ± 0.6 , $p < 0.05$, respectively). The Exe group presented a significant reduction in proteinuria when compared to the Sed-Exe group (176.6 ± 39.2 vs 61.1 ± 20.9 , $p < 0.05$, respectively). The BUN of the Exe-Sed group was inferior to Sed group (31.7 ± 2.3 vs 65.6 ± 7.8 , $p < 0.05$, respectively). There was a decrease in BP in the Sed-Exe and Exe groups when compared with the Sed group (215 ± 1 and 219 ± 2 vs 251 ± 2 , $p < 0.05$, respectively), but the BP values still remained high. The glomerulus sclerosis index was classified as follows: the Exe group presented the mild degree index (25%), the Sed-Exe and Exe-Sed groups moderate degree (50%), and the sedentary group presented degree high (over 75% injury).

CONCLUSION: The exercise minimizes the impact of Nx5/6, attenuating proteinuria, important analysis of progressive loss of renal function. Increasing physical capacity and VO₂. Finally, previous exercise indicates protection for CKD, especially under this experimental protocol. Thus, it is reasonable to suggest that exercise may be an additional strategy to be employed in CKD.

- 299** Board #137 May 29 11:00 AM - 12:30 PM
Renal Function Responses To Steady-state Moderate-intensity And High-intensity Interval Exercise In Mid-spectrum Chronic Kidney Disease
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Efficacy of exercise to improve renal function remains understudied in adults with mid-spectrum chronic kidney disease (CKD). In addition, a comparison of steady-state exercise (SSE) and high-intensity interval exercise (HIIE) may contribute clinically-relevant information for exercise-related augmentation of renal function in mid-spectrum CKD. **PURPOSE:** To determine the influence of SSE and a comparable amount of HIIE on indicators of post-exercise renal function in patients diagnosed

with secondary Stage 3 or 4 CKD. **METHODS:** Twenty participants ($n = 6$ men; $n = 14$ women; age 62.0 ± 9.9 yr; weight 80.9 ± 16.2 kg; body fat $37.3 \pm 8.5\%$ of weight; VO_2max 19.4 ± 4.7 ml/kg/min) completed 30 min of SSE at 65% $\text{VO}_2\text{reserve}$ or HIIE by treadmill walking (90% and 20% of $\text{VO}_2\text{reserve}$ in 3:2 min ratio) in a randomized crossover design. Both exercise conditions averaged $\sim 65\%$ $\text{VO}_2\text{reserve}$. Blood and urine samples were obtained by the same technician under standardized conditions just before, 1hr and 24hrs after exercise. Serum creatinine (sCr), urine epidermal growth factor ratio (uEGFr), cystatin C and estimates of glomerular filtration rate - modification of diet in renal disease (MDRD) and the CKD-EPI - responses were analyzed using 2 (condition) by 3 (sample point) repeated measures ANOVAs.

RESULTS: sCr decreased from 1.45 ± 0.05 pre-exercise to 1.26 ± 0.05 mg/dl (-13%) 1hr after exercise and returned to pre-exercise levels by 24hr ($p = 0.009$). Both MDRD and CKD-EPI estimates of glomerular filtration rate were 16 to 19% higher at 1hr, returning to pre-exercise values by 24hrs after exercise. The MDRD estimate increased from 43.1 ± 1.9 pre-exercise to 50.3 ± 2.1 ml/min/1.73m² 1hr after exercise ($p = 0.007$) and CKD-EPI from 45.2 ± 2.1 to 53.8 ± 2.4 ml/min/1.73m² at 1hr post-exercise ($p = 0.009$). Relative to pre-exercise measures, uEGFr remained stable with SSE but was 5.4% greater 24hr after HIIE ($p = 0.052$). Cystatin C remained stable in the hours after exercise ($p > 0.05$). **CONCLUSION:** By clinical estimates, renal function was not normalized but transiently improved with SSE and HIIE in mid-spectrum CKD.

A-47 Free Communication/Poster - Age-Dependent Physiology

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

300 Board #138 May 29 11:00 AM - 12:30 PM An Investigation Into Age-related Sarcopenia In Rodents

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(No relevant relationships reported)

With aging, there is a decline in both skeletal muscle size and quality. This occurrence is known as sarcopenia and the implications due to this decline can be debilitating. Previous research has elucidated genes that are associated with muscle sarcopenia and how a change in expression can affect both muscle protein synthesis and degradation, which can affect skeletal muscle size and quality. **PURPOSE:** To investigate the expression of genes relating to skeletal muscle growth, collagen synthesis, and inflammation across the lifespan of rats. **METHODS:** Sedentary male Fischer 344 rats were fed ad libitum and were aged to 3 and 24 months (mo) ($n=8$ per age group) and then sacrificed. Body and gastrocnemius (gastroc) weights were collected and muscle was processed for RNA isolation and sent out for RNA sequencing. The following genes relating to muscle growth, collagen synthesis and inflammation were analyzed: Myostatin (MSTN), Insulin-like Growth Factor 1 (IGF-1), Insulin-like Growth Factor 2 (IGF-2), phosphorylated Mechanistic Target of Rapamycin (mTOR), Collagen Type I Alpha 1 Chain (COL1a1), Collagen Type I Alpha 2 Chain (COL1a2), Collagen Type IV Alpha 1 Chain (COL4a1), Lysyl Oxidase (LOX), Nuclear Factor Kappa B Subunit 1 (NFkB1), Tumor Necrosis Factor (TNF), Interleukin 6 (IL-6), and Interleukin 1 Beta (IL-1B). **RESULTS:** MSTN expression was significantly higher in 3 vs. 24 mo rats ($p = 0.018$), and was positively correlated to relative gastroc weights ($R = 0.663$, $p = 0.005$). All genes related to collagen synthesis were significantly higher in 3 vs. 24 mo rats (COL1a1, $p < 0.001$; COL1a2, $p = 0.007$; COL4a1, $p = 0.030$; LOX, $p = 0.046$). Furthermore, COL1a1 and COL1a2 were positively correlated to relative gastroc weight ($R = 0.649$, $p = 0.007$; $R = 0.730$, $p = 0.001$, respectively). However, no genes related to inflammation were significantly different between age groups, but there was a negative correlation between IL-6 gene expression and relative gastroc weights ($R = -0.546$, $p = 0.028$). **CONCLUSION:** We suspect 24-month old rodents may be too young to capture the sarcopenia symptoms that occur with aging. However, the relationship between inflammation and relative gastrocnemius muscle weight may warrant further investigations in rodents older than 24 months.

301 Board #139 May 29 11:00 AM - 12:30 PM Skeletal Muscle Phosphodiester Content is Related to Muscle Mass and Strength in Older Sarcopenic Adults

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(No relevant relationships reported)

Age-associated loss of skeletal muscle mass and strength (sarcopenia) is a critical healthcare issue for older adults. Effective therapeutic options are limited in part because the underlying etiology is not well-defined. Studies utilizing magnetic resonance spectroscopy (MRS) revealed that resting phosphorus metabolites and maximal ATP production (ATP_{max}) are altered in muscle from older adults. However, it is unclear whether resting phosphorus metabolites and ATP_{max} are related to muscle characteristics that define the sarcopenic phenotype. **PURPOSE:** To determine whether *in vivo* resting phosphorus metabolites and ATP_{max} are associated with skeletal muscle mass, strength, and function in older adults. **METHODS:** *In vivo* metabolites and ATP_{max} were measured by phosphorus-MRS during rest and following a brief bout of isometric leg contractions in 74 sedentary older adults (68.6 ± 0.5 years; 23M/51F). Skeletal muscle mass was evaluated by DEXA and mid-thigh MRI. Quadriceps contractile function was assessed by Biodex. These variables were further explored in participants that were classified as sarcopenic ($n=6$) or non-sarcopenic ($n=15$). Muscle biopsies of the vastus lateralis were obtained to determine fiber type proportion and cross-sectional area by immunohistochemistry. **RESULTS:** Several resting phosphorus metabolites were related with muscle size and function in older adults. In particular, a phosphodiester peak (PDE2), considered a marker of membrane integrity, was negatively associated with skeletal muscle mass index ($r = -0.38$, $p < 0.01$), muscle volume ($r = -0.37$, $p < 0.01$), and peak power ($r = -0.38$, $p < 0.01$). PDE2 was elevated in sarcopenic patients in comparison to non-sarcopenic controls (2.48 ± 0.11 mM vs. 1.92 ± 0.08 mM, $p < 0.01$). ATP_{max} was not different between sarcopenic and non-sarcopenic individuals. At the cellular level, PDE2 was negatively correlated to myofiber area ($r = -0.51$, $p = 0.03$) but not fiber type proportion. **CONCLUSION:** Elevated resting PDE2 levels in muscle were associated with lower muscle mass and strength in older sarcopenic adults. While ATP_{max} was not related to the sarcopenic phenotype, our results reveal that resting *in vivo* phosphorus metabolite profiles may be a viable cellular marker of muscle quality in older adults. Supported by NIH Grants K01 AG04437 and R01 AG021961

302 Board #140 May 29 11:00 AM - 12:30 PM Amount and Variability of Adipose Tissue Content in Human Quadriceps Muscles of Older Adults

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INTRODUCTION: Obesity is a significant health problem that can compound health-related morbidities in aging adults. While substantial research has elucidated many of the metabolic consequences of obesity, much less is known about the effects of adipose tissue (fat) deposition on skeletal muscle function. Some evidence exists to suggest that obesity may interfere with muscle force production, but this is an understudied area of research. **PURPOSE:** To quantify *in vivo* the amount and distribution of fat and lean muscle tissue in the quadriceps muscles of healthy older adults. **METHODS:** The dominant legs of 8 healthy, sedentary adults (71 ± 4 yrs, mean \pm SD; 4 men; BMI: 25.1 ± 3.3 kg·m⁻²) were evaluated using a 6-point Dixon imaging technique in a 3 tesla magnetic resonance system. Axial slices (5 mm thick) were acquired for the entire thigh, and each image in which all 4 quadriceps muscles were visible was analyzed to determine fat and muscle volumes (cm³), and fat fractions (fat/total*100; %). The location (% muscle length) of peak muscle volume and fat fraction, as well as the deviation from the line of best fit (2nd order polynomial) of these variables were calculated as measures of tissue distribution and heterogeneity. Differences in means were evaluated by paired t-tests. **RESULTS:** Fat-free muscle volume, fat volume, and fat fraction were 821 ± 287 cm³, 75 ± 26 cm³ and $8.6 \pm 1.1\%$, respectively. Peak muscle volume and fat fraction occurred in different locations (70.7 ± 7.7 vs. $19.3 \pm 23.2\%$ length, $p=0.001$), with a 3-fold greater coefficient of variation for fat fraction than muscle volume. Likewise, slice-to-slice variability of fat fraction was greater than for muscle volume (4.7 ± 1.5 vs. $1.2 \pm 0.3\%$, $p<0.001$). **CONCLUSIONS:** These data show greater spatial variability of fat deposition in comparison to lean tissue in the quadriceps muscles of older adults. Combining these measures with traditional indices of muscle function may provide additional insight about the mechanical impact of intramuscular adipose tissue deposition *in vivo*.
Support: NIH R01 AG047245

303 Board #141 May 29 11:00 AM - 12:30 PM
Age-related Changes In The Passive Properties Of The Plantarflexor Muscles

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 (No relevant relationships reported)

Limited data exists examining age-related changes in the passive mechanical properties of the musculotendon unit. **PURPOSE:** To examine the influence of age on maximum range of motion (MROM), peak passive torque (PT_{pass}), and the dissipative coefficient (DC). **METHODS:** Twenty-one young (20.3 ± 2.4 yrs) and 14 older (69 ± 3.1 yrs) men completed MROM and isometric strength (for EMG normalization) assessments of the plantarflexors, following ultrasonography of the gastrocnemii. Muscle cross-sectional area (CSA) and subcutaneous fat corrected echo intensity (EI) of the gastrocnemii were determined as the sum and average of both muscles, respectively. Participants were seated in a calibrated dynamometer, with their leg fully extended and ankle and foot held in a custom steel foot plate. MROM assessments were performed by dorsiflexing the ankle at $5^\circ s^{-1}$ from 10° of plantarflexion to the participants maximally tolerated ROM. PT_{pass} , loading, unloading, and the DC were calculated during the initial 80% of MROM. Independent samples *t*-tests were used to examine group differences. A Pearson's correlation coefficient was used to determine the relationship between PT_{pass} and MROM. Analyses of covariance (ANCOVAs) were used to determine age-related differences in loading and unloading, while controlling for MROM. Additional ANCOVAs were used to determine the age-related difference in DC, while controlling for CSA and EI, respectively. An alpha level of 0.05 was used to determine statistical significance. **RESULTS:** The PT_{pass} , MROM, loading, and unloading ($P \leq 0.046$) were greater in the younger men, whereas the DC and EI ($P \leq 0.024$) were greater in the older men. When accounting for MROM, unloading ($P = 0.044$) remained significantly different between groups, while there was no difference between groups for loading ($P = 0.223$). When accounting for CSA, differences between groups for the DC remained ($P = 0.028$), while there were no longer differences between groups when accounting for EI ($P = 0.120$). PT_{pass} was also strongly related to MROM ($r = 0.755$, $P < 0.001$). Mean EMG amplitude values across muscles was 1.61% MVC. **CONCLUSIONS:** Older men exhibited lower MROM and greater DC, which may be explained by an altered stretch tolerance and qualitative changes (i.e. non-contractile tissue accumulation) in aged skeletal muscle, respectively.

304 Board #142 May 29 11:00 AM - 12:30 PM
Longevity and Physical Vitality during Aging Altered by Adipose-derived Mesenchymal Stem Cell-Lysate Injection

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Background: Adipose-derived mesenchymal stem cell (MSC)-lysate injection effectively decreases body weight and improves glucose tolerance in mice on a high-fat diet. **Purpose:** To determine whether lifelong injection of MSC can minimize age-dependent decline in physical vitality and increase longevity in naturally aging rats. **Methods:** Rats were sex-balanced and randomly assigned into the vehicle-injected group ($N = 46$) and the MSC lysate injected group ($N = 46$). We measured body composition by dual energy X-ray absorptiometry (DEXA), spontaneous locomotor activity, and longevity in rats maintained on a normal diet and received an intermittent treatment of human adipose-derived MSC lysate (3 times a week, 11 times a month given every second month), starting at 12 months of age until natural death. Although our data agreed with previous observation on fat loss and marginally improved insulin resistance index subservient to long-term MSC lysate treatments, there was a shortened average lifespan, a longer inactive time, and a greater bone loss with a relative increase in lean mass compared with the vehicle-injected counterparts. **Conclusion:** Tissue renewal in multicellular systems requires regeneration after destruction. The results of the study implicate that simply enhancing regenerative signals from MSC does not beneficial and appear to be harmful for physical vitality and longevity.

305 Board #143 May 29 11:00 AM - 12:30 PM
Aging Alters NAD⁺, Sirtuins and Targeted Protein Levels and Acetylation in the Mouse

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Sufficient intracellular NAD⁺ is required for mitochondrial function and skeletal muscle health during aging. Sirtuins (SIRT), the major NAD⁺-consuming enzymes, regulate mitochondrial function via deacetylating transcription factors and enzymes such as PGC-1 α and GCN5, whereas Poly [ADP-ribose] polymerase 1 (PARP-1), the competing enzyme with SIRT for consuming NAD⁺, is activated by DNA damages during aging, leading to depletion of cellular NAD⁺. Lowered NAD⁺ may dysregulate SIRT and induce hyperacetylation of its target proteins. Thus, it is important to know how aging impacts on NAD⁺ pool and its consuming enzyme levels in the skeletal muscle. **PURPOSE:** To investigate the effect of aging on NAD⁺ and protein levels of SIRT, PARP-1, GCN5, and PGC-1 α as well as protein acetylation (AC) in mouse muscles. **METHODS:** C57BL/6J mice at the age of 6 mo (young, Y; $N=8$), 12 mo (middle, M; $N=8$), and 24 mo (old, O; $N=8$) were used. Quadriceps (Q), gastrocnemius (G), and heart (H) muscles were collected for colorimetric assay and Western blotting to quantify NAD⁺ and proteins levels of various enzymes. **RESULTS:** Aging decreased nuclear NAD⁺ by 60 and 50% ($p < .05$) in the G, and by 60 and 70% ($p < .05$) in the Q of M and O, respectively. SIRT1 in G and Q increased by 3.1-fold ($p < .01$) and 1.4-fold ($p < .05$) with aging, whereas aging had no effect on SIRT1 in H. SIRT3 increased 1.3 ($p < .05$), 2.2 ($p < .01$), and 1.5-fold ($p < .05$), respectively, in G, Q and H of O. SIRT5 was increased by ~4.8-fold ($p < .01$) in G and Q of both M and O, but not in H. Aging increased SIRT6 by ~2.4-fold ($p < .01$) in G and Q, whereas the level was decreased by 50% in H. PGC-1 α was increased in G of M (1.7-fold, $p < .01$) and H of O (2.2-fold, $p < .01$) vs. Y. GCN5 decreased 30% in the Q of O ($p < .01$), but increased by 2.6 and 2.9-fold ($p < .01$) in the H of M and O, respectively. Aging increased PARP-1 by 80% in G of M ($p < .01$), and by 40 and 90% in H of M and O ($p < .01$), respectively, but decreased by 40% in Q of O vs. Y. Cleaved-PARP-1 and AC were increased in all muscles with aging ($p < .01$). **CONCLUSION:** Aging decreased NAD⁺ pool, whereas SIRT, GCN5, PARP-1, and AC were increased with aging. Decreased level of NAD⁺ and increased levels of NAD⁺-consuming enzymes in aged muscles may intensify the competition among enzymes for utilizing NAD⁺, which can contribute to age-associated mitochondrial dysfunction and muscle atrophy.

306 Board #144 May 29 11:00 AM - 12:30 PM
Comparison of Strength and Cognitive Performance in Elderly Individuals Aged 60 To 70 Years

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Current literature indicates that positive results were obtained on strength, hypertrophy, power, and cognitive performance when strength training protocols were chronically applied in the elderly. Twelve weeks appears to be enough to improve strength and cognitive performance. On the other hand, the age range was large, starting with 60 years through 90 years old in the same study. **PURPOSE:** The purpose of this study was to examine if elderly individuals aged 60 years old to less than 70 years old presented different responses in strength and cognitive performance after 12 weeks of a strength training program. **METHODS:** Thirty elderly women were separated into a control group (CG) ($n=7$), 60 years old group (G60) ($n=14$) and 70 years old group (G70) ($n=9$). The participants had body mass, height, upper lean limbs (ULL), lower lean limbs (LLL), and cognitive performance measured after answered the Montreal Cognitive Assessment (MoCA). The data was analyzed via a one-way ANOVA with $p \leq 0.05$. **RESULTS:** The CG indicated a difference between the G60 and G70 ($p=0.05$) for ULS, LLS, and MoCA, while G60 and G70 had no significant differences in strength capacity and cognitive performance. **CONCLUSIONS:** After 12 weeks of a strength training program all groups improved strength capacity and cognitive performance compared to CG, however no differences were observed between G60 and G70.

- 307** Board #145 May 29 11:00 AM - 12:30 PM
Relationships Among Skeletal Muscle Satellite Cells, Capillarization, And Vo2peak In Older Adults
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PURPOSE: A reduction in satellite cells has been reported to contribute to muscle loss with aging. Exercise presents a powerful strategy to stimulate satellite cells, however, to what extent various forms of exercise stimulate skeletal muscle satellite cells in older adults is less understood. The purposes of this study were to 1) examine relationships of satellite cell density, capillary density, and VO₂peak in older adults, and 2) identify changes in satellite cell density following two different intensities of aerobic exercise.

METHODS: In a counter-balanced, cross-over design, six older adults (4M, 2F; 67±2yr; BMI: 26.6±2.0 kg·m⁻²) completed an acute bout of high-intensity interval (HIIE; ten, 1-min intervals, 85-95% heart rate max, 1-min rest between intervals) and moderate intensity continuous cycling (MOD; 30-min, 60-65% VO₂peak), separated by ~1 week. Muscle biopsies (*vastus lateralis*) were obtained before exercise and 24h after each exercise bout. Immunofluorescence was used to identify myosin heavy chain (MHC), satellite cells, and capillaries. **RESULTS:** A significant relationship between capillary density and satellite cell density (P=0.018; R²=0.789) was observed. Significant correlations were also found between satellite cell density and VO₂peak (P<0.001; R²=0.99), capillary density and VO₂peak (P=0.019; R²=0.785), satellite cells/MHC I fiber and VO₂peak (P=0.026; R²=0.750), and satellite cells/MHC II fiber and VO₂peak (P=0.002; R²=0.93) at baseline. Total satellite cells/fiber and fiber type-specific satellite cells/fiber were unchanged in response to acute MOD or HIIE (P>0.05) and no differences were observed between exercise trials (P>0.05).

CONCLUSIONS: These data reveal positive relationships between capillaries and satellite cell density in skeletal muscle of older adults. Further, while no changes in satellite cell density were observed 24h following acute MOD or HIIE, our preliminary findings suggest an association between satellite cell density and VO₂peak in older adults. Thus, future research is needed to examine whether these exercise strategies differentially impact changes in proliferation or differentiation of satellite cells in older adults, and to what extent capillary density may be related to chronic adaptations in satellite cell density and VO₂peak.

- 308** Board #146 May 29 11:00 AM - 12:30 PM
Predicting Prevalence and Mortality in Female Mice Using The Mouse Frailty Phenotype
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Frailty is a clinical syndrome associated with adverse health outcomes. Preclinical studies are important in the identification of the underlying mechanisms contributing to frailty. Interestingly, previous preclinical studies focused on male rodents with minimal attention to female rodents.

PURPOSE: The two purposes of this study were to identify the prevalence of frailty across the lifespan in female mice, and to determine if frailty status at a younger age predicts mortality. **METHODS:** Female C57BL/6J (n=29) were used. Starting at 17 months of age, mice were assessed using a frailty phenotype that consisted of 5 criteria, including body weight, walking speed (Rotarod), strength (grip strength), endurance (treadmill) and physical activity (voluntary wheel running). Mice were tested every three months across their lifespan using the frailty phenotype. The designated cut-off points for each frailty criterion, using 20 months of age characteristics, were set using the top 20% for body weight and bottom 20% for the other 4 criteria. Mice with 3 or more positive frailty markers were identified as frail, mice with 2 markers were identified as pre-frail and mice with 1 or no positive marker were identified as non-frail. **RESULTS:** The mean survival age was 28.1 months, with the first and last mouse dying at 21.1 and 34.3 months, respectively. Prevalence of frailty increased across the lifespan. At 17 months of age, there is evidence of pre-frail and frail mice. Frail mice steadily increased up to 66.7% at 32 months. Non-frail mice steadily decreased to 18.2% at 29 months. Beyond 29 months, no mouse was identified as non-frail. The percentage of pre-frail mice increased and peaked at 26 months (36.8%). Following 29 months this percentage declined, with 18.2 and 33.3% of mice being identified as pre-frail at 29 and 32 months. Frail/pre-frail and non-frail mice had mean survival ages of 26.9 months and 29.0 months, respectively. Frailty status predicted mortality with the non-frail mice living longer than the frail/pre-frail mice (P=0.037). **CONCLUSIONS:** Using a mouse frailty phenotype, we are able to identify

that the prevalence of frailty in female mice increases across the lifespan. In addition to predicting mortality, this frailty phenotype has potential to yield information about underlying mechanisms contributing to frailty.

A-48 Free Communication/Poster - Joint Health and Arthritis

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

- 309** Board #147 May 29 11:00 AM - 12:30 PM
Bone Health of Patients Diagnosed With Rheumatoid Arthritis
 Sebastien Beauregard, Adriana De la Parra-Solomon, Nathan Chiarlitti, Alexe Sirois, Susan Bartlett, Ross Andersen, FACSM.
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 (No relevant relationships reported)

Rheumatoid arthritis (RA) is the most common type of chronic inflammatory disease in adults and often is associated with bone health problems. It is estimated that poor bone health may occur in 50% of patients. **PURPOSE:** First, to explore bone health among sedentary patients diagnosed with RA. Secondly, to explore the relationship among regional bone mineral density (BMD) with age, weight, and height. **METHOD:** Twenty-one sedentary participants with diagnosed RA whose mean age was 39.43± 18.3yrs, height was 162.56± 7.452 cm, and weight averaged 66.67± 9.07 kg. Dual energy x-ray absorptiometry (DXA) was used to measure bone health. Linear regression was used to explore relationships among age, height, weight, and BMD in RA patients. **RESULTS:** BMD of the FN and L1-L4 averaged 0.12± 1.29 SD and 0.38±1.57 SD, respectively. Mean Z-scores were 0.72± 1.43 for TB, 0.38± 1.57 for LV, and 0.12± 1.29 for the FN. In the FN region 25% of patients had Z-scores below -1 SD and 5% were below -2 SD. In the LS 20% has Z-scores below -1 SD and 45% were below 0 SD. Additionally, no significant relationships were observed among BMD, age, weight, and height. **CONCLUSION:** These findings suggest that a great range of variability in bone health exists in RA patients. Furthermore, healthcare professionals should monitor bone health in the RA population and future interventions should explore the effects of tailored exercise programming to simultaneously improve bone health and well-being.

- 310** Board #148 May 29 11:00 AM - 12:30 PM
Cells Progenitors Potential In Cartilage: Changes From Moderate To Severe Oa
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Cells progenitors potential in Cartilage: Changes from moderate to severe OA
PURPOSE: Recent data suggests that osteoarthritic (OA) cartilage contains mesenchymal progenitor cells (MPC) with multi – differentiation potential. Yet, there is limited information concerning how their prevalence changes with disease stages. Herein, we explore presence, prevalence and differentiation potential of MPC cells isolated from different OA grades. **METHODS:** Human osteoarthritic tibial plateaus were obtained from 25 patients undergoing total knee replacement. Each sample was classified as mild, moderate or severe OA according to OARSI scoring. The mRNA expression levels of CD105, CD166, Notch 1, Sox9, Acan, Col II A1 and Col I A1 were measured at day 0, day 14 (2 weeks in vitro) and day 35 (after chondrogenesis). At D35, the pellets matrix composition was tested on formation of proteoglycan, collagen II and I by HES and Immunofluorescence. **RESULTS:** Cells from all OA grades significantly increased MPC markers mRNA with in vitro expression. Proliferated cells expressed MPC specific antigens: CD105, CD166, CD73, CD90, Notch – 1 and Nucleostemin. The chondrogenesis induced decrease in CD105, Notch 1 and Sox9 mRNA only in mild and moderate OA. Yet, only moderate OA – derived pellets revealed significantly high levels of proteoglycans and hyaline cartilage marker – collagen II and low expression of fibrocartilage marker – Collagen I at both mRNA and protein level. **CONCLUSION:** A novel finding emerges from our data confirms differences in MPC potential between OA grades. Only moderate OA – derived cells were able to form hyaline – like matrix.

- 311** Board #149 May 29 11:00 AM - 12:30 PM
Correlation between Generalized Joint Hypermobility and Chronic Musculoskeletal Pain in College Students
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 (No relevant relationships reported)

The main complaint of patients with benign joint hypermobility syndrome (BJHS) is chronic musculoskeletal pain (MSP) that may affect their daily activities, leading to a decreased quality of life. While some studies support an association between generalized joint hypermobility (GJH) and MSP in children and adolescents, there is no published study yet looking into a correlation of GJH and MSP in a college-aged population in the US. **PURPOSE:** To determine whether young adults with generalized joint hypermobility are more likely to suffer from chronic musculoskeletal pain. **METHODS:** Undergraduate students studied the general structure of joints and range of motion, including joint hypermobility, before completing a survey that included questions about chronic musculoskeletal pain and the severity of pain. They worked in groups to evaluate each other's joints for hypermobility under supervision by the research team. **RESULTS:** Overall, 20.8% of 654 participants showed GJH based on a cutoff Beighton score of ≥ 4 . Women had statistically significant higher rates of GJH (23.9%) than men (12.2%) (Wald Test, $DF = 1$, Chi-square = 10.049, $P = 0.0015$; odds ratio female to male: 0.44). Ninety four of 650 participants (14.4%) recalled chronic joint pain. The most commonly named joints were knee ($n = 59$), shoulder ($n = 17$), hip ($n = 14$), ankle ($n = 9$), and elbow ($n = 7$). Male and female participants with GJH reported higher rates of chronic joint pain than participants without GJH. There was, however, no significant difference (Pearson Chi-square Test, Chi-square = 1.386, $p = 0.5001$, $n = 650$). The prevalence of chronic neck/back pain in our study was 20.8%. Participants with GJH reported higher rates of chronic back/neck pain, yet, the difference was not statistically significant (Pearson Chi-square Test, Chi-square = 3.850, $p = 0.1459$, $n = 650$). The average pain intensity on a scale from 0 to 10 was more or less the same for both types of chronic pain (4.5 for chronic joint pain, 4.2 for chronic neck/back pain) and for respondents with and without GJH. The ranges for the reported pain intensity as well as the standard deviations for all averages were also very similar. **CONCLUSION:** Young adults with GJH are not reporting higher rates of chronic pain in joints, the neck or the back nor do they suffer from more severe pain than their peers without GJH.

A-49 Free Communication/Poster - Physiologic Applications in Skeletal Muscle

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

- 312** Board #150 May 29 11:00 AM - 12:30 PM
Association between Muscle Carnosine Content and Changes in Muscle Cytokines following Lower-Body Resistance Exercise
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 (No relevant relationships reported)

PURPOSE: Carnosine has a pluripotent role in skeletal muscle (SkM) physiology, enhancing intracellular buffering and acting as an antioxidant, antiglycating and ion-chelating agent. Carnosine also acts as a diffusible Ca^{2+}/H^{+} exchanger. Cytokines mediate the inflammatory response to exercise-induced muscle damage. Carnosine's role as a physiochemical buffer and antioxidant may affect SkM cytokine production. Therefore, the purpose of this study was to assess the association between SkM carnosine content and cytokine production following a lower body resistance exercise session.

METHODS: Ten recreationally active men completed a lower body resistance exercise protocol consisting of the squat, leg press, and leg extension exercises. SkM biopsies were obtained from the vastus lateralis at baseline (BL), one hour (1H), and five hours (5H) post-resistance exercise. SkM Carnosine content was assessed via high performance liquid chromatography. Multiplex signaling assay kits were used to quantify SkM cytokines (GCSF, GMCSF, IL-1ra, IL-6, IL-8, MCP-1, TNF- α), and fold changes from BL were calculated. Associations were assessed with Pearson bivariate correlations, with significance set at $\alpha \leq 0.05$.

RESULTS: Carnosine content was not significantly associated with 1H and 5H changes of GCSF ($r = 0.257$, $p = 0.473$; $r = 0.254$, $p = 0.479$, respectively), GMCSF ($r = -0.285$, $p = 0.426$; $r = -0.431$, $p = 0.214$, respectively), IL-1ra ($r = -0.019$, $p = 0.962$; $r = 0.126$, $p = 0.747$, respectively), IL-6 ($r = -0.192$, $p = 0.596$; $r = -0.011$, $p = 0.977$, respectively), MCP-1 ($r = -0.491$, $p = 0.150$; $r = 0.147$, $p = 0.685$, respectively), or TNF- α ($r = -0.050$, $p = 0.899$; $r = -0.239$, $p = 0.537$, respectively). However, a trend for a significant positive correlation was noted for IL-8 at 5H ($r = 0.705$, $p = 0.051$), but not at 1H ($r = 0.044$, $p = 0.918$).

CONCLUSIONS: SkM Carnosine content was not associated with the change in GCSF, GMCSF, IL-1ra, IL-6, MCP-1, or TNF- α following resistance exercise. However, a trend for a significant positive association was observed for IL-8 at 5H and carnosine content. IL-8 and carnosine are involved in the histamine response to stress and intracellular Ca^{2+} handling, which may explain the observed relationship. Further research is required to discern the observed correlation.

- 313** Board #151 May 29 11:00 AM - 12:30 PM
Redefining Physiologic Predictors of Endurance Performance with Measures of Skeletal Muscle Oxygenation: E pluribus unum
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Reported Relationships: P.M. Batterson: Consulting Fee; Moxy Monitor, Fortiori Design, LLC.

PURPOSE: To scrutinize the ability of classic measures of endurance performance vs. NIRS-derived measures of skeletal muscle oxygenation to predict 25 km cycling time trial performance. **METHODS:** 14 participants (4 f / 10 m) underwent 3 sequential exercise bouts on a cycle ergometer while fitted with NIRS devices over each vastus lateralis: 1) A warmup consisting of 2 sequential 7.5-min bouts of 50 and 100 W at 80 rpm to determine gross efficiency (GE), exercise economy (EC), and delta efficiency (DE) across the same absolute workloads followed by an incremental max test to volitional fatigue (VF) used to discern 3 separate measures of ventilatory threshold (VT), maximal rates of whole-body oxygen consumption (VO_{2max}) and maximal aerobic power (W_{max}); 2) A warmup consisting of 2 sequential 7.5-min bouts at 80 rpm corresponding to 15% and 30% W_{max} for GE, EC, and DE across the same relative workloads followed by a 60 sec ramp to a sustained 110% W_{max} until VF to verify VO_{2max} ; and 3) A 25 km TT. Ventilatory measures were sampled throughout bouts 1 and 2. **RESULTS:** Stepwise and multiple linear regression analyses revealed that from the classic variables only mean VT_{VO2} (2.59 ± 0.53 l $O_2 \cdot min^{-1}$, $p = 0.019$) and EC at 15% W_{max} (47 ± 10 W, $p = 0.030$) explained (adj $R^2 = 0.463$; $p = 0.013$) 25 km TT performance ($46:40 \pm 04:36$ min:sec) variance whereas the change in skeletal muscle oxygenation (ΔSmO_2 ; $-6.9 \pm 6.1\%$; $p = 0.001$) from 50 to 100 W and the deoxygenated hemoglobin and myoglobin index (HHb) at W_{max} (9.57 ± 1.56 ; $p = 0.044$) were the best NIRS-derived variables to describe TT performance (adj $R^2 = 0.751$; $p < 0.001$). When combining all variables, skeletal muscle measures provided a superior physiologic explanation of 25 km TT performance versus those classically used to describe endurance performance (VT_{VO2} , EC @ 15% W_{max} , HHb $_{max}$, and ΔSmO_2 at $p = 0.083$, 0.056, 0.008, and 0.005, respectively). **CONCLUSION:** These results demonstrate that measures reflecting the balance of skeletal muscle O_2 delivery and utilization during exercise are superior to classic measures of whole-body aerobic capacity, ventilatory threshold, and/or the efficiency of exercise at predicting 25 km time trial (TT) cycling performance.

- 314** Board #152 May 29 11:00 AM - 12:30 PM
Western Diet-Induced Obesity Does Not Cause Diaphragm Muscle Abnormalities
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 (No relevant relationships reported)

Purpose: Obese individuals demonstrate ventilatory abnormalities at rest and during exercise, which may reflect inspiratory (diaphragm) muscle weakness. Several studies have shown diaphragm abnormalities in genetically obese animal models. However, the effects of an obesogenic diet on the diaphragm are not well defined. The purpose of this study was to determine if a Western diet (high-saturated fat, high-sugar: HFHS) causes diaphragm muscle pathology, perhaps related to oxidative stress.

Methods: Adult male Wistar rats were randomly allocated to one of two ad libitum diets for 24 weeks: healthy control ($n = 8$) or HFHS diet ($n = 8$). Diaphragm muscle then underwent i) in vitro contractile function assessment, ii) histology and immunohistochemistry for determination of fibrosis and fiber cross-sectional area (CSA) and iii) analysis of mitochondrial reactive oxygen species (ROS) emission. Data are mean \pm SE.

Results: We previously reported that HFHS diet did not impair diaphragm maximal specific force or peak power. Alongside this maintenance of contractile function, HFHS-fed rats did not differ in diaphragm muscle interstitial fibrosis (in %: lean 3.4 ± 0.8 , HFHS 2.7 ± 1.7), type I fiber CSA (in μm^2 : lean 1954 ± 121 , HFHS 2174 ± 103), type IIa fiber CSA (in μm^2 : lean 2062 ± 329 , HFHS 2412 ± 155), or type IIb/x fiber CSA (in μm^2 : lean 4165 ± 1232 , HFHS 4523 ± 526). Additionally, no shifts in fiber type occurred. Interestingly, HFHS diaphragm demonstrated a trend toward a lower succinate-induced increase in ROS emission (in pmol/min : lean 1.313 ± 0.2 , HFHS 0.73 ± 0.2 , $p = 0.09$). Analyses of glutathione and antioxidant enzymes are ongoing. **Conclusion:** A high-saturated fat, high-sugar diet did not induce diaphragm muscle dysfunction or morphological changes. These results, combined with our previous findings of normal contractile function, suggest that intrinsic diaphragm muscle abnormalities do not contribute to breathing difficulties in obesity.

315 Board #153 May 29 11:00 AM - 12:30 PM
Anabolic Signaling Phosphorylation Does Not Explain Differential Muscle Protein Synthesis with Intra-Set Rest Manipulation

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 (No relevant relationships reported)

Power development is imperative for dynamic sport athletes. Cluster sets (CLU) are an effective method to allay the progressive decrement in power output normally observed in a traditional (TRD) resistance exercise strategy. CLU configurations incorporate a brief intra-set rest period to preserve velocity and power. Despite favorable performance, we previously established that TRD configurations elicit higher myofibrillar protein synthesis (MPS) rates when compared to CLU. However, it remains unclear if hallmark readouts related to mTORC1-signaling underlie this observation.

PURPOSE: To elucidate anabolic signaling mechanisms driving differential MPS rates observed between CLU and TRD paradigms of the barbell back squat in trained men and women.

METHODS: In randomized crossover design, 8 resistance-trained adults (7M, 1F; 23 ± 4 y; LBM, 63 ± 9 kg; back squat 1RM, 150 ± 26 kg) performed an acute bout of either CLU (4 sets \times (2 \times 5) repetitions, 30s intra-set rest, 90s inter-set rest) or TRD (4 sets \times 10 repetitions, 120s inter-set rest) barbell back squats at $\sim 70\%$ 1RM. Volume load and total rest were matched between bouts. Participants ingested 20g of whey protein immediately before and after exercise. Muscle biopsies were collected at rest and at 0, 2, and 5 h post-exercise during primed-continuous L-[ring-¹⁴C]-phenylalanine infusions. Total and phosphorylated states of targeted proteins were assessed through immunoblotting. Data was normalized to an internal loading control.

RESULTS: The phosphorylation of focal adhesion kinase (FAK) was doubled with TRD, but not significantly different, from CLU (TRD 2.1 ± 0.9 -fold increase from baseline; CLU 1.3 ± 0.9 -fold; $p > 0.05$). Downstream targets of mTORC1 also showed no differences in phosphorylation between paradigms (4E-BP1: TRD 1.6 ± 0.3 -fold, CLU 0.4 ± 0.2 -fold; p70S6K: TRD 1.5 ± 0.4 -fold, CLU 0.9 ± 0.4 -fold). Similarly, there was no difference in AMPK phosphorylation between conditions (TRD 1.3 ± 0.9 -fold; CLU 0.9 ± 0.7 -fold).

CONCLUSION: Our data demonstrated that changes in protein phosphorylation as noted by various readouts within the mTORC1 pathway do not underpin the greater post-exercise muscle protein synthetic response with TRD versus CLU-style in resistance trained men and women.

316 Board #154 May 29 11:00 AM - 12:30 PM
Resistance Exercise-Induced Hormonal Response Promotes Satellite Cell Proliferation in Untrained Men

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 (No relevant relationships reported)

Evidence suggests that resistance exercise (RE)-induced transient release of anabolic hormones can be beneficial for muscle adaptation (e.g. muscle size, strength); however, no prior research appears to have investigated the effect of the RE-induced hormonal response on satellite cell (SC) proliferation and differentiation, an important step in any such muscle adaptations. **Purpose:** To determine the effect of transient resistance exercise (RE)-induced hormonal changes on satellite cell myogenic state following eccentric exercise. **Methods:** Untrained men ($n=10$, 22 ± 3 y) and women ($n=9$, 21 ± 4 y) completed 2 sessions of 80 unilateral maximal eccentric knee extensions followed by either an upper body RE protocol (EXE) or a 20-min rest (CON). Muscle samples were collected and analyzed for protein content of Pax7, MyoD, myogenin, cyclin D1, and

p21 before exercise (PRE), and 12 hours (+12h) and 24 hours after the session (+24h). Serum testosterone, growth hormone, cortisol, and myoglobin concentrations were measured at PRE, immediately after eccentric knee extension (IMD), immediately after (IP), 15, 30, and 60 min after the session. **Results:** Testosterone was significantly ($p < 0.05$) higher immediately after the session in EXE (6.34 ± 0.48 ng·mL⁻¹) than CON (4.87 ± 0.26 ng·mL⁻¹) for men. A significant time \times gender \times condition interaction was found for MyoD with 20.1 ± 10.8 -fold increase for EXE in men and 21.9 ± 7.6 -fold increase for CON in women at +12h compared to PRE. A significant time \times condition interaction was found for Pax7 with 0.8 ± 0.1 -fold decrease for EXE and 1.6 ± 0.3 -fold increase for CON at +24h compared to PRE. A significant time effect was found for myogenin, p21, and cyclin D1. Myogenin (+12h: 5.9 ± 1.5 -fold; +24h: 5.0 ± 1.1 -fold) and p21 (+12h: 25.4 ± 4.5 -fold; +24h: 12.4 ± 1.9 -fold) were increased at +12h and +24h and Cyclin D1 was 6.6 ± 1.9 -fold increased at +12h compared to PRE. **Conclusion:** These results suggest that the RE-induced hormonal response can be important to promote SC proliferation for men but not women. In addition, markers of SC differentiation appeared to be unaffected by the hormonal response but were increased in response to the knee eccentric exercise protocol. Supported in part by a grant from the National Strength and Conditioning Association Foundation

317 Board #155 May 29 11:00 AM - 12:30 PM
Contralateral Repeated Bout Effect of Elbow Flexors Not Observed in Young Women

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 (No relevant relationships reported)

Previous studies have reported that a prior bout of damaging exercise with one limb attenuated the magnitude of muscle damage in the subsequent damaging exercise with the contralateral limb, a phenomenon called contralateral repeated bout effect (CL-RBE). To our knowledge, these studies involved either exclusively men or a mixture of both sexes.

PURPOSE: To determine whether contralateral repeated bout effect of elbow flexors exists in women. **METHODS:** Twelve healthy women (20.9 ± 2.5 yrs) performed two bouts of 45 maximal eccentric contractions (ECC) of elbow flexors separated by 14 days. The isokinetic muscle strength (60°/sec) was measured pre-exercise, immediately post-exercise, and at 24 and 48 h post-exercise. Limb girth, range of motion (ROM), and muscle soreness were measured pre-exercise, and at 24 and 48 h post-exercise. Surface Electromyography (EMG) was recorded during both exercise bouts from the biceps brachii muscle. Data of all variables were analyzed using two-way repeated measures ANOVA (Bout \times Time) except that of median frequency of EMG which was analyzed via paired t-test.

RESULTS: The isokinetic strength was significantly reduced after the eccentric exercise for both bout 1 ($-19.3 \pm 17.4\%$, $P < 0.01$) and bout 2 ($-15.3 \pm 15.2\%$, $P < 0.01$). Significant main effects of time were also observed for muscle soreness and ROM. Limb girth did not change significantly after either exercise bout. There were no significant differences between bouts for all the measured variables.

CONCLUSION: The CL-RBE of elbow flexors was not evident in healthy young women, which is probably because the magnitude of the muscle damage induced by the first exercise bout was not sufficient to induce protective adaptation for the contralateral arm in the second bout.

318 Board #156 May 29 11:00 AM - 12:30 PM
Tissue Hemodynamics of Skeletal Muscle and Prefrontal Cortex is Related to Rowing Time Trial Performance

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 (No relevant relationships reported)

Near-infrared spectroscopy (NIRS) is a non-invasive method for measuring tissue concentrations of oxy- (HbO₂) and deoxyhemoglobin (Hb) providing information about local metabolism, tissue-specific oxygen availability, and blood flow. Time-resolved NIRS can quantitatively measure absolute hemoglobin concentrations in tissue. Its ability to separate light absorption from scattering makes it an ideal tool for measuring tissue hemoglobin levels where there may be large changes in blood volume such as with exercise. Furthermore, it has been hypothesized that blood flow and oxygenation to the prefrontal cortex (PFC) may be related to fatigue. **PURPOSE:** To quantify tissue oxy- and deoxyhemoglobin (Hb) concentrations in the vastus lateralis (VL) and (PFC) during a 2,000 m ergometer time trial test with collegiate rowers. **METHODS:** Eighteen collegiate club rowers (11 males and 7 females, 20.33 ± 1.65 years, $\text{VO}_{2\text{max}} 42.77 \pm 7.62$ mL/kg/min.) performed a maximum 2,000 m test on a Concept 2 ergometer. A two-channel time-resolved NIRS instrument (TRS-21, Hamamatsu) was used to assess tissue HbO₂, Hb, and total hemoglobin (tHb) of the right VL and PFC. **RESULTS:** Average time to complete the 2,000 m time trial was 475.4 ± 44.37 seconds. A significant correlation was observed for

the 2,000 m ergometer test and VO₂max (Pearson $r = -0.523$; $p = 0.045$). Exercise reduced HbO₂ ($p = 0.0063$) and increased Hb ($p = 0.0038$) compared to baseline in the VL with tHb remaining unchanged ($p = 0.0677$). No changes were observed during exercise in the PFC except for an increase in tHb ($p < 0.0001$). The magnitude of change in VL tissue oxygenation (HbO₂) was correlated with the time to complete the time trial with a faster time relating to a greater reduction in VL HbO₂. Similarly, the magnitude of change in VL deoxygenated hemoglobin (Hb) trended towards a greater increase in concentration with a faster time trial (Pearson $r = -0.4422$, $p = 0.0661$). **CONCLUSION:** Exercise during a 2,000 m rowing time trial test resulted in decreased HbO₂ and increased Hb levels in the VL compared to baseline which was correlated with performance on the time trial. Total hemoglobin was found to increase in the PFC which may represent increased fatigue that occurs due to the maximal nature of the time trial.

319 Board #157 May 29 11:00 AM - 12:30 PM
Calf Muscle Endurance and Gait Variability among Older Adults
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Declines in skeletal muscle functions are associated with aging which affects daily activities and quality of life. Fall risk and fall-related injuries are related to muscle fatigability among older adults. **Purpose:** Measure calf muscle endurance and gait function in older adults. We hypothesize that gait abnormalities will be associated with reduced calf muscle endurance. **Methods:** Ten participants ages 55-80 years volunteered for the study. Skeletal muscle endurance was measured on the calf muscle of the participant's right leg at 2Hz, 4Hz and 6Hz using previously established protocol. Selected gait measurements (stride length, left/right ratio step length, %CV of step length, stride width) were recorded on three trials at self-selected speed on a 20foot gait mat (Protokinetics Zeno walkway). Pearson's r was used to test the relationship between the selected gait variables and endurance index at 6Hz. ANOVA Levene's test of covariance was used to test the difference in the variance in step length of both legs. Significance was accepted at 0.05 alpha level **Results:** Muscle endurance at 6Hz ($0.75 \pm 0.21\%$) varied from 0.3% to 1.0%. Stride length ($145\text{cm} \pm 11\text{cm}$) varied from 127.4cm to 168.5cm and step length ($1.0\text{cm} \pm 0.06\text{cm}$) varied from 64.6cm to 82.7cm. There was a positive correlation between endurance index and stride length ($r = 0.68$, $p = 0.02$), and the right/left ratio step length ($r = 0.72$, $p = 0.01$) but there was no significant relationship between endurance index and step width ($r = -0.43$, $p = 0.11$). A Levene's test verified equality of variances in step length %CV of both legs ($p = 0.84$). **Conclusions:** Muscle endurance in the calf was associated with some selected gait parameters which have been shown to predict increase fall risk among older adults.

320 Board #158 May 29 11:00 AM - 12:30 PM
Effects Of Rate Of Force Production On Vastus Lateralis Pennation Angle During Isometric Squats And Knee Extensions
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Previous literature has shown that force exerted by muscle is closely related to its size, length (i.e. joint angle) and pennation angle (PA). For a mono-articular muscle such as the vastus lateralis (VL), its ability to produce maximal force is dependent on the joint angle of the knee. However, since the VL shares a joint action with a bi-articular muscle, the rectus femoris (RF), it's possible that its performance may also be affected by the angle of the hip (i.e. the RF contribution to knee extension is hip angle dependent, which may influence VL performance as well). It is unknown how the pennation angle of the VL during contraction differs between maximal multi- and single-joint exercises, such as the isometric squat (SQ) and knee extension (KE), and whether those changes are dependent on the rate of the force production. **PURPOSE:** To examine the pennation angle of the VL during slow and rapid maximal force production of the isometric SQ and KE exercises. **METHODS:** Fifteen lower-body resistance trained males (mean \pm SD age = 24 ± 3 yrs) performed two separate maximal voluntary contractions (MVC) for both SQ and KE exercises. The first MVC (MVC1) cue was used to elicit peak force, with no instructions on the rate, while the 2nd (MVCR) was used to elicit rapid force production. Knee joint angles were set at 110° during both exercises, while hip angle was $\sim 110^\circ$ and $\sim 105^\circ$ during the SQ and KE, respectively. During all MVCs, ultrasonography was used to measure pennation angle of the VL muscle at peak force production. **RESULTS:** A two-way [MVC speed (slow vs. rapid) \times exercise (SQ vs. KE)] repeated measures ANOVA indicated no significant differences in pennation angle of the VL between slow vs. rapid MVCs of the squat (mean MVC1 = $16.19 \pm 3.18^\circ$, MVCR = $16.13 \pm 3.26^\circ$) and knee extension

exercises (mean MVC1 = $16.21 \pm 2.23^\circ$, MVCR = $16.08 \pm 2.34^\circ$), nor were there any differences between the exercises ($p > 0.05$ for all analyses). **CONCLUSION:** When knee angle is controlled for, the pennation angle of the VL during isometric squats and knee extensions do not differ. Furthermore, neither the rate of force, nor the slightly different hip angles had an effect.

321 Board #159 May 29 11:00 AM - 12:30 PM
Electrical Pulse Stimulation Induced Increase In Lipid And Mitochondria Depends On Donor's Physical Activity Level
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 (No relevant relationships reported)

We have previously shown that human primary myotubes retain *in vivo* characteristics of their donors. Electrical pulse stimulation (EPS) has recently been used as an exercise mimetic in a cell culture model, and could be beneficial to understanding underlying molecular mechanisms of exercise.

Purpose: To determine if EPS induced adaptations on mitochondria and lipid content is dependent on the donor population and the duration of EPS applied.

Methods: Human primary skeletal muscle myotubes were cultured from four endurance trained athletes (23 ± 1 yrs and BMI 24.4 ± 0.9 kg/m²) and five lean healthy Caucasian donors (23 ± 1.9 yrs and BMI 24.2 ± 0.6 kg/m²). EPS was applied to pooled cells from athlete and lean donor groups for either 24 hours or 48 hours (single bipolar pulses of 1 Hz for 2 ms; 30V) and were harvested after stimulation. Control cells were maintained simultaneously and harvested alongside EPS treated cells. Lipid and Mitochondrial content were measured by fluorescent histochemical techniques, and quantified using Image J software.

Results: Myotubes cultured from athletes had a significantly greater lipid (35.68 ± 5.78 vs 0.51 ± 0.08 AU; $p < 0.0001$) and mitochondrial (108.3 ± 18.9 vs 6.9 ± 0.87 AU; $p = 0.03$) content compared to lean donors at baseline. Lipid and mitochondrial content were significantly greater in lean after 24 hours (both $p < 0.05$), but not after 48 hours (both $p > 0.05$) of EPS compared to control of EPS (Lipid: control 0.51 ± 0.08 AU, 24hr. 10.15 ± 0.79 AU, 48 hr. 6.06 ± 1.1 AU; Mitochondria: Control 6.9 ± 0.87 , 24hr. 116.9 ± 14.4 , 48 hr. 89.57 ± 12.4 AU). Lipid content did not change in myotubes cultured from athletes with EPS after 24 hours ($p = 0.8$) or 48 hours ($p = 0.4$) (Control 35.68 ± 0.51 AU, 24hr. 35.43 ± 5.12 AU, 48 hr. 25.9 ± 2.6 AU) whereas mitochondria content was significantly greater after 24 hours EPS ($p = 0.0004$) but not after 48 hours ($p = 0.8$) of EPS (control 108.3 ± 18.9 AU, 24 hr. 239.1 ± 25 AU, 48 hr. 125.1 ± 15.3 AU).

Conclusion: Primary human skeletal muscle cells cultured from athlete donors have a higher lipid and mitochondrial content compared to lean, healthy donors. EPS induced increases in lipid and mitochondrial content depends on the physical fitness of the population being studied. 24 hours of EPS stimulation seems to result in greater mitochondrial content compared to 48 hours of stimulation.

322 Board #160 May 29 11:00 AM - 12:30 PM
Whole-body Heat Shock Accelerates Recovery from a Single Blunt Trauma Contusion in Mice
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 (No relevant relationships reported)

Contusions are a common sports injury, often resulting in acute skeletal muscle contractile dysfunction. Whole-body heat shock is reported to attenuate skeletal muscle atrophy in animal models. **PURPOSE:** The purpose of this study was to test the hypothesis that whole-body heat shock attenuates contusion induced-skeletal muscle contractile dysfunction. **METHODS:** Male mice (14.4 ± 1.4 mo) were randomized to either the heat shock contusion group (HSC $n = 5$), the normal body temperature contusion group (NTC $n = 4$), or sham ($n = 3$). Under anesthesia, the *in vivo* torque-frequency relationship (1Hz-300Hz) of the anterior crural muscle group was measured in all mice. Body temperature was then raised to 41°C (HSC) or maintained at 37°C (NTC and sham) for 30 min and then all mice were allowed to recover consciousness. Twenty-four hours later all mice were anesthetized again and a single contusion (HSC and NTC) was delivered via the instrumented mass-drop technique (14.1 g steel ball was dropped through a tube from 115 cm onto an impactor directly striking the tibialis anterior) or no contusion (sham); all mice were then allowed to recover. Following 5 days of normal cage activity (5-d recovery), *in vivo* torque-frequency relationships were measured in all mice. Data were analyzed using a factorial ANOVA with an *a priori* level of significance of 0.05. Fisher's LSD pair-wise comparisons were made *post hoc*. **RESULTS:** There was a significant group-time-frequency interaction ($F = 1.791$, $p = 0.034$). Within group pairwise comparison pre to 5-d recovery revealed sham did not differ ($p = 0.529$), HSC fully recovered ($p = 0.899$), and NTC did not recover ($p = 0.001$) muscle contractile function. Within group comparison pre to 5-d

at 40hz (submaximal stimulation) and 250hz (maximal stimulation) found sham did not differ ($p=0.765$; $p=0.912$, respectively), HSC recovered ($p=0.786$; $p=0.602$, respectively), and NTC did not recover at either frequency ($p=0.001$; $p=0.006$, respectively). **CONCLUSION:** Whole body heat shock treatment prior to a single blunt trauma contusion accelerates the rate of recovery of *in-vivo* skeletal muscle contractile function within the 5-d recovery period. Funding: This work was partially supported by an Appalachian State University GRAM award.

323 Board #161 May 29 11:00 AM - 12:30 PM

The Effect of 10%O₂ Microenvironment and Electric Pulse Stimulation on Glucose and Lipid Metabolism

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(No relevant relationships reported)

PURPOSE: There is currently no successful cell contraction model in vitro. Electrical pulse stimulation (EPS) can induce muscle cell contraction. 10%O₂ microenvironment is closer to the human skeletal muscle environment. In this study, EPS was applied to myotubes to test the changes of the metabolism of glucose and lipid, and to establish successful cell contraction model in a 10%O₂ microenvironment in vitro.

METHODS: After seven days of differentiation in 5% CO₂(20%O₂) incubator, the mouse myoblast cell line C2C12 were transferred into the 10%O₂ incubator. After adaptation to the hypoxia for 12h, the myotubes were subjected to EPS. The EPS stimulation was performed for 120min each, total 4 consecutive days. And cell extracts obtained from each were prepared 3h after EPS. The content of PGC-1 α , MyHCl, MyHClIa, MyHClIb and MyHClIc were determined by ELISA. And RT-PCR analysis was applied to determine mRNA expression of PGC-1 α , MCAD, Cpt1B, GLUT1, GLUT4, PDH, LDH and GAPDH.

RESULTS: Both 10%O₂ microenvironment and EPS significantly increased the protein level of PGC-1 α , and the synergistic effect of hypoxia and EPS was more significantly. 10%O₂ microenvironment significantly decreased the content of MyHCl, MyHClIc and MyHClIa in myotubes. EPS significantly decreased the content of MyHCl and MyHClIc but significantly increased the content of MyHClIa in myotubes. 10%O₂ microenvironment significant decreased the mRNA level of GLUT1 and GLUT4. However, in stimulated myotubes, the mRNA level of GLUT1 was significantly elevated, but the RNA level of GLUT4 was decreased. Meanwhile, 10%O₂ microenvironment significantly decreases the mRNA level of MCAD, CPT1B and PDH, and EPS increased the mRNA level of MCAD.

CONCLUSIONS: 4 days of 10%O₂ microenvironment combined with EPS successfully established myotubes cell contraction model. 10%O₂ microenvironment inhibited the proliferation and glycolipid metabolism in myotubes. The usage energy of EPS-induced contraction is based on aerobic oxidation of glucose and fatty. The pulse frequency increases from 1 Hz to 2 Hz in the EPS protocol, were association with substrate from fat to glucose.

324 Board #162 May 29 11:00 AM - 12:30 PM

Assessment Of Quadricep Femoris Pennation Angle And Force Production Asymmetry In College-Aged Males

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(No relevant relationships reported)

Muscular architecture is a valuable tool for quantifying muscle function. The arrangement of muscle fibers, commonly referred to as pennation angle (PA), influences the amount of force that a muscle can produce. Levels of leg asymmetry (PA, strength, ROM, etc.) is a growing topic of interest due to its link to functional disorders, injuries, and fall risk. Hence, a better understanding of the amount of asymmetry present can serve as a guide for future researchers and practitioners when examining lower limb function and performance. **PURPOSE:** The current study examined asymmetry in pennation angle (PA) and force production (FP) in the quadriceps femoris (QF) muscle group in college aged males. **METHODS:** Thirty-eight college-aged males (22.97 \pm 2.58 yrs, 180.22 \pm 6.90 cm, 88.62 \pm 14.88 kg) were recruited to participate in this study. All measurements were taken in random order on both legs. PA's were measured using B-mode ultrasound. Three images were captured and analyzed for each muscle of the QF: the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF) and vastus intermedius (VI). QF FP was measured on two separate visits by performing 3 knee extension maximal voluntary isometric contractions (MVICs). The mean MVIC was used in data analysis. **RESULTS:** FP was significantly different between legs (31.64 \pm 103.43N, $p<0.05$) which equated to one leg being 7% stronger than the other leg. However, there was no difference in PA in any of the muscles between legs (VM, VL, RF, and VI, $p>0.05$). **CONCLUSION:** The current study revealed a significant strength asymmetry in the absence of differences in PA for

the QF muscles. These data suggest that the strength asymmetry was not due to muscle architecture differences as measured by PA. However, further research is needed in other musculature of the legs as it relates to PA and FP differences.

325 Board #163 May 29 11:00 AM - 12:30 PM
Comparison Of Effects Of Different Exercise Modes On Gastrocnemius Of Obese Rats

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(No relevant relationships reported)

Purpose: To explore the effects of different exercise patterns on gastrocnemius in obese rats.

Methods: Forty-eight SD rats were randomly divided into 4 groups, 12 in each group, which were quiet control group(Con), continuous exercise group (CE), high-intensity intermittent exercise group (HIIT) and ladder exercise group (LE). After 8 weeks of exercise training, each exercise group was anesthetized including quiet control group and samples were collected for testing. The body weight and gastrocnemius weight of each group were recorded. The cross-sectional area of gastrocnemius muscle was observed by HE staining. The levels of MSTN and insulin in serum were detected by ELISA. The expressions of MSTN, IGF1 and p70S6K in rat gastrocnemius muscle were detected by Western blot.

RESULTS: Compared with the group Con, the body weights of group CE, HIIT, LE were reduced by 13.8%,14%,10%, and the weight of the gastrocnemius muscles in group HIIT was decreased by 22%. Compared with the group Con, the gastrocnemius mass index of group CE and group LE was increased by 10.7%. Morphological observation of the gastrocnemius showed that compared with the group Con, the gastrocnemius muscle cross-section of the group LE was increased by 17%. The serum GDF8 level in the group CE was reduced by 32% than that in the group Con, and the serum insulin level in the group CE and group HIIT was decreased by 42% and 35%. Compared with the group Con, the expression of GDF8 and P70S6K protein in the gastrocnemius muscle of the group CE and group HIIT was reduced by 31%, 26%,13% and 21% respectively, while the expression of IGF1 protein in the three exercise groups was increased by 6%,40% and 190% respectively.

Conclusion: Although the three exercise modes may significantly reduce the body weight of rats, only continuous exercise and ladder exercise improve the gastrocnemius muscle mass index. Continuous exercise and high-intensity intermittent exercise had similar effects on serum GDF8, insulin, and similar effects on the proteins of MSTN, IGF1 and P70S6K in the gastrocnemius muscle, but the effects of three exercise modes on serum GDF8 and insulin and gastrocnemius MSTN, IGF1 and P70S6K proteins, laddering exercise is different from sustained exercise and High intensity intermittent exercise.

326 Board #164 May 29 11:00 AM - 12:30 PM
Pennation Angle of the Quadricep Femoris Muscles in Resistance Trained Males vs. Non-Resistance Trained Males

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(No relevant relationships reported)

Pennation angle (PA) is the orientation at which muscle fibers attach to the deep aponeurosis within a muscle. PA is measured using in-vivo methods (ultrasound) which allows researchers to observe any angle discrepancies throughout different locations in the muscle. The quadriceps femoris (QF) is a muscle group used on a daily basis. Understanding the architecture of the QF is helpful for understanding and improving performance in sports or activities which relies on running, jumping, or explosive movements. Another reason to pursue our understanding of muscle architecture is examining potential for injury. Furthermore, asymmetrical strength of the quadriceps can lead to increased risk of injuries. However, limited research has looked at muscle architecture asymmetry as it relates to injury and function. **PURPOSE:** The aim of this study was to determine the magnitude of bilateral asymmetry for PA in the QF in resistance trained (RT) and non-resistance trained (NRT) males. **METHODS:** Thirty-eight males (22.97 \pm 2.58 yrs., 180.22 \pm 6.90cm, and 88.62 \pm 14.88 kg) were recruited to participate in this study (25 were lower body RT and 13 were NRT). The first visit consisted of protocol explanation and familiarization. The following visit consisted of PA assessment of the QF muscles using B-mode ultrasound. All PA measurements were taken in random order on both legs. Three images were taken and analyzed from the vastus medialis (VM), vastus lateralis (VL), rectus femoris (RF) and vastus intermedius (VI). **RESULTS:** There was no significant group x leg effect for PA of the QF, [VM ($p=0.470$), VL ($p=0.795$), RF ($p=0.431$), VI ($p=0.563$)]. Collapsing across groups revealed a non-significant effect on asymmetry as well (all $p>0.05$). The between leg percent differences were; VM 6.08% \pm 3.65%, VL 4.84% \pm 4.1%, RF 3.87% \pm 4.0% and VI 3.53% \pm 5.87%. **CONCLUSION:** This study revealed that PA angle in the QF muscles was not significantly different between RT and NRT in males.

327 Board #165 May 29 11:00 AM - 12:30 PM
Field-based Simplified Methods For Predicting Skeletal Muscle Index In Japanese University Women

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(No relevant relationships reported)

PURPOSE: A recent study reported that the rate of 'presarcopenia' (low SMI without impact on muscle strength or physical capability) was over 30% for healthy young women in Japan. This means that the SMI assessment is particularly attentive for the healthy young women in early prevention of mobility problems and frailty. Thus, we examined if the field-based simplified methods for predicting skeletal muscle index (SMI) in Japanese university women.

METHODS: A total of 193 Japanese university freshmen women (ages 18-25 years) volunteered to participate in this study. A stepwise multiple-regression analysis (method of increasing and decreasing the variables, criterion was set at $p < 0.05$) was performed to SMI and 17 variable factors (body mass index, % body fat, waist-hip ratio, girth (mid-thigh and lower-leg), muscle thickness (anterior and posterior mid-thigh and posterior lower-leg), handgrip, knee extension, standing long jump, vertical jump, sit-to-stand test, side step test, multi-stage 20-m shuttle run test, two-step test, sit and reach).

RESULTS: Twelve of 17 variables was correlated ($P < 0.05$) with SMI. There was excellent relationship between mid-thigh girth and SMI ($r = 0.81$, $P < 0.001$). The prediction equations were highly correlated with SMI ($R^2 = 0.64$ for step 1 [$SMI = 0.11 \times \text{thigh girth (cm)} + 0.71$] and $R^2 = 0.90$ for step 7 [$SMI = 0.02 \times \text{thigh girth (cm)} - 0.07 \times \text{body fat (\%)} + 0.22 \times \text{BMI (kg/m}^2\text{)} + 0.02 \times \text{handgrip (kg)} + 0.04 \times \text{lower leg girth} + 0.01 \times \text{side step} + 0.14$], $P < 0.05$).

CONCLUSIONS: Our results indicated that the SMI could be evaluated by the field-based simplified methods, especially for the mid-thigh girth measurement, which may be a major determinant to maintain an active life for healthy young women.

328 Board #166 May 29 11:00 AM - 12:30 PM
Muscular Activation Differences during Daily Activities in a Unilateral Trans-Femoral Amputee

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(No relevant relationships reported)

Lower-limb amputees often exhibit an increased atrophy of remaining skeletal musculature as compared to the non-amputated side. This difference in lean mass may present variations in the contribution of physical effort between the affected and unaffected musculature. While most literature has focused mainly on microprocessor-controlled prosthetics, few investigations have examined mechanical (i.e., un-powered) prosthetics during daily activity tasks. **PURPOSE:** The purpose was to examine the electromyographical activity of the lower limb musculature of the amputated versus non-amputated side in a unilateral trans-femoral amputee. **METHODS:** The participant ($n=1$, age=26) performed four activities of daily living (i.e., sit-to-stand, 10-meter walk, and stair ascent and descent without support) with an above-knee mechanical prosthetic. The participant completed each task three times with 1-minute rest in between each trial. EMG was recorded, on both sides of the body, at the following sites and compared to a percentage of maximal voluntary contraction (%MVC): gluteus maximus (GM), gluteus medius (GMed), rectus femoris (RF), and biceps femoris (BF). Ratios (affected:unaffected) and percent differences between the affected and unaffected sides of the body were calculated. **RESULTS:** Results demonstrated large mean muscular activation differences of 34% for RF and 20% for GMed throughout overall movement patterns. Small mean activation differences were seen within the GM (2%) and BF (1%). The largest observed imbalance ratios for the sit-to-stand trials were in the RF (1:18) and GM (4:1). For the 10-meter walk, the largest differences were seen in the GM (3:1) and GMed (4.5:1). During the stair ascent without support, only the RF and GMed showed large imbalances between limbs (i.e., 1:3.5 and 3:1, respectively). Lastly, for the stair descent, the GM (4:1) and GMed (2:1) demonstrated a large imbalance; while BF and RF exhibited small differences. **CONCLUSIONS:** Results indicate that performing daily tasks for amputees may provide large imbalances in muscular effort between limbs. While some imbalances (increased motor unit recruitment) favored the unaffected limb, the affected limb did display increased recruitment in the gluteal musculature during walking, stair climbing, and sit-to-stand tasks.

329 Board #167 May 29 11:00 AM - 12:30 PM
Skeletal Muscle Mass And Bone Mineral Density Of Japanese alpinist Mr. Yuichiro Miura.

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Purpose: In this study, we report on the skeletal muscle mass and bone mineral density of Japanese alpinist Mr. Yuichiro Miura who is the oldest person to climb to the summit of Mount Everest (8,848m) at the age of 80 years compared with Japanese community-dwelling middle-aged and older men. **Method:** The appendicular skeletal muscle mass index (SMI), total bone mineral density (tBMD), whole body fat free mass index (FFMI) and fat mass index (FMI) in Mr. Miura (84.6 yr) and 209 community-dwelling middle-aged and older men (50-79 yr, mean age: 68.1 yr) were obtained by dual X-ray absorptiometry. **Results:** The SMI, tBMD, FFMI and FMI in Mr. Miura were 8.79 kg/m², 1.075 g/cm², 22.3 kg/m² and 9.8 kg/m², respectively, and in the community-dwelling middle-aged and older men 7.46 \pm 0.81 kg/m², 1.020 \pm 0.100 g/cm², 18.1 \pm 1.9 kg/m² and 5.5 \pm 1.7 kg/m², respectively. The values were higher in Mr. Miura than the community-dwelling middle-aged and older men, with z-scores for the SMI and tBMD of 1.63 and 0.55, respectively. **Conclusion:** Mr. Miura maintained total body bone mineral density and skeletal muscle mass at a high level even at the age of 84 years which may in part be due to his long-term training for mountain climbing.

330 Board #168 May 29 11:00 AM - 12:30 PM
Motor Nerve Conduction Velocity with Eccentric Contractions of Flexor Pollicis Brevis Muscle

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Eccentric contractions (ECCs) cause muscle damage indicated by loss of muscle strength, limited range of motion (ROM), and development of delayed-onset muscle soreness (DOMS). Previously, we showed that ECCs induce nerve dysfunction and damage in rats and humans. In a human study, the M-wave latency of the biceps brachii increased by 12-24% at 1-2 days after eccentric exercise of the elbow flexors in women. However, whether ECCs cause a decrease in motor nerve conduction velocity (MCV) is unknown. **PURPOSE:** In the present study, we aimed to establish a new ECC model for the flexor pollicis brevis muscle (FPBM) and evaluate MCV. **METHODS:** Twelve men (age, 19.8 \pm 1.7 y; height, 172.4 \pm 7.0 cm; weight, 64.0 \pm 8.6 kg) performed 100 maximal ECCs at 60 deg/sec with the FPBM of the non-dominant arm (ECC) with a custom-made torque dynamometer. The dominant arms were the controls (CON). Maximal voluntary contraction (MVC), ROM, DOMS, and MCV were assessed before, immediately after, and 1, 2, and 5 days after the ECCs. MCV was calculated as the distance by stimulation divided by the latencies of the waveforms generated. Values were statistically analyzed, and the significance level was set at p values of < 0.05 . **RESULTS:** MVC, ROM, and DOMS of the ECCs significantly increased as compared with their values before the ECCs (MVC: post, 67.1%; day 1, 73.8%; ROM: post, 83.4%; day 1, 92.1%; DOMS: day 1, 178.8%; day 2, 181.0%; $p < 0.05$) and as compared with those of the CON (MVC: post, 67.1%; day 1, 73.8%; ROM: post, 83.4%; day 1, 92.1%; DOMS: day 1, 178.8%; day 2, 181.0%; $p < 0.05$). The MCV of the ECCs decreased significantly immediately after exercise (63.6%, $p < 0.05$) and as compared with that of time-matched CON. The M-wave latency of the ECCs delayed significantly immediately after exercise (127.3%, $p < 0.05$) and as compared with before exercise. **CONCLUSIONS:** Our new ECC model leads to muscle damage similar to those reported in previous studies that used other muscles and motor nerve dysfunction.

331 Board #169 May 29 11:00 AM - 12:30 PM
Combined Exercise and Leucine Supplementation Promotes Skeletal Muscle Protein Deposition in Tumor Bearing Mice

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PURPOSE: To investigate the effect of concurrent exercise training and leucine supplementation on skeletal muscle protein deposition in Colon 26 tumor bearing mice.

METHODS: Male BALB/c mice were divided into a control group (C, n=8), a C26 tumor bearing group (T, n=8) and a tumor bearing plus exercise and leucine supplementation group (TEL, n=8). Mice in the C and T groups were fed with normal chow diet, while mice in the TEL group were fed with formulated diet contained 5% leucine and received 30-min swimming training 3 days per week (Monday, Wednesday and Friday) and resistance training 3 days per week (Tuesday, Thursday and Saturday) for 2 weeks. At 24 hours after the last training session, blood and gastrocnemius muscle samples were collected under full anesthesia. The contents of TNF- α and IL-6 in gastrocnemius muscle and serum were determined by ELISA. maximal grip strength was measured with a commercial grip strength meter. Two-way ANOVAs and post-hoc tests were used for data analysis.

RESULTS: After tumor bearing, cumulative food intake appeared to decrease, whereas body weight (20.7 g vs. 26.1 g), wet gastrocnemius muscle weight (97.3 mg vs. 128.9 mg), total protein content (35.7 mg/g vs. 51.2 mg/g), sarcoplasmic protein content (26.5 mg/g vs. 38.3 mg/g), myofibrillar protein content (28.6 mg/g vs. 43.3 mg/g) and muscle strength (82.7 g vs. 156.5 g) were significantly lower in the T group than in the C group (all $p < 0.01$). TNF- α and IL-6 contents in serum and gastrocnemius were obviously higher in the T group than in the C group ($p < 0.01$). After exercise and leucine supplementation, cumulative food intake and the TNF- α and IL-6 content were significantly lower in the TEL group than in the T group ($p < 0.05$), while body weight (21.8 g), wet gastrocnemius muscle weight (111.1 mg), total protein content (40.3 mg/g), sarcoplasmic protein content (30.7 mg/g), myofibrillar protein content (34.0 mg/g) and muscle strength (112.2 g) were significantly higher in the TEL group than in the T group ($p < 0.05$ to $p < 0.01$).

CONCLUSIONS: Combined exercise and leucine supplementation significantly ameliorated skeletal muscular protein deposition in C26 tumor bearing mice, which may be through down-regulating the inflammatory response. (Supported by Research Foundation of Sichuan Provincial Department of Education grant #18ZB0106).

332 Board #170 May 29 11:00 AM - 12:30 PM
Environmental Enrichment Increases Spontaneous Locomotor Activity In Rats

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(No relevant relationships reported)

[Purpose] Environmental enrichment (EE) involves housing conditions that facilitate enhanced sensory, cognitive and motor stimulation. EE is beneficial to brain functions, probably due to increases in spontaneous locomotor activity. However, actual spontaneous locomotor activity has not been directly measured because of the technical difficulties involved in housing rats in groups. The purpose of this study was to assess spontaneous locomotor activity in the EE using a recently developed three-axis accelerometer. We also examined whether wheel running is the key to increase spontaneous locomotor activity housed in the EE. [Methods] Thirty-two Wistar rats were divided into four different housing groups (standard environment: SE; only running wheel group: W; EE without running wheel group: EE-S and EE). The present EE contained running wheel, slope, three tunnels, and small hut. Locomotor activity of each was continuously recorded using a three-axis accelerometer, which was embedded in the back. After exposure to each environment for 6 weeks, the tibialis anterior (TA), extensor digitorum longus (EDL) and soleus (Sol) muscles were removed and immediately weighted. [Results] Locomotor activity was higher during the dark period in the W (23,182 \pm 9,730, frequency/day) and EE (28,260 \pm 12,705) groups compared with EE-S (15,703 \pm 6,510) and SE (19,757 \pm 9,964) groups ($p < 0.05$, respectively). In contrast, locomotor activity during the light period was not different between groups. All hindlimb muscles except for EDL muscle were greater in the W (TA: 1.60 \pm 0.23, Sol: 0.42 \pm 0.49 mg/g) and EE (TA: 1.60 \pm 0.24, Sol: 0.41 \pm 0.51) groups compared with EE-S (TA: 1.52 \pm 0.23, Sol: 0.39 \pm 0.50) and SE (TA: 1.49 \pm 0.21, Sol: 0.37 \pm 0.52) groups ($P < 0.05$, respectively). [Conclusions] The present study suggests that environmental enrichment increase spontaneous locomotor activity housed in groups, which was accompanied by muscle hypertrophy. Wheel running appears to play a key role in increased spontaneous locomotor activity in the EE.

333 Board #171 May 29 11:00 AM - 12:30 PM
Investigating The Repeated-bout Effect To Eccentric Contractions For Females And Males

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(No relevant relationships reported)

Performing unaccustomed eccentric (ECC) exercise leads to temporary muscle damage, initiating a prophylactic response to minimize injury from a subsequent bout (i.e., the repeated-bout effect; RBE). Few studies have investigated sex-related differences to ECC maximal voluntary contractions (MVCs). There is indirect evidence to suggest females may have greater muscle damage following ECC MVCs. If true, this could induce a larger RBE for females than males; however, the RBE has not been compared between the sexes. **PURPOSE:** To compare the magnitude of the RBE for females and males. **METHODS:** To date, data from two bouts of ECC MVCs have been collected from 15 healthy young participants (22.7 \pm 2.8y; 6 females). The fatigue/damage protocol involved 200 ECC MVCs of the dorsiflexors (60°/s from a neutral ankle position to 30° of plantar flexion; 4 sets of 50 reps; 2s rest between reps and 1min rest between sets). Isometric (ISO) MVC torque and the ratio of ISO torque responses to low vs. high frequencies of electrical stimulation (10:100Hz) were compared before and after (2, 3, and 5min, as well as 2, 4, and 7d) the fatigue/damage protocol. The fatigue/damage protocol and recovery visits were repeated four weeks later. **RESULTS:** After bout 1, ISO MVC torque decreased 27.2 \pm 10.9% (females) and 25.1 \pm 14% (males) at 2min post-fatigue. At 2d, ISO MVC torque was 91.0 \pm 8.3% and 90.0 \pm 11.9% control for females and males, respectively. The 10:100Hz ratio decreased markedly in acute recovery (5min: 53.5 \pm 13.6% and 40.4 \pm 10.4% for females and males, respectively) but returned to 94.7 \pm 16.3% and 88.8 \pm 10.6% control at 2d. After bout 2, ISO MVC torque was impaired by 19.4 \pm 13.3% (females) and 23.1 \pm 13.7% (males) at 2min post-fatigue, and restored to 91.3 \pm 8.1% and 96.3 \pm 6.0% control (females and males, respectively) at 2d. The decrease in the 10:100Hz ratio at 5min post-fatigue was 41.8 \pm 15.0% and 35.7 \pm 12.3% for females and males, respectively. At 2d, the ratio was 92.1 \pm 12.5% (females) and 94.7 \pm 8.8% (males) of control.

CONCLUSIONS: Our preliminary results suggest that an initial bout of ECC MVCs may cause greater fatigue or transient damage for females than males. After bout 2, acute decreases in ISO MVC torque and 10:100Hz ratio appear to be attenuated more for females than males, which may suggest a greater RBE for females.

Supported by NSERC, CFI, and BCKDF

A-50 Free Communication/Poster - Supplements and Nutritional Ergogenic Aids

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

334 Board #172 May 29 9:30 AM - 11:00 AM
Effect of Red Spinach Extract Supplementation on Cycle Time Trial Performance in Recreationally Active Individuals

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(No relevant relationships reported)

Red spinach extract (RSE) offers a rich source of dietary nitrates and evidence suggests that it may positively impact exercise performance. **PURPOSE:** The purpose of this investigation was to examine the effects of short-term red RSE supplementation on cycling time trial performance. **METHODS:** Seventeen recreationally active men (n=9, 22.2 \pm 3.8 y) and women (n=8, 22.8 \pm 3.5 y) underwent two testing sessions administered in a randomized, counterbalanced, double-blind fashion. Participants were assigned to supplement daily with 1 gram of RSE or placebo (PL) for seven days prior to each testing session. During each testing session, an additional serving was provided 1 hour prior to completing a 4-km cycling time trial test. Performance variables (time-to-completion, average power, relative power, cadence, and average speed) and subjective measures (perceived exertion and muscle fatigue) were assessed during each testing session. Heart rate, systolic blood pressure, and diastolic blood pressure (DBP) were also assessed around exercise. **RESULTS:** Compared to PL, RSE supplementation significantly improved ($p < 0.05$, $\eta_p^2 \geq 0.24$) 4-km completion time (404.6 \pm 24.6 vs. 410.6 \pm 31.3 s), relative power (2.53 \pm 0.44 vs. 2.46 \pm 0.40 W \cdot kg⁻¹), and average speed (35.7 \pm 2.2 vs. 35.3 \pm 2.5 km \cdot hr⁻¹). Additionally, a trial \times time interaction was observed for DBP ($F = 4.5$, $p = 0.020$, $\eta_p^2 = 0.22$) where DBP was lower following the RSE trial compared to the PL trial (66.1 \pm 6.1 vs. 70.1 \pm 5.0 mmHg). No other differences were observed between trials. **CONCLUSION:** In conclusion, RSE

supplementation significantly reduced time-to-completion and increased measures of power and speed during a 4-km cycling time trial. RSE also appeared to lower DBP following the cycling time trial, without altering participants' perceived exertion or subjective measures of muscle fatigue. Supported by a grant from American Health Foods, Inc.

335 Board #173 May 29 9:30 AM - 11:00 AM
The Probiotic *Streptococcus Salivarius* M18 Increases Plasma Nitrite But Does Not Alter Blood Pressure

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(No relevant relationships reported)

The probiotic *Streptococcus salivarius* M18 increases plasma nitrite but does not alter blood pressure

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Some species of bacteria in the mouth can reduce nitrate (NO_3^-) from the diet to nitrite (NO_2^-) which can be later converted to nitric oxide (NO). Increased levels of NO can reduce blood pressure (BP) and improve exercise performance. The bacteriocin-producing probiotic *Streptococcus salivarius* M18 (*S.salivarius* M18) can inhibit pathogenic oral bacteria but it is unclear whether an alteration to the oral microbiome will influence circulating levels of NO metabolites and BP. **Purpose:** To determine the effects of *S.salivarius* M18 supplementation on BP, plasma and saliva [NO_2^-], and [NO_3^-]. **Methods:** Eight healthy males (age 32 ± 8 y, body mass 80 ± 11 kg) completed 2 x 14 day supplementation phases in a randomized order at least 14 days apart. In one phase, participants consumed *S.salivarius* M18 probiotic lozenges (2.5 billion colony-forming units/dose) once per day and in the other they ingested water (placebo). Samples of unstimulated saliva and venous blood were collected, and BP was measured before and after each phase. Samples of saliva were later analysed for [NO_3^-] and [NO_2^-] using chemiluminescence. The change (Δ) in each outcome from pre- to post-supplementation was compared between phases using paired t-tests.

Results: Plasma NO_2^- increased from baseline (173 ± 38 nM) following probiotic supplementation ($\Delta 50.24 \pm 51.23$ nM, $P = 0.04$) in comparison to the placebo phase ($\Delta 8.77 \pm 61.51$ nM). There were no significant changes in systolic BP (probiotic $\Delta 0 \pm 3$ mmHg; placebo $\Delta 1 \pm 4$ mmHg, $P = 0.51$). Diastolic BP and salivary NO metabolites were also unaffected (all $P > 0.05$). **Conclusions:** Supplementation with *S.salivarius* M18 increased plasma NO_2^- , a key marker of NO availability, potentially by altering the abundance or activity of NO_3^- -reducing bacteria in the mouth. Despite this, *S.salivarius* M18 did not lower BP in healthy participants. Further research is therefore required to determine the therapeutic and ergogenic potential of probiotic supplementation.

Supported by a grant from the Hannah Dairy Research Foundation

336 Board #174 May 29 9:30 AM - 11:00 AM
Effect of Beetroot Juice Supplementation on Thermoregulation and Running in a Hot Environment

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(No relevant relationships reported)

Beetroot juice (BRJ) is a rich source of dietary nitrate (NO_3^-), and has become increasingly popular as a dietary supplement due to its positive effects on exercise performance. However, the effect of BRJ supplementation on thermoregulation and/or exercise performance in the heat is uncertain.

PURPOSE: To examine the effects of BRJ supplementation on thermoregulation and running performance and physiology in a hot/humid environment. **METHODS:** Using a double-blind, placebo-controlled, crossover design, 13 male runners (age, 35.8 years ± 6.1 yr; $\dot{V}_{O_{2\max}}$, 57.4 ± 6.5 mL·kg⁻¹·min⁻¹) were randomly selected to receive either nitrate-rich BRJ or a nitrate-depleted placebo (PLA) (2×70 mL) for 6 days, separated by a washout period of at least 10 days. On Day 6 of BRJ or PLA supplementation, subjects performed a 10 km time trial in an environmental chamber (26.6°C , 50 % RH) after consuming their last supplement dosage. The first 8 km of each trial were run on a motorized treadmill (fixed speed for each subject), while the final 2 km were run on a non-motorized treadmill, allowing subjects to select their own pace. We examined core body temperature (T_{c}), heart rate (HR), ratings of perceived exertion (RPE) and thermal stress ratings (TSR) during each trial (every 2 min), as well as time trial performance (every 500 m). **RESULTS:** Only 4 out of 13 participants completed a full 10 km trial in both (BRJ and PLA) conditions. Participants who did not finish both trials had their session(s) terminated when their T_{c} reached 39.5°C (safety precautions), and one trial ended early due to the participant not feeling well. A time to event

analysis revealed that a higher proportion of runners from the PLA group remained in the trial compared to the BRJ group for any given distance, although these differences were not statistically significant ($P = 0.221$). For the first 5.5 km (a distance every participant completed in both conditions), there were no significant differences in T_{c} ($P = 0.092$), HR ($P = 0.437$), or RPE ($P = 0.5013$) between trials. TSR was significantly greater in PLA vs. BRJ ($P < 0.001$) during the first 5.5 km. **CONCLUSION:** There is weak evidence that BRJ supplementation may be associated with elevated T_{c} when running in the heat, even though thermal perceptions of heat stress are lower. It is unclear if these differences have health or performance implications.

337 Board #175 May 29 9:30 AM - 11:00 AM
Ergogenic Effect of Citrulline Malate Supplementation on Total Training Load and Muscle Thickness in Trained Women.

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(No relevant relationships reported)

Practitioners of physical activity, to improve performance in training sessions, commonly use pre-workout supplements. Recently, Citrulline Malate (CM) has attracted attention for its potential to improve performance in resistance training (RT). However, there is still a need to understand the ergogenic effect of CM in some populations with different levels of training. **PURPOSE:** To evaluate the acute effects of CM supplementation on the total training load and muscle thickness (MT) in recreationally resistance-trained women. **METHODS:** Six women (27.8 ± 3.5 y; 67.8 ± 6.6 kg; 164.5 ± 3.1 cm) experienced in RT (36.1 ± 19.5 months) underwent three RT sessions (RTS) in a randomized, double blind fashion. Participants were submitted to the maximum strength test (1RM) for the Arm Curl (AC) and Leg Extension (LE) exercises 120h before experimental trials (ET). Then, each participant performed a RTS in three randomized ET with 96h of interval among them: i) Control (CON): without consumption of any supplement; ii) Placebo (PLA): with 8g of synthetic magnesium silicate and; iii) Supplemented (SUP): with 8g of CM. PLA and SUP consumed their supplements 60min before the RTS that consisted in 3 sets until concentric muscle failure with 80%1RM and 90sec interval-rest among sets in AC and LE exercises. The total number of repetitions and the total training load was recorded for each series and the muscle thickness of the extensor muscles of the thigh and arm flexor muscles was obtained, immediately, before and after each exercise (Bodymetrix PRO-BX2000®). One-way ANOVA with Tukey's post-hoc was utilized to compare differences among ET, Wilcoxon test was utilized to within groups analyzes and effect size (ES) was calculated by using Cohen d. **RESULTS:** There were no significant differences in total training load among the ET (CON: 4714 ± 1269 kg; PLA: 4758 ± 922.4 kg; SUP: 4826 ± 940.7 kg). Significant differences were observed in MT pre and post RTS in all ET in the arm flexors (CON: $p=0.01$, ES:1.2; PLA: $p=0.007$, ES:1.8; SUP: $p=0.005$, ES:1.4) and in the thigh extensors (CON: $p=0.048$, ES:0.6; PLA: $p=0.01$, ES:1.2; SUP: $p=0.01$, ES:1.4), however, no significant differences were observed when compared to the ET. **CONCLUSION:** The supplementation with 8g of CM 60min before a RTS has no ergogenic effect on total training load or MT in resistance-trained women.

338 Board #176 May 29 9:30 AM - 11:00 AM
Oral Creatine Supplementation On Physically Active Elderly Women Cognition Improvement

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(No relevant relationships reported)

PURPOSE: The aim of this study was to verify if creatine supplementation in conjunction with a community-based exercise program improved cognition in elderly women.

METHODS: Twenty elderly women were randomized into 2 groups: creatine (CRE, $n=10$, age = 71 ± 6 y; body mass = 67.4 ± 6.0 kg; height = 166 ± 2 cm) or control (CON, $n=10$, age = 73 ± 6 y; body mass = 67.4 ± 5.7 kg; height = 164 ± 4 cm). All subjects were active and did not use CM or pro-cognitive drugs before the experiment. CRE group received 2.0 g.kg body mass⁻¹.d⁻¹ of CM for 28 days. CON group received 2.0 g.kg body mass⁻¹.day⁻¹ of dextrosol. Community-based exercises (walking, dancing, calisthenics, stretching) were performed 3x a week with 1 h per session. Cognition was assessed using a battery of five tests: a Visual Reaction Time (VRT) test, a visual GO/NO GO reaction time (GNG) test; a Differentiation task test (DTT), an Eriksen flanker test (EFT), and a Corsi block test (CBT). Subjects completed a familiarization, taking the testing battery on two sessions over nonconsecutive days the week prior to the experiment. The week after familiarization, subjects completed the test battery and initiated supplementation (CRE or CON). After 28 days, they repeated the test battery.

Chi-square tests were used to compare groups and sessions for DTT, EFT, and CBT. Repeated measures ANOVA were used to compare VRT and GNG. Significance level was set $p \leq 0.05$.

RESULTS: Significant ($p \leq 0.05$) pre-post performance increases in GNG, EFT, and CBT were observed in CRE vs. CON (table 1). We did not find difference between moments or groups in VRT ($p > 0.05$) nor DTT ($p > 0.05$).

Table 1 - Cognitive tests results * $p \leq 0.05$ difference from other means according to ANOVA. Differing superscripts (^{a,b}) indicate $p \leq 0.05$ difference according to Chi-Square

Test (units)	Group	Pre	Post	p-value
GNG (ms)	CRE	1140.2 ± 520.7	590.3 ± 134.1*	0.0235
	COM	967.6 ± 386.6	997.9 ± 517.7	
EFT (%)	CRE	76 ^a	94 ^b	0.0104
	COM	74 ^a	76 ^a	
CBT (%)	CRE	56 ^a	84 ^b	0.0298
	COM	62 ^a	70 ^a	
VRT (ms)	CRE	952.1 ± 442.5	578.2 ± 219.9	0.0915
	COM	543.4 ± 448.7	611.4 ± 418.3	
DTT (%)	CRE	66	68	0.6304
	COM	62	74	

CONCLUSIONS: We conclude that $2\text{g} \cdot \text{kg}^{-1} \cdot \text{day}^{-1}$ during 28 days of oral CM supplementation improved results in some cognitions tasks in elderly woman.

339 Board #177 May 29 9:30 AM - 11:00 AM Creatine Supplementation And Repeated Sprint Ability - A Systematic Review And Meta-analysis

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(No relevant relationships reported)

PURPOSE: The aim of this study was to conduct a systematic review and meta-analysis of the effects of creatine supplementation on repeated sprint ability.

METHODS: Sixteen studies met the inclusion criteria of adopting double-blind randomized placebo-controlled designs (crossover or between-subject) in which adult participants (age ≥ 18 years) completed a repeated sprint test (number of sprints: $4 < n \leq 20$; sprint duration: ≤ 10 s; recovery duration: ≤ 90 s) before and after supplementing with creatine or placebo for ≥ 3 days in a dose of ~ 20 g per day. No exclusion restrictions were placed on the mode of exercise. Meta-analyses were completed using random-effects models, with effects on measures of peak sprint performance (peak power or fastest sprint) and fatigue during each repeated sprint test presented as standardized mean difference (δ) and with effects on body mass and post-test blood lactate concentration presented as raw mean difference (D). Analyses were completed using pre-post supplementation differences, with standard deviations imputed, where necessary. 95% confidence limits (CL_{95}) were calculated for all estimates. **RESULTS:** Relative to placebo, creatine supplementation resulted in a significant increase in body mass ($D = 0.67$ kg; CL_{95} [0.47, 0.88]; $p < 0.00001$). However, there was no corresponding effect of creatine supplementation on measures of peak sprint performance ($\delta = 0.25$; CL_{95} [-0.19, 0.69]; $p = 0.27$), fatigue ($\delta = 0.19$; CL_{95} [-0.14, 0.53]; $p = 0.26$), or post-test blood lactate concentration ($D = 0.36$ mmol·L⁻¹; CL_{95} [-0.13, 0.85]; $p = 0.15$). **CONCLUSION:** Although the increase in body mass following creatine supplementation supports an increase in creatine retention; the results of this meta-analysis show that there is no corresponding effect on measures of repeated sprint ability.

340 Board #178 May 29 9:30 AM - 11:00 AM The Effect of Creatine Supplementation on Muscle Oxygen Saturation and Arterial Stiffness

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(No relevant relationships reported)

There is a void in our knowledge on the impact of exercise, in particular creatine monohydrate supplementation, on arterial stiffness (AS) in the major elastic arteries. This study also examined the effects of creatine supplementation on skeletal muscle oxygen saturation (SmO_2) in the lower leg. Data have indicated that creatine supplementation can result in an increase in lower leg anterior compartment pressure at rest and post exercise. Although the increased pressures seen during these studies were not pathological, this and additional factors associated with creatine supplementation could possibly effect SmO_2 during exercise and recovery. **PURPOSE:** To determine the effects of acute creatine monohydrate supplementation on AS and SmO_2 .

METHODS: 12 male, physically active participants were randomized in a double-blind fashion to placebo (PL) ($n=6$, 23 ± 2 yrs) or creatine (CM) ($n=6$, 21 ± 2 yrs) groups. Subjects received 0.3 g/kg/day creatine monohydrate or placebo in gelatin capsules for 7 days. Ultrasonography of the carotid artery, applanation tonometry, submaximal exercise tests (10 minute treadmill activity at 3.7 mph and 9% incline), and lower leg pain (analog visual scale and pain test algometer) assessments were conducted at baseline and on day 7 of the study period. **RESULTS:** There were no significant differences between PL and CM in carotid-femoral pulse wave velocity (CF PWV) (4.60 ± 10.42 vs. -2.71 ± 21.20 % change), β -stiffness index (5.81 ± 26.3 vs. 1.65 ± 41.35 % change), central pulse pressure (CPP) (-17.38 ± 16.31 vs. 6.05 ± 24.61 % change), and arterial compliance (AC) (19.79 ± 37.50 vs. 12.48 ± 53.89 % change) (all $P > 0.05$). There were no significant changes in SmO_2 (-7.95 ± 10.24 vs. 29.94 ± 36.13 % change) and peak pain (-6.55 ± 29.87 vs. -12.5 ± 30.62) between PL and CM, respectively (all $P > 0.05$). Finally, there were also no significant differences in body weight (0.53 ± 0.79 vs. 0.20 ± 0.87 % change), fat mass (-3.40 ± 3.49 vs. -0.23 ± 8.17 % change), and fat free mass (1.12 ± 0.98 vs. 0.23 ± 0.80 % change) between PL and CM, respectively (all $P > 0.05$). **CONCLUSIONS:** Using a randomly controlled, double-blind trial with validated measurements of AS and SmO_2 , acute creatine supplementation does not appear to impact vascular compliance or oxygen saturation in skeletal muscle in young, otherwise healthy males.

341 Board #179 May 29 9:30 AM - 11:00 AM Exhaustive Resistance Exercise Alters Serum Creatine and Guanidinoacetic Acid in Active Men

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(No relevant relationships reported)

Exhaustive exercise adversely affects biomarkers of creatine metabolism yet it remains unknown when the values back toward pre-disturbance conditions. **PURPOSE:** To evaluate a 24-hour post-exercise response in serum guanidinoacetic acid (GAA), creatine and creatinine in young active men subjected to a single session of exhaustive resistance exercise and matched it with exercise-induced changes in serum cortisol, interleukin 6 (IL-6), creatine kinase (CK), and lactate dehydrogenase (LDH).

METHODS: Twelve healthy active men (age 22.7 ± 0.8 years; weight 79.8 ± 7.3 kg; height 182.4 ± 4.9 cm; weekly exercise 5.1 ± 1.6 hours) were subjected to a single session of bench press exercise until volitional exhaustion, with venous blood sampled before, immediately after exercise (~ 2 min), and after 15 min, 60 min and 24 h after the end of exercise. **RESULTS:** Baseline values for serum GAA, creatine and creatinine were 2.2 ± 0.5 $\mu\text{mol/L}$, 18.9 ± 3.6 $\mu\text{mol/L}$, and 72.4 ± 6.0 $\mu\text{mol/L}$, respectively. Serum GAA significantly dropped for $9.6 \pm 7.3\%$ immediately after bench press exercise (95% CI, 5.0 to 14.2; $P < 0.001$), while both creatine and creatinine increased immediately after the test for $5.0 \pm 2.5\%$ (95% CI, 3.4 to 6.6; $P < 0.001$) and $11.9 \pm 4.3\%$ (95% CI, 9.2 to 14.6; $P < 0.001$), respectively. GAA and creatine levels recovered to the baseline values after 24 hours post-exercise, yet creatinine remained significantly higher at 24-hour period as compared to the baseline values for $2.5 \pm 2.3\%$ (95% CI, 1.0 to 4.0; $P = 0.002$). **CONCLUSIONS:** A single session of exhaustive resistance exercise induces transient alterations in biomarkers of creatine metabolism, with serum creatinine outlined as a most persistent marker of exhaustion. Exercise-induced changes in creatine metabolism poorly corresponded to perturbations in inflammation and muscle fatigue biomarkers following exercise. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (175037 and 179011), the Provincial Secretariat for Higher Education and Scientific Research (142-451-2473 and 114-451-710) and the Faculty of Sport and Physical Education, University of Novi Sad (2018 Annual Award).

342 Board #180 May 29 9:30 AM - 11:00 AM Fish Oil Intake and Exercise Improve Physical Function and Resting Metabolic Rate in Older Adults

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(No relevant relationships reported)

Omega-3 polyunsaturated fatty acids (n-3) have received great attention due to their health-enhancing benefits; however, effects of chronic n-3 administration combined with resistance training (RT) in physical function and resting metabolic rate (RMR) in older adults are not well established. **PURPOSE:** To investigate the effects of 12-wk n-3 administration with programmed RT on muscular strength, physical function, and RMR in older adults. **METHODS:** Healthy older adults (62 - 77 years) were randomly assigned to the fish oil plus RT group (FRT; $n=8$) or control group (CON; $n=5$). The FRT group consumed fish oil supplements enriched with n-3 polyunsaturated fatty acids [3 capsules per day - 2100 mg of eicosapentaenoic acid (EPA) and 720 mg of

docosahexaenoic acid (DHA)) and performed progressive RT including lat pull-down, seated row, biceps curl, leg press, and calf raise (2 sets of 10 repetitions; 2x/week for 12 weeks). Muscular strength, physical function, and RMR were evaluated pre- and post-intervention. Data were analyzed using 2×2 (group \times time) repeated-measures ANOVA. **RESULTS:** There were significant group \times time interactions for muscular strength ($p < 0.01$), physical function ($p < 0.05$), and RMR ($p < 0.01$). There were significant increases in muscular strength; lat pull-down (+22%), seated row (+45%), biceps curl (+36%), leg press (+54%), and calf raise (+43%) ($p < 0.01$) in FRT with no detectable changes in CON. In addition, there were great improvements in physical function; five-stand chair (+22%) and 30-sec chair stand (+22%) in FRT ($p < 0.05$) with no changes observed in CON. RMR significantly increased in FRT (+6%, $p < 0.05$), while remarkably decreased in CON (-6%, $p < 0.05$). **CONCLUSION:** Twelve-weeks of n-3 administration with progressive RT greatly improved muscular strength and physical function as well as appears to reverse the aging-induced decline in RMR in healthy older adults.

Supported by New Mexico State University.

343 Board #181 May 29 9:30 AM - 11:00 AM
Effects Of A Single Dose Multi-ingredient Pre-workout Supplement On Aerobic And Anaerobic Performance In Men

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(No relevant relationships reported)

PURPOSE: To assess the effects of a single dose of a multi-ingredient pre-workout supplement (MIPS) on aerobic and repeated anaerobic performance tests. **METHODS:** Eight college-aged men were recruited to participate in a randomized, double-blind, placebo-controlled, crossover study. All participants were tested within the same week separated by 48 hours and were provided either the placebo (PLA) or the MIPS on each day. As per the manufacturer's instructions, the participants waited 25 minutes to begin the tests, following consumption of the drink. Aerobic exercise performance was assessed using the Modified Astrand Treadmill Protocol, during which maximal oxygen consumption (VO₂max) and maximal aerobic exercise time were determined. Following this test, participants were provided a 20-minute seated rest period. After the rest period, participants completed a short warm-up which consisted of 2 minutes of cycling at 50 RPMs against a light resistance, followed by 3, 10-second sprints, to determine the max RPMs. After the warm-up, participants completed the repeated anaerobic power test, which consisted of 10, 6-second sprints, with 45 seconds of active rest in between each sprint. For each sprint, a resistance of 7.5% of the participant's body mass was applied at 90% of their max RPM. Peak power (PP) was determined for each sprint and the percent decline in PP from the first to the last sprint was calculated. VO₂max, exercise time and the percent decline in PP for the sprints were analyzed using a dependent t-test. The peak power of the 10 sprints were analyzed using 2x10 ANOVA. The alpha level was set a priori to $p < 0.05$. **RESULTS:** There was no significant difference between the PLA and MIPS for VO₂max. However, there was a significant difference in treadmill time ($p = 0.005$) with MIPS (10.4 \pm 1.6 min) performing better than PLA (10.0 \pm 1.6 min). There were no significant differences between the PLA and MIPS when analyzing peak power during the 10 sprints or percent decline in PP. **CONCLUSIONS:** A single dose of this MIPS improved maximal aerobic exercise time despite no changes in VO₂max. However, this MIPS did not improve performance during a repeated anaerobic power test. Study supported by Cenegenics®

344 Board #182 May 29 9:30 AM - 11:00 AM
Antioxidants Supplementation Hamper Muscle Growth after 10 Weeks Strength Training

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 (No relevant relationships reported)

Strength Training (ST) is recommended for increased muscular mass. It has been suggested that reactive oxygen species (ROS) produced by a ST session may play a positive role in the hypertrophic process. However, there is some evidence that chronic antioxidant supplementation may indeed reduce ROS and play a negative role in protein synthesis. Few studies have investigated the effects of ST combined with antioxidants supplementation on muscle hypertrophy. However, results are still controversial. **PURPOSE:** To investigate the effects of ST combined with Vitamin C and E supplementation on muscle thickness (MT). **METHODS:** Thirty-three untrained

women (22.9 \pm 2.5 years, 57.7 \pm 8.4 kg, 1.6 \pm 0.6 m) were allocated into three groups: Vitamins (VG, n=12), Placebo (PG, n=11) and Control (CG, n=10). Participants of VG and PG underwent lower-body (lunge and deadlift exercises) periodized ST, two-times a week, for 10 weeks. VG group was supplemented with vitamins C (1g/day) and E (400IU/day) during the training period, PG ingested placebo pills and CG did not perform training or supplementation. Muscle thickness (MT) of the quadriceps femoris of the dominant limb was analyzed by ultrasonography. **RESULTS:** Both VG (+11.6%; $P < .05$) and PG groups (+17.1%; $P < .05$) presented increased values of MT after 10 weeks of ST. However, there was no difference between the VG and PG groups, only the PG presented a significant gain of MT when compared to CG (17.1% vs 2.0%; $p < .05$). **CONCLUSIONS:** The results of this investigation suggest that chronic antioxidants supplementation may mitigate improvements in muscle hypertrophy, after 10 weeks of ST in untrained young women.

345 Board #183 May 29 9:30 AM - 11:00 AM
Combination Polyphenol and MSM Supplementation Alters Post Half Marathon Systemic Inflammatory Response

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(No relevant relationships reported)

Individuals participating in prolonged endurance performances and associated training experience regular inflammation and muscle soreness. Natural products with known anti-inflammatory and/or oxidative stress blocking effects represent attractive options to traditional NSAID treatments. **PURPOSE:** To investigate the effect of combined curcumin (500-1000 mg/d; Longvida), pomegranate extract (500-1000 mg/d; Pomella), and methylsulfonylmethane (500-1000 mg/d; OptiMSM) supplementation for 30-days on inflammation-associated RNA, protein inflammatory biomarkers, and biomarkers of oxidative stress. **METHODS:** All protocols were approved by the University IRB committee and participants gave written informed consent. Subjects supplemented with the combination supplement (N=5) or placebo (N=5) for 30-d prior to the half marathon race. Venous blood samples were collected for RNA (PAXgene tube) or serum (evacuated serum separator tube) 24-h pre-race, 4-h, and 24-h after a half marathon race. PAXgene treated blood was analyzed in duplicate using a custom, bead-based RNA assay (Quantigene; ThermoFisher). Serum samples were analyzed in duplicate using separate bead-based protein assays to measure cytokines, soluble cytokine receptors, and myokines (Milliplex; Millipore-Sigma). Bead-based analysis was conducted using an automated analyzer (Luminex FM3D). Oxidative stress (TAC, AGE) was measured using enzymatic assays (Cell Biolabs, Aviva Systems Biology). Fold change from pre was calculated for the various outcome variables to allow for better comparison and model creation. **RESULTS:** Fold changes in RNA and proteins exhibited a trend toward reduced inflammation while showcasing an increased ability of soluble cytokine receptors to tolerate inflammation with supplementation post-race. Reduced oxidative stress (via TAC and AGE) was observed post-race with the supplement compared to placebo. **CONCLUSIONS:** These data support the notion that the combined use of curcumin, pomegranate and MSM prior to and after a half marathon race may result in reduced systemic inflammation and oxidative stress. More research is needed in order to understand how to use these effects to improve the effectiveness of a long-term training program.

346 Board #184 May 29 9:30 AM - 11:00 AM
Acute Fermented Soy Supplementation Improves 20-km Time Trial Performance through Improvements in Power and Speed

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(No relevant relationships reported)

INTRODUCTION: Isoflavones, a chemical class of phytoestrogens, are found in soybeans and soy products and may have biological functions similar to estradiol. After binding with ER β , or perhaps independently of estrogen receptors, isoflavones may augment vascular endothelial relaxation, contributing to improved skeletal muscle blood flow. **PURPOSE:** To determine if acute fermented soy extract supplementation influences 20-km time trial cycling performance and cardiac hemodynamics compared to a placebo. **METHODS:** Subjects included twenty-five recreationally trained cyclists and triathletes (31 \pm 8 y, 177.3 \pm 5.9 cm, 78.3 \pm 8.5 kg, VO_{2peak}: 55.1 \pm 8.4 mL \cdot kg⁻¹ \cdot min⁻¹ (4.3 \pm 0.7 L \cdot min⁻¹) at 315 \pm 42 W). Each subject completed a VO_{2peak} assessment, familiarization, and two 20-km time trials in randomized order following ingestion of a fermented soy extract supplement or placebo. The fermented soy extract consisted of 30 g powdered supplement in 16 fl. ounces of water. The placebo consisted of the same quantities of organic cocoa powder and water. Each trial

consisted of 60 min of rest, 30 min of steady-state exercise at 55% W_{peak} , and a self-paced 20-km time trial. Heart rate, stroke volume, and cardiac output were measured continuously using impedance cardiography. Ergometer software continuously recorded power output, speed, cadence, and time to completion. **RESULTS:** Soy supplementation elicited a faster time to completion (-0.22 ± 0.10 min; -37 s), lower average heart rate (-5 ± 1 bpm), and significantly greater power (6.8 ± 2.5 W) and speed (0.42 ± 0.16 km·hr $^{-1}$) during the last 5 km of the time trial compared to placebo. Analysis of the results by relative fitness level (< 60 vs. ≥ 60 mL·kg $^{-1}$ ·min $^{-1}$) indicated that soy supplementation resulted in lower values of cardiac output (-1.6 ± 0.8 L·min $^{-1}$), stroke volume (-5.4 ± 3.1 mL·beat $^{-1}$), and heart rate (-5 ± 3 bpm) in those with higher levels of fitness. **CONCLUSIONS:** Ingestion of a fermented soy extract supplement improved sprint-distance performance through improvements in both power and speed. For those with great aerobic fitness, soy supplementation may help to decrease cardiac demand alongside performance improvement.

347 Board #185 May 29 9:30 AM - 11:00 AM
Effects of Short-Term Spirulina Supplementation on Oxidative Stress Markers in Mountaineers at High Altitude

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PURPOSE: To investigate effects of 14 days of spirulina supplementation on oxidative stress responses of climbers at high altitude. Spirulina is a source of antioxidants, which can protect against oxidative damage.

METHODS: Eighteen apparently healthy men and women mountaineers (age 24.87 ± 5 yr, height 170.7 ± 15.34 cm, weight 75.92 ± 17.21 kg) volunteered to participate in a one group pretest-posttest study design. All participants completed two winter ascents to the summit (4,000meters) a week before as well as 14 days after spirulina supplementation (3g/day). Blood samples (4cc) were collected at pre-climbing and summit prior to and following supplementation under the same conditions. Participants were instructed to maintain their diet and avoid using antioxidant-containing products throughout the study. Blood samples were analyzed to measure oxidative stress markers such as malondialdehyde (MDA), superoxide dismutase (SOD), catalase (CAT), glutathione peroxidase (GPx), and total antioxidant capacity (TAC). All data were expressed as the mean \pm SEM. Statistical comparisons were performed using t-test (p values < 0.05 were considered to be statistically significant).

RESULTS: Results indicated that resting MDA at pre-climb were significantly reduced following supplementation (3.37 ± 0.017 U vs. 2.89 ± 0.14 U; $p=0.036$); however, significant increases occurred in SOD resting values (132.8 ± 6.39 U vs. 147.8 ± 3.37 U; $p=0.042$) and TAC (10.52 ± 0.32 U vs. 12.98 ± 0.48 U; $p=0.001$) after supplementation. The TAC values were significantly higher at the summit compared to pre-climb values in pre-supplementation (10.87 ± 0.30 U vs. 10.52 ± 0.32 U); conversely, TAC values were significantly lower at the summit compared to pre-climb values after the supplementation (12.09 ± 0.36 U vs. 12.98 ± 0.48 U) ($p=0.047$). Spirulina Supplementation did not significantly change resting GPx and CAT levels as well as the responses of MDA, SOD, GPx and CAT in high altitude ($p>0.05$).

CONCLUSION: Spirulina supplementation for a 14-day period reduced the oxidative stress in participants during pre-climbing phase and increased the total antioxidant capacity. However, there were no significant changes in the variables at high altitude. It appears that 3g/day of spirulina cannot completely cope with oxidative stress in hypoxic condition.

348 Board #186 May 29 9:30 AM - 11:00 AM
Effect of Huperzine A on Cognitive Function and Perception of Effort During Exercise

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PURPOSE: Huperzine-A has shown the ability to acutely improve cognitive function in certain populations, and therefore is commonly added to pre-workout supplements.

However, its effects have not been studied in exercise-trained individuals. We hypothesized that acute consumption of huperzine-A would improve cognitive function during exercise, which may be beneficial for exercise performance.

METHODS: From January to April, 2018, 15 exercise-trained individuals (women and men, BMI 23.5 ± 1.4 kg/m 2 , age 30.4 ± 3.6 years) were studied in a double blind randomized-sequence cross-over study, in which they underwent tests for cognitive function (digit span, verbal/word fluency, and Stroop), neuromuscular performance (sharpened Romberg and dart throwing), and exercise performance (estimated aerobic capacity, hand-grip strength, vertical jump, and push-up) after acute ingestion of huperzine-A (200 mcg) or placebo. A 7- to 10-day washout period separated the subsequent trials.

RESULTS: No measures of cognitive function differed between placebo or huperzine-A trials (all $p \geq 0.296$). Heart rates (157 ± 4 vs. 158 ± 4 bpm; $p=0.518$) and ratings of perceived exertion (13.7 ± 0.56 vs. 13.9 ± 0.61 ; $p=0.582$) did not differ between placebo and huperzine-A trials, respectively. Ratings of subjective difficulty post-exercise (0-10 scale) were significantly higher (5.7 ± 0.38 vs. 6.8 ± 0.38 ; $p=0.002$) in the huperzine A trial than the placebo trial. No differences were observed for neuromuscular or exercise performance measures between both groups (all $p \geq 0.497$). **CONCLUSION:** Huperzine-A does not enhance cognitive function during exercise despite it being marketed as a cognitive enhancer. Because of its inability to enhance cognitive function, its inclusion in pre-workout supplements warrants reconsideration. Other more practical and effective strategies should be considered.

349 Board #187 May 29 9:30 AM - 11:00 AM
No Recovery Differences with Acute vs. Pre-load Montmorency Tart Cherry Juice Supplementation Following Strenuous Exercise

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 (No relevant relationships reported)

Montmorency tart cherry juice (MC) has been shown to enhance exercise recovery following high intensity exercise by decreasing inflammation and oxidative stress.

Methodologies for previous studies involving MC consumption as a recovery aid utilize a pre-load dosage strategy involving a 3-7 day loading phase prior to strenuous exercise. No consistent rationale has been provided for dosage strategies, therefore a pre-load strategy may be unnecessary for proposed benefits. **PURPOSE:**

To investigate whether acute consumption of MC following a bout of strenuous exercise is equally as effective as consuming MC pre and post exercise on markers of recovery. **METHODS:** Healthy resistance-trained males ($n=10$, age, height, mass: 25.30 ± 8.08 years, 179.81 ± 10.84 cm, 90.95 ± 18.04 kg) and females ($n=8$, age, height, mass: 25.63 ± 3.85 years, 165.89 ± 3.46 cm, 70.98 ± 8.54 kg) were randomized into two groups that consumed 30 mL of MC twice per day for three days following exercise (no-preload; NPL) or six consecutive days beginning three days prior to strenuous exercise (pre-load; PL). Participants completed a squatting exercise protocol designed to induce muscle damage and reported to the lab immediately post-exercise, 24, 48 and 72-h later to assess recovery indices including: serum creatine kinase (CK), the Adapted Brief Assessment of Mood (BAM+) survey, pressure-pain threshold (PPT), countermovement jump height (CMJ) and the Wingate anaerobic test (WANT).

RESULTS: Serum CK peaked at 24-h in the NPL and PL group as compared to baseline (410.56 ± 253.90 , 778.17 ± 780.95 U/L, respectively) ($p<0.05$). Perceived recovery (BAM+) was lowest at 48-h in the NPL and PL group (45.16 ± 25.59 , 35.96 ± 29.67 mm, respectively) ($p<0.05$). PPT of the vastus medialis muscle was lowest at 48-h in the NPL and PL group (5.99 ± 1.34 , 5.36 ± 0.84 kg-force, respectively) ($p<0.05$). CMJ performance was lowest at 24-h in the NPL and PL group as compared to baseline (94.28 ± 5.29 , $88.94 \pm 11.74\%$, respectively) ($p<0.05$). No differences were found between the NPL and PL groups for all recovery indices. **CONCLUSIONS:** These results suggest no additional benefits of a pre-load strategy when using MC as a post-exercise recovery aid following high-intensity, muscle-damaging exercise. These findings could have implications for dosage strategies currently used by athletes.

350 Board #188 May 29 9:30 AM - 11:00 AM

Performance Enhancing Effects Of Ecdysterone- A Human Intervention Study

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PURPOSE: Recent studies suggest that the anabolic effect of ecdysterone (a naturally occurring steroid hormone present in some supplements claimed to enhance physical performance) is mediated by estrogen receptor (ER) binding. In comparison to the prohibited anabolic agents (e.g. metandienone and others) ecdysterone revealed to be even more effective in a recent study performed in rats. However, scientific studies in humans are very rarely accessible. Thus, our project aimed at investigating the effects of ecdysterone containing products on human athletic performance

METHODS: A ten weeks intervention study in young man has been conducted including regular resistance training for all volunteers. Different doses of ecdysterone containing supplements have been administered during the study to evaluate the performance enhancing effect. Analysis of blood and urine samples for ecdysterone and potential biomarkers of performance enhancement have been conducted. To ensure the specificity of the measured effects a comprehensive screening for prohibited compounds was also performed. Furthermore, the administered supplements have been tested for the absence of anabolic steroid contaminations prior to administration.

RESULTS: Used ecdysterone supplements displayed anabolic activity in C2C12 cells. Dose dependent administration of Ecdysterone supplements to human volunteers results in detectable ectysterone concentrations in serum. Effects on endocrine parameters were detectable. Serum IGF1 concentrations increased in comparison to the control group while thyroxin (T4) concentrations decreased. Significantly higher increases in muscle mass were observed in those volunteers that were dosed with the ecdysterone supplements. Even more relevant with respect to sports performance, also significantly more pronounced increases in one-repetition bench press performance were observed.

CONCLUSIONS: These data underline the effectivity of an ecdysterone supplementation with respect to sports performance. Our results strongly suggest to include ecdysterone in the list of prohibited substances and methods, in the class S1.2 "other anabolic agents".

351 Board #189 May 29 9:30 AM - 11:00 AM

Citrus Active Substances Improve Elite Weightlifters' Aerobic Exercise And Resilience

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(No relevant relationships reported)

Citrus Active Substances Improve Elite Weightlifters' Aerobic Exercise And Resilience
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PURPOSE: Citrus active substances can extend aerobic exercise time in mice. The objective of this study was to determine whether citrus bioactive substances could improve aerobic exercise and resilience of athletes.

METHODS: Weightlifters (male = 6; female = 5) Took citrus bioactive substance (200mg/d) orally for 5 weeks, blood sampling before intervention, and then collected once every 6 days, and the fasting sampling was proceeding from 7:00 to 8:00 am. Athlete-related biochemical indicators were detected and analyzed.

RESULTS: Citrus active substances could maintain the number of athletes leucocytes. After 5 weeks, the testosterone contents of male and female athletes decreased and then increased during intervention time, increasing the testosterone content (more than 1.5 times) of male athletes with low initial testosterone levels. The cortisol concentrations of all athletes significantly lower than that before non intervention. Serum ferritin content rose during intervention time. The erythrocytes number of male athletes decreased and the amount of increased compared the initial state, while hemoglobin/red blood cells showed an increasing trend. In terms of fatigue index, the

male athlete's blood urea level fell, while that of the female athlete escalated; male athletes' uric acid content decreased, female athletes increased gently in the early stage.

CONCLUSION: Our findings showed that the citrus bioactive substance diminished serum cortisol levels and increased the testosterone/cortisol ratio, thus helping the recovery of the athlete's body. The increase in the amount of hemoglobin carried by athletes in red blood cells increases the rate of oxygen transport. In general, athletes can use citrus

bioactive substances as a supplement to enhance physical recovery and exercise capacity.

352 Board #190 May 29 9:30 AM - 11:00 AM

7-Day Hydrogen Inhalation Affects Exercise Performance and Hormonal Profiles in Young Volunteers

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(No relevant relationships reported)

The use of medical gasses has been recently displayed as an emerging exotic strategy in exercise physiology and sports medicine community, with few unconventional medical gasses put forward as performance-enhancing agents. Among others, molecular hydrogen (H₂) pops up as an innovative compound that might be applicable among athletes.

PURPOSE: To examine the effects of 7-day H₂ inhalation on exercise performance outcomes and serum hormonal and inflammation profiles in a cohort of young men and women. **METHODS:** Twenty healthy volunteers (10 men and 10 women; age 22.9 ± 1.5 years; body mass index 23.4 ± 2.5 kg/m²) participated in this randomized, double-blind, placebo-controlled, crossover pilot trial. All participants were allocated to receive either gaseous hydrogen (4%) or placebo (room air) by 20-min once-per-day inhalation for 7 days, with wash-out period of 7 days to prevent the residual effects of interventions across study periods. Gaseous hydrogen was provided by biological gas supplying apparatus (MIZ Company Ltd, Kanagawa, Japan), with day-to-day H₂ inhalation supervised by study investigators throughout the trial. The primary treatment outcome was the change in running time-to-exhaustion from baseline to day 7. Secondary outcomes included change from baseline to end of treatment in other exercise performance endpoints and clinical chemistry biomarkers.

RESULTS: Breathing H₂ was superior to placebo to increase peak running velocity during a maximal incremental running test (for up to 4.2%; $P \leq 0.05$), also to attenuate a drop in maximal voluntary isometric strength at 7-day follow-up ($P = 0.04$).

Hydrogen inhalation resulted in a notable drop in serum IGF-1 for 48.2 ng/mL at follow-up, while IGF-1 levels were elevated by 59.3 ng/mL after placebo intervention ($P = 0.04$). Baseline CRP levels were decreased by 1.0 mg/L and 0.7 mg/L after H₂ and placebo inhalation at 7-day follow up, respectively. **CONCLUSION:** Inhalational hydrogen appears to show ergogenic properties in young volunteers. Gaseous H₂ should be further evaluated for its efficacy and safety in athletic environment.

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353 Board #191 May 29 9:30 AM - 11:00 AM

Using Combined Curcumin and Boswellia Serrata Supplementation to Alter Inflammatory Response to Consecutive Exercise Days

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Repetitive exercise on consecutive days is a key component of many long-term training plans. This type of training results in muscle inflammation and soreness that limits the capacity to sustain exercise at a high intensity. Several dietary polyphenols have the capacity to manage inflammation and thus supplementation may be an effective component of a long-term training plan. **PURPOSE:** The purpose of this study was to investigate the effect of combined oral supplementation with curcumin and boswellia serrata prior to and following three consecutive days of intense interval exercise. **METHODS:** All protocols were approved by the University IRB committee and participants gave written informed consent. Participants were supplemented with either combined active (N=10; 95% full spectrum curcumin=400 mg/d and 90% boswellia serrata extract standardized for AKBA=100 mg/d) or placebo (rice flour; N=7) for 7-d prior to and immediately following each exercise session. Each exercise day consisted of 45-min of interval exercise (ladder climbing, cycling, and downhill running). Subjective muscle soreness and muscle strength were evaluated using a visual analog scale and isokinetic dynamometer respectively. Venous blood samples were collected for serum prior to and 1-h after each of the three exercise days and 24-h after the final exercise day. Samples were analyzed in duplicate using separate bead-

based assays to measure cytokines and myokines (Milliplex; Millipore-Sigma). Sample analysis was performed on a multiplex analyzer (Luminex LX200). **RESULTS:** Active resulted in trends toward reduced muscle soreness and improved muscle strength compared to placebo. Active was also associated with transient reductions in serum creatine kinase, MIP-1 β , and IL-6. **CONCLUSIONS:** These data support the notion that combined supplementation with curcumin and boswellia serrata may represent an effective means to manage systemic inflammation during consecutive days of training. More research is needed to understand how curcumin and boswellia serrata may be able to manage inflammation in other exercise models.

354 Board #192 May 29 9:30 AM - 11:00 AM

Curcumin Supplementation Alters Inflammatory Cytokines Following Exercise

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Reported Relationships: B.K. McFarlin: Industry contracted research; Research Grant to UNT.

Nutritional supplementation is often misused as a component of a holistic approach to muscle recovery following exercise. Supplementation that reduces post exercise inflammation or muscle soreness might improve recovery time. **Purpose:** The phase 1 purpose was to evaluate different doses of a curcumin supplement following a bout of eccentric leg press. The phase 2 purpose was to determine if the effective curcumin dose from phase 1, could alter inflammation in an open-label, field-based model. **Methods:** We consented self-reported healthy men and women to participate in the two phases of the study. In phase one, we tested a dose response for curcumin (Longvida) by comparing three doses (200, 400, & 1000 mg/d) to a placebo. In phase two, we evaluated a single dose of curcumin (1000 mg/d) combined with another polyphenol (pomegranate extract; Pomella; 1000 mg/d) endurance exercise model (half-marathon performance). Venous blood samples and analyzed for inflammatory cytokines (IL-1 β , IL-6, IL-8, and TNF- α) using a bead-based multiplex assay and an automated analyzer. Creatine kinase was analyzed using an enzymatic assay on a biochemistry analyzer (ChemWell T). **Results:** The 400 and 1000 mg doses were associated with a reduction in inflammatory cytokines and CK at 24 & 48-h after injury. Only the 1000 mg dose was associated with a reduction in subjective muscle soreness. The 200 mg dose responded in a similar manner as placebo (i.e. no reduction in muscle soreness or inflammation). When curcumin (1000 mg) was combined with pomegranate (1000 mg) in half-marathon runners, we found a significant reduction in inflammatory cytokines at 24-h post-race compared to pre-race. **Conclusions:** The key findings of this study suggest that the effectiveness of an oral curcumin supplement is dose-dependent and also activity-dependent. The combination of curcumin with pomegranate extract appeared to be more effective than curcumin alone at altering inflammation. More research is needed to identify how to incorporate curcumin and pomegranate supplementation into long-term exercise program.

355 Board #193 May 29 9:30 AM - 11:00 AM

Effect Of New Zealand Blackcurrant Extract On Recovery From Exercise Induced Muscle Damage Following Half Marathon Running

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(No relevant relationships reported)

New Zealand blackcurrant (NZBC) is a rich source of polyphenols, namely anthocyanins, which improve blood flow and display anti-inflammatory and anti-oxidant properties that may improve recovery from exercise-induced muscle damage (EIMD). Limited evidence is available as to whether a polyphenol supplement can aid recovery in the days following a half-marathon event. **Purpose:** To examine whether NZBC extract would accelerate recovery after a half-marathon race. **Methods:** Following a double blind, independent groups design, 20 (8 women) recreational runners (mean \pm SD: age 30 \pm 6 years, height 1.73 \pm 0.74 m, body mass 68.5 \pm 7.8 kg, previous half-marathons 7 \pm 2, finishing time 1:56:33 \pm 0:18:08 h:min:s) ingested either 2 x 300 mg day⁻¹ capsules of a NZBC supplement (CurraNZTM; each containing 105 mg anthocyanin) or a visually matched placebo (PLA) 7-days prior to and 2-days following a half-marathon. Force plates sampling at 1000 Hz recorded countermovement jumps (CMJ) performance variables: jump height (JH), time to take off (TTT) and reactive strength index modified (RSImod) and visual analogue scales for perceived muscle soreness and fatigue were measured pre-, immediately post-, and at 24 h and 48 h after the half-marathon. The CMJ performance variables, muscle soreness and fatigue were analysed using a mixed model ANOVA. **Results:** CMJ variables were reduced immediately after the half marathon ($P < 0.05$) (NZBC; JH 0.19 \pm 0.06 and PLA 0.18 \pm 0.05 m, NZBC; TTT 0.98 \pm 0.16 and PLA 1.03 \pm 0.20

s, NZBC; RSImod 0.20 \pm 0.08 and PLA 0.18 \pm 0.06 ratio) and had returned to baseline by 48 h, with no difference between NZBC and PLA for any variables ($P > 0.05$). Perceived muscle soreness was increased immediately post (NZBC; 6 \pm 2 and PLA; 6 \pm 2) and had returned to baseline by 48 h, with no difference between NZBC and PLA ($P = 0.404$). Perceived muscle fatigue was increased immediately post (NZBC; 7 \pm 2 vs. PLA; 6 \pm 2) and had returned to baseline by 48 h, with no difference between NZBC and PLA ($P = 0.170$). **Conclusion:** NZBC extract did not accelerate recovery of CMJ variables or perceptions of muscle soreness or fatigue following a half-marathon in recreational runners, possibly because the event only induced modest changes in the indices of EIMD in the days after the event. **Acknowledgement:** We thank Health Currency Ltd (UK) and CurraNZ (NZ) for supplements.

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New Zealand Blackcurrant Extract Increases Circulating Hsp32 And Hsp90 α But Doesn'T Affect Circulating Hsp72

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Extracellular heat shock protein 72 (eHSP72) acts as an inflammatory molecule, inducing cytokine production in immune cells, whereas HSP90 α is implicit in recovery and adaptation to cellular stress. Heme oxygenase-1 (eHSP32) protects the vasculature and suppresses inflammation. Each are elevated following exertional heat stress. Polyphenols are proposed to have anti-inflammatory properties, so may affect eHSP responses to exercise. **Purpose:** To determine the effects of 7-days supplementation with New Zealand blackcurrant (NZBC) extract on eHSP72, eHSP90 α , and eHSP32 before and after exertional heat stress. **Methods:** In a randomized double-blind design, 12 men (Age: 28 \pm 6 years, stature: 1.81 \pm 0.07 m, mass: 80.5 \pm 9.8 kg, $\dot{V}O_{2max}$: 55.6 \pm 6.0 mL \cdot kg⁻¹ \cdot min⁻¹) completed 2 trials. Participants ingested 2x300 mg day⁻¹ capsules of CurraNZTM (each containing 105 mg anthocyanin) or a visually matched placebo for 7 days (washout 14 days). On day 7, participants ran 60 minutes at 65% $\dot{V}O_{2max}$ in hot ambient conditions (34°C and 40% relative humidity). eHSP72, eHSP90 α , and eHSP32 were measured in EDTA plasma at rest and 20 and 60 minutes after exercise. **Results:** Post exercise eHSP72 concentrations were elevated after the placebo [by 1.98 ngmL⁻¹ (95% CI: 0.65 - 3.33 ngmL⁻¹)] and NZBC trials [by 1.59 ngmL⁻¹ (95% CI: 0.03 - 3.15 ngmL⁻¹)] and remained elevated 60 minutes after exercise [Placebo: by 0.68 ngmL⁻¹ (95% CI: -0.07 - 1.46 ngmL⁻¹); NZBC by 0.51 ngmL⁻¹ (95% CI: -0.37 - 1.40 ngmL⁻¹)]. Basal eHSP90 α concentration was increased following NZBC supplementation [by 5.60 ngmL⁻¹ (1.85 - 9.51 ngmL⁻¹), trial x time interaction, $F = 3.57$, $p = 0.046$, $np^2 = 0.25$], and were elevated at 20 and 60 minutes post exercise in both conditions. Similarly, basal eHSP32 was elevated after NZBC supplementation [by 3.9 ngmL⁻¹ (95% CI: 0.37 - 7.42 ngmL⁻¹), trial x time interaction $F = 5.62$, $p = 0.01$, $np^2 = 0.34$], but were not altered at 20 or 60 minutes after heat stress in either condition. **Conclusion:** We present moderate evidence to support that 7 days of NZBC extract supplementation increases basal eHSP32 and eHSP90 α , with no effect on eHSP72 before or after exercise. Further research is required to determine the functional relevance of these increases. **Acknowledgement:** We thank Health Currency Ltd (UK) and CurraNZ (NZ) for supplements.

357 Board #195 May 29 9:30 AM - 11:00 AM

Does Supplementation With Pedicoccus Acidilactici Probiotics Alter Inflammatory Response To Exercise On Consecutive Days?

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(No relevant relationships reported)

Oral supplementation with probiotics has been reported to treat a variety of common gastrointestinal conditions (i.e. IBS, IBD, etc.); however, probiotics have not been studied for potential sport nutrition applications. Management of post-exercise inflammation, particularly on consecutive days poses a unique challenge to the body and effects future training and performance. **PURPOSE:** The purpose of this study was to investigate if a novel plant based, non-spore forming high temperature (up to 85°C) and acid resistant probiotic strain (*Pedicoccus acidilactici*; NRRL B-50517) may alter post-exercise inflammation. **METHODS:** Subjects were consented for participation using a University IRB approved informed consent form. Subjects were supplemented with either probiotic condition (*Pedicoccus acidilactici*; NRRL B-50517, 8 billion cfu per day; N=6) or placebo condition (maltodextrin; N=5) for 14-d prior to two consecutive days of 45-min of intense, interval exercise (intervals of ladder climbing, cycling, and downhill running). Subjective muscle soreness and muscle strength were

evaluated using a visual analog scale and isokinetic dynamometer respectively. Venous blood samples were collected prior to exercise and 48-h after the final exercise day. Samples were analyzed in duplicate using separate bead-based assays to measure cytokines and myokines (Milliplex®; Millipore-Sigma). Sample preps were analyzed using a multiplex analyzer (Luminex LX200). **RESULTS:** There were trends toward reduced MIP-1 α , MIP-1 β , and IL-8 in probiotic compared to placebo during recovery from exercise. There were no obvious trends in any additional outcome measures.

CONCLUSIONS: These data support the concept that probiotics may be useful for managing the trafficking of monocytes and other phagocytes during exercise-induced inflammatory responses. More research is needed to determine if a more extensive exercise model may be capable of eliciting probiotic associated improvements in post-exercise inflammation.

358 Board #196 May 29 9:30 AM - 11:00 AM
Combined Dietary Polyphenol Supplementation
Reduces Inflammation Associated Gene Expression
Following a Half Marathon Race

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Prolonged endurance exercise provides a unique model for investigating skeletal muscle damage through the combined effects of oxidative stress and eccentric muscle contraction on differential gene expression with nutritional interventions known to blunt inflammation. Dietary polyphenols (i.e. curcumin, pomegranate, etc.) have been shown to reduce exercise-induced inflammation associated mRNA and protein expression with fewer side effects than NSAIDs. **PURPOSE:** To investigate the effect of a combined curcumin (500-1000 mg/d; Longvida) and pomegranate extract (500-1000 mg/d; Pomella) supplement for 30-days on mRNA expression following a half marathon race. **METHODS:** All protocols were approved by the University IRB committee and participants gave written informed consent. Participants supplemented for 30-days prior to running a half marathon race with either the active (N=6) or no supplement (N=6). Venous blood samples were collected in PAXgene RNA tubes 24-h before (PRE) and 4-h after completing a half marathon race. After collection, tubes were stored frozen at -80°C until RNA isolation. PAXgene whole blood was thawed and isolated using a PAXgene Blood miRNA sample processing system (PreAnalytiX) along with a QIAcube automation system (Qiagen). Isolated RNA was analyzed using a 594-plex Human Immunology Panel on a NanoString nCounter platform. Data were normalized to housekeeper genes and reported as log2 fold change. Detailed pathway and interaction analysis was conducted using Nanostring nSolver software to identify RNA that were significantly affected by the supplement. **RESULTS:** Analysis revealed significant down regulation of nine pro-inflammatory associated mRNA at 4-h post-race with supplementation compared to control. **CONCLUSIONS:** Combined curcumin and pomegranate extract supplementation altered expression of inflammation associated mRNA prior to and following a half marathon race. Based on these findings, it appears that curcumin and pomegranate extract supplementation may positively affect short-term inflammatory response and recovery in endurance athletes and recreationally active individuals participating in half marathon races. More research is needed to determine how to best use these dietary polyphenols as part of a long-term training plan.

359 Board #197 May 29 9:30 AM - 11:00 AM
Mood: There Are Some Connection Between Probiotics
Supplementation On Marathon Runners? A Double
Blind Study

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Prolonged exercise may cause Gastrointestinal Symptoms (GIS) as well as rise some negative affects, which may be mitigated by probiotics according to evidences. **PURPOSE:** Investigate the probiotic effect on mood and GIS after a marathon race. **METHODS:** Twenty seven marathonists were double-blind randomly assigned to either a probiotic group (PR) (35.96 \pm 5.81 years, 79.30 \pm 10.99 Kg) or placebo (PL) (PL=13.40, 46 \pm 7.79 years, 72.67 \pm 10.20 Kg). PR consumed during 30 days a sachet containing *Lactobacillus Acidophilus* and *Bifidobacterium Lactis* (10x10⁹UFC + maltodextrin 5g/day) while PL received a sachet with maltodextrin (5g/day). GIS were evaluated before the supplementation period (B) and one day before the race (1D) by questionnaires. Brunel Mood Scale (BRUMS) was applied at the B, immediately after the race (AR) and one hour after the race (1H). The data were analyzed in SPSS version 25® using ANOVA two way with repeated measures, "group" and "time"

as factors, and Tukey's post-hoc test ($p < 0.05$). Results were expressed as means \pm standard deviation (SD). **RESULTS:** GIS were not different after the supplementation period or between groups. According to BRUMS, PL group showed significant increase of depression (B: 0.23 \pm 0.43; AR: 1.30 \pm 2.01; 1H: 1 \pm 0), anger (B: 0 \pm 0; AR: 6.61 \pm 1.51; 1H: 5.53 \pm 1.33), fatigue (B: 0.69 \pm 1.54; AR: 12.15 \pm 0.98; 1H: 7.30 \pm 0.75), tension (B: 1.46 \pm 2.06; AR: 6.38 \pm 0.65; 1H: 3.84 \pm 0.37) and mental confusion (B: 0.53 \pm 0.77; AR: 4.46 \pm 0.51; 1H: 2.92 \pm 0.27) and decrease of vigor (B: 10.30 \pm 2.25; AR: 2 \pm 0.91; 1H: 6.76 \pm 1.30) when compared with B, AR and 1H. Probiotic group shown significant increase of anger (B: 0.21 \pm 0.42; AR: 1.21 \pm 0.89; 1H: 0.14 \pm 0.36), fatigue (B: 1 \pm 0.87; AR: 4.28 \pm 1.43; 1H: 0.71 \pm 0.72), tension (B: 0.92 \pm 1.20; AR: 1.42 \pm 0.64; 1H: 0.71 \pm 1.13) and mental confusion (B: 0.28 \pm 0.46; AR: 0.42 \pm 0.51; 1H: 0.42 \pm 0.64) when compared B, AR and 1H. Between groups, for all mood parameters, PL showed significant increase at AR and 1H compared to PR ($p < 0.05$). **CONCLUSION:** *Lactobacillus Acidophilus* and *Bifidobacterium Lactis* (10x10⁹UFC/day) consumption did not seem to have effect on GIS, but it plays a positive role on mood affects in order to attenuating the increase of negative affects and maintaining the vigor state which may influence sport performance. **Financial Support:** CNPq, CAPES/PROEX.

360 Board #198 May 29 9:30 AM - 11:00 AM
No Acute Effects of Placebo or Open-Label Placebo
Supplementation on Strength and Neuromuscular
Fatigue

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 (No relevant relationships reported)

PURPOSE: We utilized a repeated measures design to examine the acute effects of placebo, open-label placebo, and control treatments on muscle strength and voluntary activation (Experiment #1), as well as neuromuscular fatigue (Experiment #2).

METHODS: Following a familiarization session, 21 untrained males ($n = 11$) and females ($n = 10$) visited the laboratory on three occasions to receive placebo, open-label placebo, and control treatments in a randomized, counter-balanced manner. All visits involved a pretest, 15-minute intervention period, and posttest. All visits were at the same time of day. The time between sessions was ≥ 48 hours but < 1 week. Laboratory conditions were constant throughout the study, and participants were asked to keep their physical activity levels, dietary habits, and caffeine consumption consistent. In Experiment #1, knee extensor maximal voluntary isometric contraction (MVIC) peak torque and percent voluntary activation were evaluated. In Experiment #2, participants performed 20, six-second MVICs while surface electromyographic signals were detected from the vastus lateralis. Subjective assessments of energy and perceived exertion were also examined.

RESULTS: In Experiment #1, there were no differences among interventions for peak torque or voluntary activation, but a main effect revealed that energy levels increased following all treatments ($p = .016$, $\eta^2 = .257$). Experiment #2 demonstrated that placebo and open-label placebo treatments had no influence on neuromuscular fatigue, but there were main effects for declines in absolute ($p = .001$, $\eta^2 = .675$) and normalized peak torque ($p = .001$, $\eta^2 = .765$), normalized electromyographic mean frequency ($p = .001$, $\eta^2 = .565$), neuromuscular efficiency ($p = .001$, $\eta^2 = .585$), and energy levels ($p = .006$, $\eta^2 = .317$).

CONCLUSIONS: Compared to a control condition, placebo and open-label placebo treatments had minimal influence on muscle strength, voluntary activation, and fatigue resistance in untrained participants.

361 Board #199 May 29 9:30 AM - 11:00 AM
Evaluation of the Placebo Effect in Elite and Amateur
Athletes

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Purpose: The aim of the present study was to test the placebo effect. This was made possible by the research design. In this way the impact of the placebo effect could be effectively measured. **Methods:** 22 athletes were selected for the experiment. Out of this total 16 recreational and 6 elite. The test was performed on a cycle ergometer. The tests were performed in 2 days, with a 72-hour interval between one and the other. All tests were performed at the same time of the day. The load of the test was adjusted by the weight of the athlete to work with the same load relative to the weight (watt / kg). The load was kept fixed throughout the test and the test ended after exhaustion and voluntary request of the athlete. During the evaluation, the heart rate was continuously measured and the subjective perception of effort (Borg scale) was measured minute by minute. On the first day the athletes received 30 minutes before the test a supplement. This supplement was placebo. There was no ergogenic feature in the capsule, but they received the information that it was a new, very powerful supplement.

In the second encounter, the athlete did the test without any capsule. He was informed that the goal was to compare how much the supplement, offered in the first encounter, would lead to a better performance.

Summary of Results: Overall, in the supplement test (which was placebo) there was an average increase of 9.66% in performance, measured by a longer time to exhaustion. This result was obtained with all 22 athletes. In the case of elite athletes, the result was lower, showing an increase of 4.39%, on average. In the case of amateur athletes, the increase was 22.87%.

The fact that the increased impact of the placebo effect was greater in amateur athletes seems quite reasonable and may be explained by their greater susceptibility to placebo. In the case of elite athletes, the impact of the placebo effect was smaller, but can be considered as important from a practical point of view, since a performance increase of 4.39% a professional athlete, seems to be something fantastic.

Conclusion: The present study showed that the placebo effect is important to be considered even in the case of elite athletes. The way the study was designed allowed a more reliable measurement of the real dimension of the placebo effect.

362 Board #200 May 29 9:30 AM - 11:00 AM
Effects of Nutritional Supplementation on Body Composition and Bio-markers during Army Initial Entry Training

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Purpose: Previous research has reported that military training can result in reductions in fat free mass (FFM) and serum testosterone while increasing cortisol and interleukin-6 (IL-6). This can be due to inadequate nutrition combined with rigorous training. The purpose of this study was to investigate whether once daily whey protein (WP) or carbohydrate (CHO) supplementation positively impacts the physiologic response to Initial Entry Training (IET).

Methods: Eighty-one male soldiers (WP: n = 39, Ht. = 173 ± 8 cm, Wt. = 76.8 ± 12.8 kg, Age = 21 ± 3 yrs; CHO: n = 42, Ht. = 175 ± 8 cm, Wt. = 77.8 ± 15.3 kg, Age = 23 ± 4 yrs) participating in Army IET were supplemented with one 38.6 g protein (from WP hydrolysate; WP, n = 45) or one energy, fat and taste matched CHO (n = 51) serving per day, for seven weeks. Physical performance, body composition and serum markers were collected during weeks one and eight of training. Testosterone, cortisol and IL-6 were measured using enzyme-linked immunosorbent assays. All measures were collected in the morning after an overnight fast, in a hydrated state, and prior to physical activity. Repeated measures ANOVA with one within subjects' factor (time) and one between subjects factor (group) were used to evaluate biomarker response to training. Regression analysis was used to determine if change in biomarkers were related to changes in FFM.

Results: There was a significant increase in testosterone (F = 14.06, p < 0.01) and the testosterone to cortisol ratio (F = 10.08, p = p < 0.01) and a significant decrease in IL-6 across military training (F = 7.63, p = 0.01). There was no significant change in cortisol (F = 3.64, p = 0.06). There were no group by time interactions for testosterone, cortisol or testosterone to cortisol ratio or IL-6. Change in Testosterone to cortisol ratio was a significant predictor of change in FFM (P = 0.04). FFM increased 1.2 kg (95% CI: 0.4, 2.0 kg) in the WP group; whereas FFM increased only 0.1 kg (95% CI: -0.9, 1) in the CHO group during IET.

Conclusion: We found no differential effects of once daily supplementation with WP or CHO on testosterone, cortisol or IL-6. However, our results in light of previous research in military training, suggests that supplementation in general may benefit the physiologic response to training. Additionally, there may be a clinical benefit of WP on FFM during Army IET.

363 Board #201 May 29 9:30 AM - 11:00 AM
Adverse Reactions and Perceived Benefits of Dietary Supplements used by SEAL Qualification Training Students

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Sea, Air, and Land (SEAL) Qualification Training (SQT) students must successfully complete several months of advanced tactical training in order to become a NAVY SEAL Operator. During SQT training students are discouraged from consuming any dietary supplements (DSs). **PURPOSE:** Evaluate the DS habits of SQT Students. **METHODS:** 282 male Students (Age 24 ± 2.7 y) completed a detailed DS questionnaire. **RESULTS:** Ninety percent of SQT students reported consuming at least one DS on a consistent basis during the previous 12 months. Of these, 59% consumed

whey protein supplements (WP), 47% multivitamin and mineral supplements (MVM) and 31% energy drinks (EDs) (Table 1). Table 1: Common dietary supplements, purpose for use, perceived benefits and adverse reactions among SQT students (top 3 responses reported as % Students)

Supplement Category	Purpose of Use*	Adverse Reactions	Perceived Benefits*	Impact*
Whey	Increase muscle mass, strength, recovery 88% Supplement diet Improve health 23% Improve performance 23%	None 98% Bloating, gas, lactose intolerance 2%	No benefit 40% Improved recovery 41% Increase muscle mass/strength 34%	Beneficial 85% Neither harmful or beneficial 15%
Multivitamin & Mineral Supplement	Supplement diet/ Improve Health 97% Improve performance 15% Increase muscle mass, strength, recovery 6%	None 99% Upset stomach 1%	No benefit 74% Stayed healthy/ Improved immunity 14% Better energy/ feel better 8%	Beneficial 63% Neither harmful or beneficial 36% N/A 1%
Energy Drinks	Improve cognitive function 50% Improve performance 35% Tastes Good 8%	None 85% Jittery/ Shaky 7% Increased heart rate 3%	Awake/Alert 48% More energy 31% No benefit 23%	Beneficial 62% Neither Harmful/ Beneficial 19% Harmful 17%

*Subjects were allowed to select more than 1 response. **CONCLUSION:** SQT students reported taking WP was beneficial (75%) in increasing muscle mass/strength and improving recovery. MVM supplements had the lowest reported adverse reactions and was beneficial in maintaining/improving health. EDs had the highest response for adverse reactions including jitters, shakiness and increased heart rate, with 17% of Students indicating taking EDs was harmful. Whey protein and MVM are safe and effective DSs that aid in muscle hypertrophy/strength (WP) and supplementing the diet (MVM). **Supported by ONR N00014-11-1-0929.**

364 Board #202 May 29 9:30 AM - 11:00 AM
Dark Chocolate Supplementation Elevates Resting Energy Expenditure In Exercise Trained Females

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(No relevant relationships reported)

PURPOSE: To investigate the influence of dark chocolate supplementation on resting and exercise metabolism.

METHODS: Using a randomized, double-blind design 18 exercise trained female subjects were assigned to a 30 day supplementation with either 20-g per day of 70% dark chocolate (DC) (n=9) or a calorically matched white chocolate (WC) (n=9). Prior to supplementation (PRE), subjects underwent indirect calorimetry assessment for resting energy expenditure (REE) followed by an assessment of exercise energy expenditure consisting of cycling for 20 min, 10 min at 50 watts (EEE-50) and 10 min at 100 watts (EEE-100). Upon completion of the 30 day supplementation, subjects repeated the assessment for REE, EEE-50, and EEE-100. All data are presented as mean (SE).

RESULTS: Pre supplementation REE (DC 1454 (51), WC 1565 (48) kcal per day), EEE-50 (DC 4.86 (0.11), WC 4.61 (0.18) kcal/min), and EEE-100 (DC 7.07 (0.15), WC 6.77 (0.18) kcal/min) were not significantly different between groups (p > 0.05). Post supplementation REE was significantly increased by 9.4% in the DC group (DC 138 (39), WC -29 (18) kcal per day, p=0.001). Neither EEE-50 (DC 4.49 (0.19), WC 4.48 (0.11) kcal/min), nor EEE-100 (DC 6.50 (0.20), WC 6.65 (0.14) kcal/min) were significantly different between groups (p > 0.05).

CONCLUSIONS: These results indicate that in athletic female subjects, DC supplementation significantly increases REE by 9.4%, but doesn't significantly influence exercise energy expenditure.

* Product was provided by The Hershey Company, Hershey, Pennsylvania.

365 Board #203 May 29 9:30 AM - 11:00 AM

Amelioration Of Capillary Regression Of Skeletal Muscle Under Disuse Condition By Enterococcus Faecium Strain R30 Supplementation

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(No relevant relationships reported)

PURPOSE: Disuse condition results in impaired capillary network of skeletal muscle. Capillary regression appears to be an adaptation to a reduction in blood flow to the skeletal muscles caused by a decrease in oxidative demand. Increased blood flow leads angiogenesis via increases in angiogenic factors in skeletal muscles. A probiotic strain of lactobacillus affects autonomic nerve activity has been reported. The purpose of the present study was to investigate the amelioration of enterococcus faecium strain R30 (R30) supplementation on the capillary regression and fatigue of skeletal muscle under disuse condition. **METHODS:** Thirty-six male Sprague-Dawley rats were assigned randomly either to a control, control with R30 supplementation, hindlimb unloaded or hindlimb unloaded with R30 supplementation group for 14 days. The three-dimensional capillary network of soleus muscle was visualized using a confocal laser scanning technique, and the capillary volume and diameter were measured. The angiogenic factors, VEGF and eNOS, were also determined. Furthermore, the tensions during muscle isometric contraction in plantar muscles was generated by successive electrical stimulations were measure in vivo. **RESULTS:** The capillary volume and diameter in disuse muscle were lower than those in control. R30 supplementation attenuated the decrease of capillary volume and diameter in disuse muscle. In addition, the decreased expression levels of VEGF and eNOS in R30 supplemented muscle were attenuated. In addition, the resistance to fatigue (isometric tension expressed relative to the initial value) was significantly higher in the R30 supplementation group than the hindlimb unloaded group **CONCLUSION:** These data suggest that R30 supplementation may be an effective treatment to counter the detrimental effects of a chronic decrease in muscle activities on the microcirculation and endurance in skeletal muscle.

366 Board #204 May 29 9:30 AM - 11:00 AM

Circulating Levels of Select Micro-RNA Are Not Impacted by Manipulating Nutrient Intake Following High-Intensity Cycling

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(No relevant relationships reported)

Circulating microRNAs (ci-miRNA) may facilitate intercellular communication as well as fine-tune phenotype adaptations to exercise through post-transcriptional regulation. Ci-miRNA levels are sensitive to acute aerobic exercise, yet much less is known about the influence of high-intensity interval type exercise. Further, almost nothing is known about the impact of post-exercise nutrition (carbohydrate and/or protein) on ci-miRNA levels. **Purpose:** To examine the effects of high-intensity interval cycling and different post-exercise nutrition treatments on select ci-miRNA levels. **Methods:** Eight recreationally active males (age 22 ± 2 yrs; VO_{2max} 50 ± 4 mL/kg/min) completed 3 trials, each consisting of 4 sets of 3-min intervals ($90\% W_{max}$) flanked by 30-sec Wingate intervals. Placebo (PLA; water), carbohydrate (CHO; 65 g), and carbohydrate (65 g) + protein (20 g) (PRO) beverages (600 mL) were consumed immediately following exercise. Serum levels of 9 miRNA (miR-1, -21, -126, -146a, -150, -210, -221, -222, and -486) were measured pre-exercise (Pre), immediately post (Post-0), Post-1hr, and Post-4hr. miRNA levels were expressed as fold changes relative to baseline and analyzed with repeated measures ANOVAs. **Results:** With the exception of a 1.3-fold increase ($p < 0.05$) in ci-miRNA-486 there was no main effect of time for any of the target ci-miRNA from Pre to Post-0 (i.e. prior to any nutritional intervention). There was a main effect of time for Ci-miRNA-150 from Pre to Post-1hr (0.6 fold-change, $p < 0.05$) and from Pre to Post-4hr (0.7 fold-change, $p < 0.05$), but there were no detectable nutritional effects. Further, ci-miRNA-1 increased from Pre to Post-4hr (3.1-fold-change, $p < 0.05$) but again with no nutrition effect. No other differences, across time or between treatments, were detected. **Conclusion:** In general, high-intensity cycling had a subtle impact on serum levels of miRNA. However, miRNA associated with skeletal muscle (miRNA-1 and -486) and cardiac physiology (miRNA-1 and -150) were affected by exercise. Post-exercise nutrition had no consequences on any of the targets of interest. However, the extent to which ci-miRNA reflects intracellular miRNA activity is poorly understood and future work should investigate how nutrition may influence intracellular mi-RNA levels.

A-51 Free Communication/Poster - Immunology I

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

367 Board #205 May 29 9:30 AM - 11:00 AM

Can a Dynamic Warm-up Reduce the Magnitude of Immune Perturbation Following Vigorous Aerobic Exercise?

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Exercise transiently increases several leukocyte populations in peripheral blood in an intensity-dependent manner, with numbers returning to baseline or lower during recovery. This mobilization of immune cells is explained in part by sympathetic activity and the release of stress hormones (catecholamines and cortisol). The literature examining immune responses to exercise has by and large failed to control for the presence of a warm-up prior to the experimental bout. Gradually increasing exercise intensity over a period of minutes may reduce the stress of the exercise bout and thus may influence the immune response to a given exercise protocol.

PURPOSE: To compare the mobilization of leukocyte subpopulations following a bout of high intensity aerobic exercise with and without a dynamic pre-exercise warm-up.

METHODS: 8 physically active adults (4 women, 27 ± 4 years) cycled 30 minutes at 80% heart rate maximum with and without warm-up in a randomized, counter-balanced order. Warm-up was provided immediately prior to the exercise, and involved increasing wattage by 10% each minute for 10 minutes starting at 10% of desired exercise intensity. Blood collected pre-, post- and 1-hour post-exercise was analyzed by flow cytometry to characterize cell populations. Differences in cell concentrations across time points and conditions were assessed by maximum likelihood linear mixed models.

RESULTS: Exercise transiently increased lymphocyte concentration in blood, and the number and proportion of late differentiated CD8 T cells (main effects of time; $p < 0.001$). Inclusion of warm-up diminished these post-exercise increases in lymphocytes (pre- to post- change with warm-up: 45 ± 19 cells/microliter, representing a 17% increase; change with no warm-up: 93 ± 11 cells/microliter, a 42% increase; $p < 0.05$) and in late differentiated CD8 T cells (pre- to post- change with warm-up: 1 ± 5 cells/microliter representing a 2% increase; change with no warm-up: 10 ± 4 cells/microliter, a 46% increase; $p < 0.05$).

CONCLUSIONS: Inclusion of a dynamic warm-up prior to vigorous aerobic exercise lessens the exercise-induced mobilization of lymphocytes and late differentiated T cells. Athletes should include a dynamic warm-up to reduce immune perturbations during high intensity exercise.

368 Board #206 May 29 9:30 AM - 11:00 AM
Mobilization and Fc -Receptor Expression of Six NK Cell Subsets During and After Acute Exercise

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(No relevant relationships reported)

Natural killer (NK) cells are the most responsive lymphocytes during acute exercise, with increased concentrations. After exercise, NK cell levels drop below their resting level if the exercise intensity was high, but values usually recover within 1-3 hours. NK cells may be divided into CD56^{dim} and CD56^{bright} subsets. The CD56^{dim} subset is the major population, representing about 80% of NK cells. Smaller subpopulations were recently studied for cell developments and diseases. We previously reported that exercise decreased the expression of Fcγ-receptor III (CD16); however, it is not yet understood how exercise affects these small subsets.

PURPOSE: To clarify the effect of acute exercise on the mobilization and expression of CD16 on the six different NK cell subsets.

METHODS: Healthy male students ($n=6$, 22.8 ± 0.8 years old) exercised on a cycle ergometer for 30 min at intensities corresponding to the individual's onset of blood lactate accumulation (70-85% maximum oxygen consumption). Venous blood samples were collected at rest (PRE), just before the end of exercise (END), 30 (POST 30), 60 (POST 60), 120 (POST 120), and 180 (POST 180) min after exercise. Cell counts and proportions of total lymphocytes expressing CD16^{CD56^{bright}} (R1), CD16^{CD56^{bright}} (R2), CD16^{CD56^{dim}} (R3), CD16^{dim}CD56^{dim} (R4), CD16^{bright}CD56^{dim} (R5) and CD16^{bright}CD56^{dim} (R6) subsets were determined. CD16 expressions of these subsets were also examined by flow cytometry. ANOVA was used for statistical analyses.

RESULTS: Exercise induced changes in NK cell concentration in CD56^{dim} (R3, $p=0.04$; R4, $p<0.01$; R5, $p<0.01$) and CD56^{bright} (R6, $p<0.01$) subsets. However significant changes between time points were only found in R5. In this subset, NK cell counts increased from PRE (356 ± 151 cells/ μ L) to END (1182 ± 159 cells/ μ L, $p<0.01$) and decreased under the PRE-level at POST 30 (108 ± 27 cells/ μ L, $p<0.01$) and POST 60 (106 ± 70 cells/ μ L, $p<0.01$). There were no changes in CD56^{bright} (R1, R2) subsets. These cell mobilizations were reflected in proportions to the total lymphocyte count. Expressions of CD16 were down-regulated at END in R5 (-502 ± 135 , $p<0.01$) and R6 (-416 ± 99 , $p<0.01$) then recovered at POST 30.

CONCLUSIONS: These results suggest that the influence of acute exercise on NK cell mobilization and CD16 expression are clear in subset R5, but not in R1 and R2.

369 Board #207 May 29 9:30 AM - 11:00 AM
Tumor Necrosis Factor- α , TNFR, And STNFR Relationships to Body Temperature

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 (No relevant relationships reported)

PURPOSE: To examine the TNF- α , TNFR, and STNFR relationships to body temperature in response to the heat. **METHODS:** 12 recreationally active men (24.4 ± 3.1 yrs; 181.0 ± 6.8 cm; 81.5 ± 8.0 kg; 47.2 ± 4.8 ml \cdot kg⁻¹ \cdot min⁻¹) completed an exercise protocol under four conditions: 23°C/45%RH; 23°C/70%RH; 35°C/20%; and 35°C/45% RH. The protocol consisted of a 60-minute cycling trial at 60% VO₂max, a 15-minute rest, and a time-to-exhaustion trial at 90% VO₂max (TTE). Blood was collected before (T1) and after (T2) the 60-minute trial, and immediately after TTE (T3). Plasma concentrations of TNF- α , STNFR1, and STNFR2 were measured via ELISA. Surface expression of TNFR1 and TNFR2 on human classical (CD14⁺CD16⁻) monocytes was measured via flow cytometry ($n=8$). Participant's rectal (T_{re}) and skin temperatures at 5 locations: Chest, Triceps, Forearm, Thigh and Calf were monitored continuously. Total skin temperature (T_{sk}) and whole body temperature (T_{wb}) were calculated using weighted averages. The Area Under the Curve with respect to increase (AUCi) was then calculated for T_{re} , T_{sk} and T_{wb} . Data were analyzed as Pearson Product Moment Correlations between AUCi for T_{re} , T_{sk} and T_{wb} with TNF- α , TNFR, and STNFR. The time spent above specific critical temperatures for T_{re} (37.5, 38.0, 38.5 and 39.0°C) and T_{wb} (35.0, 36.0, 37.0 and 38.0°C) were related to TNF- α , TNFR, and STNFR using stepwise linear regression. **RESULTS:** T_{re} was correlated with the change in STNFR1 from T1 to T3 ($r=0.307$; $p=0.048$) and with the change in STNFR2 from T1 to T3 ($r=0.340$; $p=0.028$). T_{sk} was correlated with both the change in STNFR1 from T1 to T2 ($r=0.321$; $p=0.038$) and from T1 to T3 ($r=0.320$; $p=0.039$); with the change in STNFR2 from T1 to T3 ($r=0.430$; $p=0.004$); and with the change in TNF- α from T1 to T2 ($r=0.357$; $p=0.020$). Time spent with a T_{re} above 38.5°C was related to the change in STNFR1 from both T1 to T2 ($r=0.837$; $p<0.001$) and from T1 to T3 ($r=0.773$; $p<0.001$); and to the change in TNF- α from T1 to T2 ($r=0.426$; $p=0.005$) and from T1 to T3 ($r=0.415$; $p=0.006$). **CONCLUSION:** Changes in circulating levels of TNF- α , STNFR1, and STNFR2 are influenced by rectal and whole body temperature. Classical monocyte expression of TNFR1 and TNFR2 do not appear to be influenced by rectal or whole body temperature.

This investigation was partially funded by Kent State University Research Council.

370 Board #208 May 29 9:30 AM - 11:00 AM
Monocyte Adhesion Molecule Expression Following an Acute Bout of Moderate Intensity Cycling

Natalie J. Bohmke, Lindsay M. LaFratta, Lauren N. Pedersen, Anson M. Blanks, Virginia L. Mihalick, Morgan B. Senter, R. Lee Franco. Virginia Commonwealth University, Richmond, VA.
 (No relevant relationships reported)

Monocyte adhesion to the endothelium is a key step in the development of atherosclerosis. It is well established that higher CV fitness is associated with a reduced risk for CV disease. **PURPOSE:** To investigate the impact of fitness on monocyte surface receptor expression of CD11c and VLA4 following an acute bout of exercise. **METHODS:** 9 fit (VO₂ peak; males: ≥ 45 mL/kg/min, females: ≥ 35 mL/kg/min) and 13 unfit (VO₂ peak; males: < 40 mL/kg/min, females: < 30 mL/kg/min) subjects performed 30 min of moderate intensity (60% VO₂ peak) cycling. Blood samples were obtained pre-exercise, immediately, and 1 h post-exercise. Monocytes were stained with antibodies against CD14, CD16, VLA4, and CD11c and were analyzed via flow cytometry. A mixed between-within repeated measures ANOVA was used to determine the impact of fitness on VLA4 and CD11c following a submaximal bout of exercise. **RESULTS:** There were no significant between-subjects main effect for groups in either of the monocyte subsets ($p>0.083$). A main effect for time was significant in VLA4 ($p=0.004$) and CD11c ($p=0.014$) expression in non-classical and classical monocytes, respectively. A profile plot suggested that VLA4 was increased 1 h post-exercise and CD11c was reduced immediately post-exercise. **CONCLUSIONS:**

Monocyte receptor expression does not appear to be impacted by physical fitness in young, apparently healthy adults. Nevertheless, an acute bout of cycling altered the expression level of monocyte adhesion molecules to varying degrees depending on the specific monocyte subset.

371 Board #209 May 29 9:30 AM - 11:00 AM
Aerobic Capacity And LPS-induced iNOS mRNA Expression In Leukocytes Of Healthy College-aged Males

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 (No relevant relationships reported)

PURPOSE: Inducible nitric oxide synthase (iNOS) is an enzyme expressed in leukocytes that supports innate immune function. While iNOS expression is low-to-undetectable in leukocytes under normal resting conditions, LPS-stimulated overexpression of iNOS increases indices of pro-inflammation, oxidative stress, and apoptosis. Aerobic exercise is a known anti-inflammatory mechanism shown to regulate iNOS expression. Therefore, this study examined the relationship between LPS-induced iNOS mRNA expression and indices of pro-inflammation, oxidative stress, and apoptosis in isolated leukocytes of aerobically fit (AF) and unfit (UF) males. **METHODS:** iNOS mRNA expression and TNF- α , MDA, and p53 concentrations were quantified from 3-hour LPS stimulated and unstimulated whole blood.

RESULTS: iNOS mRNA expression remained unaltered following LPS stimulation in AF and UF subjects ($p=0.146$). However, LPS stimulation significantly lowered MDA concentrations to a greater extent in UF compared to AF subjects ($p=0.001$), whereas LPS stimulation increased TNF- α and lowered p53 to a similar extent in both groups ($p=0.002$, $p=0.022$, respectively). Interestingly, change in relative iNOS mRNA expression was not associated with the percent change (control vs. LPS stimulation) in the concentrations of MDA, TNF- α , and p53.

CONCLUSIONS: Findings suggest that although aerobic fitness did not alter iNOS mRNA expression following LPS stimulation and may not directly impact indices of pro-inflammation or the pro-apoptotic marker p53 in healthy, young males, fitness may impact LPS-induced oxidative stress.

372 Board #210 May 29 9:30 AM - 11:00 AM
Monocyte Chemoattractant Protein-1 and C-C Chemokine Receptor Type 2 Expression related to Body Temperature Changes

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 (No relevant relationships reported)

Purpose: To examine the relationship between Monocyte Chemoattractant Protein-1 (MCP-1) and its receptor C-C Chemokine Receptor Type 2 (CCR2) and the time spent above critical body temperatures while cycling. **Methods:** 12 recreationally active men (24.4 ± 3.1 yrs; 1.81 ± 0.07 m; 81.5 ± 8.0 kg; 47.2 ± 4.8 ml/kg/min) completed five experimental visits: a VO₂ max test and cycling trials in 23°C/45%RH, 23°C/70%RH, 34°C/20%RH and 34°C/45%RH. Within each trial, participants completed a 60-minute bout of cycling at 60% VO₂max, 15min rest, and a time to exhaustion (TTE) at 90% VO₂max. Blood samples were taken prior to cycling (PRE), immediately after (60), and after TTE. Rectal temperature (T_{re}) and skin temperatures (chest, triceps, forearm, thigh and calf) were monitored continuously during trials. Total skin (T_{sk}) and whole body (T_{wb}) temperatures were calculated using weighted averages. The Area Under the Curve with respect to increase from baseline (AUCi) was then calculated for T_{re} , T_{sk} and T_{wb} at 60 and TTE. Data were analyzed as Pearson Product Moment Correlations between AUCi for T_{re} , T_{sk} and T_{wb} with changes in MCP-1 and CCR2 from PRE to 60 (p_{60}) and PRE to TTE (p_{TTE}). Additionally, the time spent above critical temperatures for T_{re} (37.5, 38.0, 38.5, 39.0°C) and T_{wb} (34.5, 35.5, 36.5, 37.5°C) were related to MCP-1 and CCR2. **Results:** No significant correlations were observed between MCP-1_{p-60} or MCP-1_{p-TTE} and AUCi of T_{re} and T_{wb} ($p \geq 0.260$). There were no significant correlations observed between CCR2_{p-60} or CCR2_{p-TTE} and AUCi of T_{re} and T_{wb} ($p \geq 0.156$). MCP-1_{p-60} was significantly correlated to time spent with a T_{wb} above 35.5°C ($r=0.292$; $p=0.047$), however no correlations were observed between MCP-1_{p-60} or MCP-1_{p-TTE} and any other critical T_{re} and T_{wb} ($p \geq 0.112$). CCR2_{p-60} and CCR2_{p-TTE} were not significantly correlated to time spent above critical T_{re} and T_{wb} . Of note was a non-significant negative correlation ($r=-0.312$) observed between CCR2_{p-TTE} and T_{re} above 37.5°C ($p=0.053$). **Conclusion:** These data suggest that the duration of time spent at T_{wb} above 35.5°C influences MCP-1_{p-60} concentrations, while not being affected by time spent above other critical T_{re} and T_{wb} . CCR2 expression was not influenced by time spent above critical T_{re} and T_{wb} .

373 Board #211 May 29 9:30 AM - 11:00 AM

Changes In Salivary Antimicrobial Protein Concentrations In Response To Maximal Exercise In Collegiate Swimmers

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Salivary Antimicrobial Proteins (sAMPs) play a central role in innate immune responses by exerting their antibacterial and antiviral properties. Acute psychological and physiological stressors reduce sAMPs concentrations, and increase the risk of upper respiratory tract infections (URTI). However, the impact of sustained stressors on sAMPs and their relation to URTI symptoms is unknown. **Purpose:** To characterize the impact of acute bouts of exercise on sAMPs and symptoms of URTI in collegiate swimmers over a 6-month period. **Methods:** Salivary samples were collected from sixteen NCAA D1 swimmers (8 M, 8 F: 19.8 ± 0.7 yrs) before and after exhaustive in-pool swims at 2 timepoints (V₁: immediately post-season 1 and V₂: early season 2). An additional V₃ mid-off season 1 timepoint was collected in a subset of 10 swimmers. Azurocidin and secretory leukocyte protease inhibitor (SLPI) sAMPs were measured by ELISA, and self-reported measures of stress were collected to assess sleep quality (PSQI) and symptoms of URTI (WURRS-21). Linear mixed models were used to determine the effects of exercise, season timepoint, and their interaction on sAMP concentrations and secretion rates ($\alpha=0.05$). Pearson's correlation coefficients were used to determine linear correlations between resting sAMP concentrations and secretion rates with stress measures. **Results:** Post-exercise SLPI levels were elevated 8 fold at V₂ and 3 fold at V₃ when compared to resting values ($p<0.05$); however, resting SLPI concentrations and secretion rates remained unchanged during the season ($p>0.05$). Acute exercise was associated with increased Azurocidin concentrations, with the greatest post-exercise increase seen at V₂ ($p=0.03$). Resting salivary Azurocidin concentrations and secretion rates were positively associated with sleep quality ($r=0.42$, $p=0.04$ and $r=0.49$, $p=0.02$ respectively), while salivary SLPI concentrations were not. Furthermore, resting Azurocidin concentrations were associated with self-reported symptoms of URTI ($r=0.52$, $p=0.03$) during all 3 visits. **Conclusion:** Oral innate immunity in collegiate swimmers is differently impacted by acute maximal exercise over a season. Greater sleep quality appears to promote salivary Azurocidin concentration and oral innate immune health, which could in turn protect athletes against URTIs.

374 Board #212 May 29 9:30 AM - 11:00 AM

Acute And Chronic Anti-inflammatory Responses During A Season Training In Young Swimmers

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It is well established that prolonged intense exercise training suppresses aspects of immune function and a perturbation in balance between pro- and anti-inflammatory cytokines may induce chronic, low-level systemic inflammation. Although swimming exercise training is demanding, however it is not clear whether it can promote changes in inflammatory responses. **Purpose:** This study investigated the acute and chronic effects of a full season swimming training on serum interleukin (IL)-4 and IL-1 receptor antagonist (IL-1ra), both at rest and after a maximal exercise bout. **Methods:** Twelve well-trained male swimmers (14.08±1.0 yrs) were recruited. Measurements were carried out at the beginning of the training season (T1) and pre- and post the taper of each of the two competitive periods (i.e., T2, T3 for the first macrocycle, and T4, T5 for the second macrocycle, respectively). At each of the above time points, blood samples were collected pre- and 1 hour post a maximal, 400m swimming testing. Serum IL-1ra and IL-4 levels were measured by ELISA. Adjustment for exercise-induced plasma volume changes was performed before all data analyses. Two-way ANOVA with repeated measures was used for statistics. **Results:** Significant pre-post testing differences for IL-1ra ($p=0.000$), but not for IL-4 ($p>0.05$), were found throughout the experimental period. Pre-post testing difference was greater at T5 for IL-1ra and at T1 for IL-4 (165.95±36.16 pg/ml and 0.06±0.04 pg/ml, respectively). Both IL-1ra and IL-4 had similar, no significant ($p>0.05$) pre-testing responses, exhibiting an increase from T1 to T2 (IL-1ra:

200.04±14.73 vs 250.76±73.56 pg/ml and IL-4: 0.08±0.02 vs. 0.11±0.03 pg/ml) and from T3 to T5 (IL-1ra: 171.15±11.85 vs 187.66±19.89 pg/ml, IL-4: 0.08±0.03 vs 0.9±0.3 pg/ml) and a decrease from T2 to T3 (IL-1ra: 250.76±73.56 vs 171.15±11.85 pg/ml, IL-4: 0.11±0.03 vs 0.08±0.03 pg/ml). Post-testing, IL-4 response exhibited a 59% decline from T1 to T4 (0.14±0.05 vs 0.08±0.03 pg/ml,) and a 157% increase from T4 to T5 (0.08±0.03 vs 0.13±0.03 pg/ml), however those responses failed to reach statistical significance throughout the experimental period ($p>0.05$). **CONCLUSION:** These findings indicate that long-term swimming training can affect the resting and acute (pre-post testing) anti-inflammatory profile in young swimmers.

375 Board #213 May 29 9:30 AM - 11:00 AM
Fitness-related Differences In The Polarization Of Lipid-exposed Macrophages Following Acute Exercise

Lauren Pedersen, Lindsay Lafratta, Natalie Bohmke, Anson Blanks, Virginia Mihalick, Morgan Senter, Robert Lee Franco. *Virginia Commonwealth University, Richmond, VA.*
(No relevant relationships reported)

Compared to anti-inflammatory M2 (CD206⁺) macrophages, pro-inflammatory M1 (CD86⁺) macrophages are considered to be highly atherogenic. Increased cardiovascular fitness is linked to attenuated atherosclerotic plaque formation as well as anti-inflammatory alterations in the immune cells that mediate this process. Therefore, macrophage polarization in unfit individuals may differ from that of fit individuals following exposure to physical stress and elevated lipids. **Purpose:** To determine fitness-related differences in the polarization of lipid-exposed macrophages following acute, moderate-intensity exercise. **Methods:** 8 fit (VO₂ peak; M: ≥ 45 mL O₂/kg/min, F: ≥ 35 mL O₂/kg/min) and 12 unfit (VO₂ peak; M: < 40 mL O₂/kg/min, F: < 30 mL O₂/kg/min) male and female subjects performed 30 minutes of moderate-intensity (60% VO₂ peak) cycling. Blood samples were collected pre-exercise (PRE) and immediately- (POST), 1 hour- (1HR), and 2-hours (2HR) post-exercise. Peripheral blood mononuclear cells (PBMCs) were isolated by density gradient centrifugation, and adherent monocytes were cultured with LDL (150 mg/dL) and palmitate (10ug/mL) for 4 hours. Cells were washed and cultured with 20% autologous serum for 7 days. The resulting macrophages were subsequently stained with antibodies against CD86 and CD206 for flow cytometric analysis. A mixed between-within ANOVA was performed to determine differences in receptor expression between groups (fitness) and within subjects (time). **Results:** A mixed between-within ANOVA found no significant between-subjects main effects for CD86 ($p=0.667$) and CD206 ($p=0.675$) macrophage expression. A main effect of time was significant for the expression of CD206 ($p=0.033$). A profile plot suggests that CD206 expression was different between fitness groups PRE, POST, and 1HR. **Conclusion:** Macrophage expression of CD206 was observed to be different between fit and unfit individuals immediately before and following an acute bout of moderate-intensity exercise and lipid exposure. Alterations in "M2" macrophage polarization may contribute to cardiovascular risk in unfit individuals.

A-52 Free Communication/Poster - Exercise and Children

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

376 Board #214 May 29 9:30 AM - 11:00 AM

Associations Among Obesity, Physical Activity, Nutrition, And Family Environment In Adolescents

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Previous research has shown that the Family Nutrition and Physical Activity (FNPA) Screening Tool is related to obesity risk in children. However, there is limited research on the utility of the FNPA among adolescent populations and its association with health behaviors. **Purpose:** To examine the association of the FNPA Screening Tool with physical activity, dietary quality, screen time behaviors, and obesity risk in ninth grade students. **Methods:** Data were collected from ninth grade students ($n=175$, 51% boys, 72% Caucasian) from a Midwestern high school. Physical activity, dietary quality, and screen time behavior were measured using the Physical Activity Questionnaire (PAQ-A; 8 items, scored 1-5), Healthy Eating Index-2010 (HEI-2010; scored 0-100), and self-reported total screen time (television, video game, and computer usage), respectively. Trained research assistants measured height and weight to calculate body mass index (BMI). Percent body fat (BF) was measured using a foot-to-foot bioelectrical impedance scale. The FNPA Screening Tool was mailed

home to parents of the students to be completed. Upon completion, parents returned the FNPA to researchers, and it was scored (range 20-80). Multiple linear regression, with and without controlling for age, sex, and race (Caucasian or non-Caucasian), was used to examine associations between the FNPA and PAQ-A, HEI-2010, and total screen time. Logistic regression was used to determine differences in FNPA score by weight categories. **RESULTS:** Mean BMI ($22.3 \pm 4.6 \text{ kg/m}^2$) approximated the 65th percentile, with 18.3% of the sample being overweight and 11.4% being obese. No significant relationships were found in the linear regression analyses between the FNPA, PAQ-A, HEI-2010, or total screen time ($F=0.49$, $p=0.83$, Adjusted $R^2 = 0.018$). When controlling for age, sex, and race, these relationships remained non-significant. Logistic regression analyses showed no significant associations between the FNPA and weight status ($OR = 1.21$, $CI = 0.62\text{--}2.36$) or overfatness ($OR = 1.91$, $CI = 0.92\text{--}3.95$). **CONCLUSION:** This study highlights that the FNPA Screening Tool may not be associated with health behaviors or obesity risk in an adolescent population. Further research is needed to explore the utility of the FNPA Screening Tool in adolescents.

377 Board #215 May 29 9:30 AM - 11:00 AM
Factors Associated to Mechanical Efficiency among Adolescent Boys Performing a Graded Maximal Exercise
 Georges Jabbour¹, Lina Majed. *Qatar University, Doha, Qatar.*
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 (No relevant relationships reported)

Factors Associated to Mechanical Efficiency among Adolescent Boys Performing a Graded Maximal Exercise

Georges Jabbour¹, Lina Majed¹
¹Qatar University, Doha, Qatar.

PURPOSE: To determine the mechanical efficiency (ME) and associated factors among adolescent boys at different stages of graded maximal exercise. **METHODS:** 45 sedentary adolescent boys were separated into three groups according to their percentage of fat mass as follows: 15 normal-weight (NW) (body fat: $16.0 \pm 1.9\%$), 15 overweight (OW) (body fat: $24.0 \pm 1.6\%$) and 15 obese (OB) (body fat: $31.0 \pm 3.0\%$). Each of them completed a maximal graded test in which energy consumption in watt (E), ME (expressed as a %), plasma epinephrine, and norepinephrine concentrations were determined consecutively through three stages corresponding to ~50% and 75% of each participant's maximal heart rate (50%HRmax and 75%HRmax) and at peak oxygen consumption (VO_{2peak}) level. **RESULTS:** During the maximal graded test, plasma epinephrine, and norepinephrine as well as ME determined at 50%HRmax, 75%HRmax and at VO_{2peak} stages were significantly lower in OB compared to NW and OW individuals ($p < 0.01$). ME correlated negatively to body weight ($r = -0.80$; $p < 0.01$) at 50%HRmax level. However, at 75%HRmax and at VO_{2peak} stages, ME correlated significantly to power output ($r = 0.88$ and $r = 0.91$, $p < 0.01$) as well as with epinephrine ($r = 0.82$, $p < 0.01$) and norepinephrine concentrations ($r = 0.88$, $p < 0.01$) for entire group. **CONCLUSION:** These findings suggest that the body's weight excess exerts a negative effect on ME values at a low intensity, while at higher intensities (75%HRmax and VO_{2peak}) the lower ME could be better explained by the reduced catecholamine responses as observed in obese adolescent boys.

378 Board #216 May 29 9:30 AM - 11:00 AM
Weight Trajectories Are Associated With Exercise Capacity Among Children With Complex Congenital Heart Defects
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 (No relevant relationships reported)

Children with complex congenital heart defects (CHD) are often short/lightweight relative to peers, and may require supplementary feeding to meet energy demands. It was hypothesized that CHD patients with limited growth would also have decreased energy for exercise. **PURPOSE:** To investigate the impact of chronic energy deficit, as evidenced by negative growth trajectory, on submaximal exercise capacity. **METHODS:** Retrospective chart review of Bruce treadmill exercise test results, weight/height at each visit for 5 years prior to the exercise test, age at exercise test, sex and CHD diagnosis among CHD patients 8 to 14 years of age. Submaximal energy consumption (VO_{150} = estimated ml O₂/kg/min at heart rate of 150 bpm) and growth trajectory (slope of the body weight z-score over 5 years) were calculated per child. A linear regression model examined energy consumption by growth trajectory, adjusting for age, sex, CHD severity and initial body weight z-score. **RESULTS:** Participants were 90 children with CHD (34 females (38%)), mean age 10.5 (SD=2.3) years. CHD diagnoses were simple ($n=19$, 21.1%), moderate ($n=33$, 36.7%) or complex ($n=38$, 42.4%). Mean VO_{150} at 150bpm was 28.7 (SD=7.4). Initial height (median 0.36, IQR: -0.65, 1.04) and weight (median 0.21, IQR: -0.69, 1.12) z-scores indicated most participants were taller/heavier than expected for age.

Submaximal energy consumption was significantly higher (model $R^2 = 0.29$) with lower initial weight z-score ($b = -1.4$ [0.2, 2.5] per 1 unit increase, $p = .02$), a decreasing slope of the weight z-score ($b = 7.9$ [1.8, 14.0], $p = .01$), male sex ($b = 3.8$ [1.2, 6.3], $p = .004$) and severe CHD ($b = 4.0$ [0.7, 7.4], $p = .02$), but not by age ($b = 0.4$, $p = 0.15$). **CONCLUSIONS:** Children with CHD who were underweight or had a negative growth trajectory had significantly higher energy consumption during submaximal exercise. The relationship between a negative growth trajectory and daily physical activity should be examined to assess whether the higher energy demands for submaximal exercise are also associated with an inactive lifestyle, and therefore the known increase in risk for sedentary lifestyle morbidities. Prospective studies are required to understand the mechanisms linking growth limitations to reduced exercise capacity.

379 Board #217 May 29 9:30 AM - 11:00 AM
Boys with Obesity have Attenuated Cardiorespiratory Fitness Independent of Fat Mass
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Purpose: The assessment of cardiorespiratory fitness using ratio scaling to total body mass (TBM) is confounded by fat mass in obese populations because fat tissue does not contribute to oxygen utilization during exercise. Our objective was to isolate the independent effects of obesity on fitness when normalized to total lean body mass (TLM) and leg lean mass (LLM). We tested the hypothesis that boys with obesity would have attenuated cardiorespiratory fitness compared to age-matched non-obese boys. **Methods:** Values are expressed as means \pm SD with significance set at $P < 0.05$. Seventeen non-obese boys (10.6 ± 0.9 y, 141.8 ± 6.5 cm, 35.5 ± 7.0 kg, $24 \pm 5\%$ body fat) and thirteen age-matched obese boys (10.6 ± 1.4 y, 146.3 ± 10.6 cm, 60.25 ± 13.0 kg, $44 \pm 2\%$ body fat) completed a cardiorespiratory fitness test (VO_{2peak}) and body composition scan (DXA). **Results:** Utilizing a 2-tailed independent T-test, both groups had comparable VO_{2peak} test times (9.1 ± 1.4 min; $P = 0.80$), and peak heart rates (187 ± 12 bpm; $P = 0.50$). Boys with obesity had a reduction in VO_{2peak} when normalized to TBM (54% of age-matched boys without obesity); however, this effect was reduced less when compared to LBM (76%) and LLM (68%). Further, simple linear regression found that total body fat accounted for 69% variance for mL/kgTBM/min, 49% variance for mL/kgLBM/min, and 40% variance for mL/kgLLM/min. **Conclusions:** These data indicate that obesity in young boys impairs cardiovascular fitness which supports the concept that obesity in pediatrics reduces aerobic capacity, which may have later life consequences in regards to cardiorespiratory fitness and all-cause mortality. Lastly, we show that the normalization of VO_{2peak} to LBM and LLM can provide an independent measure of fitness.

A-53 Free Communication/Poster - Exercise & Neuroscience

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

380 Board #218 May 29 9:30 AM - 11:00 AM
Social Media-Based Physical Activity Promotion by Craft Brewing Establishments Located in Knoxville, Tennessee
 Paula-Marie M. Ferrara, Eugene C. Fitzhugh, Cory T. Beaumont, Kelley Strohacker, FACSM. *University of Tennessee, Knoxville, TN.*
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Researchers have consistently observed a positive relationship between physical activity (PA) and alcohol consumption (AC). Anecdotally, craft breweries (CBs) appear to capitalize on this relationship by marketing to active populations (e.g. sponsorship of athletic associations, post-competition product donation, hosting of PA-related events). To date, empirical analysis of PA promotion by CBs has not been conducted. **PURPOSE:** Preliminarily assess PA promotion by CBs located in a single community. **METHODS:** Facebook posts by 15 CBs located in Knoxville, TN were screened between November 2016-October 2017, with PA-related posts coded by activity type. Non-parametric correlations assessed associations between CBs' total PA posts and built environment factors via Geographic Information System (e.g. walk score, transit score, culture score). Chi-square tests were also used to assess the distribution of PA-posts across each season (Winter, Spring, Summer, Fall).

RESULTS: Of 3845 Facebook posts, 147 (3.82%) referred to PA. PA posts made by individual CBs ranged from 0-47 (median=4.50; IQR=9; mean=10±13) over one year, and pertained to fitness classes (29.25%), biking (24.49%), running, (21.77%), outdoor activities (12.24%), sports (4.08%), and miscellaneous PA (8.16%). PA posts were not equally distributed across seasons ($\chi^2(2, N=3)=14.68, p=0.002$); Summer contained the highest percentage of posts (34.51%), followed by Spring (28.87%), Fall (23.94%), and Winter (12.68%). PA posts were significantly and inversely correlated with scores regarding culture ($r=-0.67, p=0.01$) and shopping ($r=-0.62, p=0.01$). Moderate, but statistically insignificant correlations were observed between PA posts and scores for walkability ($r=-0.36, p=0.18$), dining and drinking ($r=-0.46, p=0.08$), and errands ($r=-0.38, p=0.16$). **CONCLUSIONS:** Although PA posts represent a minimal portion of social media advertising in this local sample of CBs, a wide variety of activities is promoted. Additionally, promotion volume fluctuates seasonally, and CBs that promote PA more frequently tend to be located in areas that are less walkable, with fewer desired amenities.

381 Board #219 May 29 9:30 AM - 11:00 AM
Pre- and Post-Season Electroencephalography Measures of Brain Vital Signs in Youth Football Players

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 (No relevant relationships reported)

Amid growing concern of potential brain trauma caused by repetitive head impacts (RHI) in youth football, there is an emerging need to develop objective, physiologic assessments of brain function that can identify sub-concussive impairment. Electroencephalography (EEG) may be a viable tool to evaluate neurologic dysfunction associated with RHI. **PURPOSE:** To evaluate the neurophysiologic activity of youth football players in association with RHI. **METHODS:** EEG data were captured from nine middle school football players (13.1 ± 0.5 yr) before (PRE) and after (POST) one season using a portable 8-channel EEG cap with three electrodes (Fz, Cz and Pz) while subjects listened to an auditory stimulus sequence (~5 min). Amplitudes (A) and latencies (L) of event-related potentials (ERP) corresponding to auditory sensation (N100A, N100L), basic attention (P300A, P300L), and cognitive processing (N400A, N400L) were converted to normalized brain vital signs scores (0-100 scale). Larger ERP amplitudes equate to higher scores and delayed latencies equate to lower scores. RHI were measured during the season via accelerometry (Head Impact Telemetry System). EEG data from three subjects were of insufficient quality for analysis; thus, results were limited to the six remaining subjects. **RESULTS:** Scores for N400L decreased significantly ($P = 0.031$) from PRE (63.9 ± 7.6) to POST (38.2 ± 16.8). There were no significant changes in N100A ($P = 0.971$), N100L ($P = 0.308$), P300A ($P = 0.562$), P300L ($P = 0.183$), or N400A ($P = 0.685$) scores. On average, players sustained 134 ± 66 head impacts during the season. Head impact frequency was not significantly associated with any brain vital signs score ($P = 0.169-0.783$). **CONCLUSION:** In this small sample of youth football players, cognitive processing was delayed following a single season as measured by the significant reduction in N400 latency scores. However, this change was not associated with RHI incurred by the players. While these data should be interpreted with caution, they provide preliminary evidence for the potential value of using the brain vital signs framework to evaluate brain function and sub-concussive impairment in collision-sport athletes.

This work was supported by a grant from the T. Denny Sanford Pediatric Collaborative Research Fund between Mayo Clinic and Sanford Health.

382 Board #220 May 29 9:30 AM - 11:00 AM
Aerobic Exercise Regulates Gamma Oscillation in Hippocampal CA1 of APP/PS1/Tau Mice

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 (No relevant relationships reported)

PURPOSE: Changes in gamma oscillations have been observed in multiple brain regions in mouse models of Alzheimer's disease. This study aimed to investigate the effect of aerobic exercise on gamma activity in hippocampal CA1 of APP/PS1/Tau transgenic (3×Tg) mice during awake state when theta oscillation occurs, and the effect on slow gamma activity in CA1 during sleep state when SWRs occur.

METHODS: 3×Tg mice (6 months old) and C57BL/6J mice were randomly divided into exercise groups and sedentary groups respectively. The exercise groups were made to run on the treadmill for 1 hour per one day, five times a week, for 12 weeks. The exercise workload consisted of running at a speed of 12 m/min for the first 10 min, 15 m/min for the last 50 min, with 0% grade of inclination. Radial arm maze was used to evaluate the memory function of the mice. Multichannel recording technology was

used to record electrical activity of hippocampal CA1 in vivo. Theta oscillation and sharp waves and ripples (SWRs) were detected by MATLAB programs, and spectral analysis was computed using multi-taper methods. Immunofluorescence was used to detect the Aβ deposits in CA1.

RESULTS: 12 weeks of treadmill exercise ameliorated working memory (2.00±0.35 vs. 1.20±0.38, $p<0.05$) and reference memory (5.47±0.36 vs. 3.70±0.45, $p<0.05$) deterioration of 3×Tg mice. The 9-month-old 3×Tg mice exhibited a reduction of both gamma power (0.33±0.05 vs. 0.51±0.02, $p<0.01$) during the theta rhythms awaking and slow gamma power (0.50±0.03 vs. 0.55±0.04, $p<0.01$) during SWRs sleeping in the hippocampal CA1 compared to control mice, respectively. 12 weeks of treadmill exercise could increase gamma power either being awake (0.50±0.06, $p<0.01$) or being asleep (0.54±0.03, $p<0.05$) in 3×Tg mice. Furthermore, these disturbances were observed to be consistent with Aβ pathological deposits (AS, 1.42±0.21, $p<0.01$ vs. CS; AE, 0.53±0.09, $p<0.01$ vs. AS).

CONCLUSIONS: Consistencies between these alteration in gamma power and Aβ deposits suggest that disturbances in rhythmic organization of theta and gamma may contribute to spatial memory deficits in 9-month-old 3×Tg mice. Given these data, aerobic exercise could improve spatial performance by regulating gamma power when theta oscillations or SWR occur.

Supported by the National Natural Science Foundation of China (31571229).

383 Board #221 May 29 9:30 AM - 11:00 AM
Aerobic Exercise Differential Alters Intrinsic Neuronal Properties In The 3xtg Mouse Model Of Alzheimer's Disease

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PURPOSE: Alterations in network activities in Alzheimer's disease (AD) are accompanied by an early imbalance of excitation and inhibition that related to cognitive function. Although that aerobic exercise could enhance synaptic plasticity from various AD mouse models have been found, the properties of neurons firing in specific conditions remain poorly understood. This study was to investigate the neurophysiological signals underlying the effects of aerobic exercise on the brains of APP/PS1/Tau transgenic (3×Tg) mice and 129 mice as wild type (Wt) control at 9 months of age.

METHODS: 3×Tg mice (6 months old) were randomly divided into exercise groups and sedentary groups (AS, AE), and Wt mice as cohort control. The exercise groups would run on the treadmill for 12 weeks. Multichannel recording technology was used to record population spikes in cortical and hippocampal region at 9 months of age in vivo during awake or sleep state. Spike sorting was performed using offline sorter software. Pyramidal cells (PNs) were distinguished from putative interneurons (INs) on the basis of average firing rate, bursting properties, and spike width.

RESULTS: Recordings took place across 5-7 consecutive days while mice were awake exploring or asleep, and the number of spikes was calculated every 10 sec as a session. During awake, in three AS, AE and Wt mice, we recorded 15 PNs, 48 PNs and 10 PNs, while 9, 23 and 11 INs in cortex (with a total of 192 place fields); 36 PNs, 77 PNs and 35 PNs, while 10, 37 and 15 INs in hippocampus (with a total of 330 place fields). During sleep state, with a total of 138 place fields, we recorded 22 PNs, 19 PNs and 13 PNs, while 7, 15 and 14 INs in cortex; 29 PNs, 58 PNs and 21 PNs, while 9, 24 and 11 INs in hippocampus (with a total of 270 place fields). In both awake and sleep state, IN firing rates were differential changed in AS compared to the control, and the ratio of IN/PN was lower in both cortex (0.6±0.02, 0.31±0.00) and hippocampus (0.28±0.00, 0.31±0.01) of AS compared to Wt mice (1.1±0.02, 0.43±0.01/ 1.08±0.02, 0.52±0.01, $P<0.01$). Exercise attenuated the phenomena (0.48±0.01, 0.48±0.01/0.79±0.02, 0.41±0.02, $p<0.01$).

CONCLUSIONS: Aerobic exercise could regulate aberrant cellular neurophysiology related to cognitive impairments dependent network function.

384 Board #222 May 29 9:30 AM - 11:00 AM
Aerobic Exercise Regulates GSK3β Activity to Attenuate the Neuropathology In APP/PS1 Transgenic Mice

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 (No relevant relationships reported)

PURPOSE: Glycogen synthase kinase 3 beta (GSK3β) is involved in hyperphosphorylated Tau, one of the hallmarks of Alzheimer's disease (AD). This study was to evaluate the possible effect of aerobic exercise on GSK3β and the phosphorylating Tau protein in APP/PS1 transgenic mice. **METHODS:** C57BL/6J (6-month-old) and APP/PS1 transgenic mice (6-month-old) were randomly divided into exercise group (CE/AE) and sedentary group (CS/AS) respectively. Animals

were subjected to treadmill exercise for 12 weeks. The changes of behavior were detected by eight arm maze. The phosphorylation levels of AKT, GSK3 β and Tau were measured by using Western Blotting. **RESULTS:** The eight arm maze showed that working and reference memory errors and time to complete testing in AE decreased significantly compared with the mice of AS (3.67 ± 0.41 vs 4.83 ± 0.24 , $p < 0.05$; 6 ± 0.73 vs 8.40 ± 0.59 , $p < 0.01$; 109 ± 35 vs 256 ± 45.26 , $p < 0.05$), indicating that aerobic exercise improved behavioral and cognitive response ability. The levels of pTau ser262 and pTau ser396 were severely increased in hippocampus in AS compared with those of control cohorts (CS) (0.98 ± 0.09 vs 0.82 ± 0.09 , $p < 0.05$; 0.89 ± 0.06 vs 0.73 ± 0.11 , $p < 0.05$). Aerobic exercise could decrease pTau ser262 and pTau ser396 (0.69 ± 0.08 vs 0.98 ± 0.09 , $p < 0.01$; 0.67 ± 0.02 vs 0.89 ± 0.06 , $p < 0.05$). As in case of GSK3 β , the levels of pGSK3 β ser9 were significantly decreased, while pGSK3 β tyr216 were significantly increased in hippocampus of AS compared with those of CS (0.51 ± 0.08 vs 0.69 ± 0.08 , $p < 0.05$; 0.90 ± 0.07 vs 0.67 ± 0.02 , $p < 0.01$). The levels of pGSK3 β ser9 were increased (0.79 ± 0.09 vs 0.51 ± 0.08 , $p < 0.01$), and the levels of GSK3 β tyr216 were decreased after aerobic exercise training in the hippocampus (0.69 ± 0.06 vs 0.90 ± 0.07 , $p < 0.05$). The levels of pAKT (GSK3 upstream regulator) ser473 were significantly decreased in hippocampus of AS compared with those of CS (0.49 ± 0.07 vs 0.73 ± 0.13 , $p < 0.05$). Aerobic exercise induced to increase the activity of pAKT ser473 (0.74 ± 0.13 vs 0.49 ± 0.07 , $p < 0.05$). **CONCLUSION:** Aerobic exercise regulates GSK3 β activity to attenuate the neuropathology of hyperphosphorylated Tau in APP/PS1 transgenic mice. Supported by the National Natural Science Foundation of China (NSFC) (No. 31571229)

385 Board #223 May 29 9:30 AM - 11:00 AM
Aerobic Exercise Attenuates The A Oligomer-induced Mitochondrial Permeability Transition Pore Opening In App/ps1 Transgenic Mice

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 (No relevant relationships reported)

PURPOSE: The mitochondrial permeability transition pore (mPTP) plays a role in the onset and the progression of Alzheimer's disease (AD). This study was to analyze the effects of 12 weeks aerobic exercises on mPTP activation in AD models mice.

METHODS: 6-month-old of APP/PS1 transgenic mice and C57BL/6J mice were randomly divided into exercise group (CE, AE) and sedentary group (AS, CS) respectively. The exercised mice were subjected to a treadmill exercise for 12 weeks, then the experimental age was at 9-month-old. The behavioral changes were detected by eight arm maze. Immunofluorescence, histochemistry and Dot blot were to analyze mPTP opening, the level of amyloid- β (A β) and soluble oligomers (oA β). ELISA and Western Blotting were used to detect the activity of COXIV, ABAD, and the levels of COXIV, ABAD, Cyp-D, ANT1, ANT2, VDAC-1. **RESULTS:** Both working memory errors and reference memory errors were significantly increased in AS compared with those in the CS (40 ± 4 vs $30 \pm 4\%$; 71 ± 2 vs $54 \pm 1\%$, $p < 0.01$). The AE performed better than AS (22 ± 1 vs $39 \pm 3\%$; 55 ± 3 vs $71 \pm 2\%$, $p < 0.05$). A β was aggregated at hippocampus in AS, accompanied with an increase of oA β ($1 \text{ vs } 1.1 \pm 0.1$, $p < 0.05$). A decline was detected in A β plaque and oA β content in AE than AS (0.6 ± 0.1 vs 1.5 ± 0.1 ; 0.9 ± 0.1 vs 1.1 ± 0.1 , $p < 0.05$). There was an increase in AS compared with CS in the mPTP opening (0.07 ± 0.002 vs 0.08 ± 0.002 , $p < 0.01$), and which was decreased after aerobic exercise (0.07 ± 0.002 vs 0.08 ± 0.003 , $p < 0.01$). AS displayed an increase in Cyp-D, ANT1, VDAC-1, ABAD of the hippocampus compared with the CS (1.1 ± 0.1 vs 1 , $p < 0.05$), but a decrease in ANT2, COXIV protein (0.9 ± 0.1 vs 1 , $p < 0.01$). Aerobic exercise decreased the expression of Cyp-D, ANT1, VDAC-1, ABAD in AS (1.1 ± 0.1 vs 1 ± 0.1 , $p < 0.05$) and increased ANT2, COXIV (0.9 ± 0.1 vs 1 ± 0.1 , $p < 0.05$). The activity of COXIV and ABAD in the hippocampus of AS were decreased compared with those of the CS (3.3 ± 0.1 vs 3.7 ± 0.2 ; 0.5 ± 0.1 vs 1 ± 0.2 , $p < 0.01$), and aerobic exercise caused an increase of their activities (3.3 ± 0.1 vs 5.6 ± 0.2 ; 0.5 ± 0.1 vs 0.8 ± 0.1 , $p < 0.01$). **CONCLUSIONS:** Aerobic exercise attenuates the oA β deposition and the opening of mPTP, then regulates the mitochondrial oxidative phosphorylation for energy production in AD models. Supported by the National Natural Science Foundation of China (NSFC) (No. 31571229)

386 Board #224 May 29 9:30 AM - 11:00 AM
Effects Of Aerobic Exercise On Learning And Memory Ability And Hippocampal Tgf- 1 In Depressed Rats

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OBJECTIVE: To investigate the effects of different periods of aerobic exercise intervention on hippocampal TGF- β 1 expression and spatial learning and memory ability in depressive model rats.

METHODS: 36 male SPF grade Sprague Dawley (SD) rats were randomly allocated into 4 groups (n=9): Control group (C group), Pre-model exercise group (EC group), Model group (M group), Motion group (ce group). Except for group C, all other groups

used CUMS stress stimulation to establish an animal model. Morris water maze test was used to detect spatial learning and memory ability of rats. Nissl staining was used to observe the morphology of rat hippocampal neurons. Real-time PCR, Western Blotting were used to detect the expression of TGF- β 1.

RESULTS: There was no significant difference in time-consumption of escaping the incubation period between the 1st and the 2nd day in each group ($P > 0.05$). On the fourth day, the escape latency of M group was significantly longer than that of rats in the C and ce groups ($P < 0.05$). On the 5th day, the escape latency in M group was significantly longer than that in C and ce groups ($P < 0.05$), and EC group was significantly longer than that in C group ($P < 0.05$). Results of the number of crossing platforms: The number of crossing in the M and EC groups were significantly lower than those in the C and ce groups ($P < 0.01$). Compared with EC and M group, the morphological structure of neurons in ce group was better. The expression of TGF- β 1 mRNA in hippocampus of EC and ce group was significantly lower than that of C and M groups ($P < 0.01$). The expression levels of TGF- β 1 protein in C and M groups were significantly higher than those in ce group ($P < 0.01$). The expression of TGF- β 1 protein in M rats was significantly higher than that in EC and ce groups ($P < 0.01$). **CONCLUSION:** Aerobic exercise intervention can improve the morphological structure of hippocampal CA3 neurons, and decrease the expression of TGF- β 1. It indicated that aerobic exercise can improve the depression.

387 Board #225 May 29 9:30 AM - 11:00 AM
Aerobic Exercise Inhibits Tau Hyperphosphorylation Through Activation Of The PI3k/Akt Pathway In The Hippocampus Of App/ps1 Mice
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 (No relevant relationships reported)

PURPOSE:

Many studies suggest that regular physical exercise can reduce the risk of Alzheimer's disease and slow its onset and progression. However, the exact mechanism is still unclear. Clinically, Alzheimer's disease is characterized by the presence of extracellular amyloid plaques and intraneuronal neurofibrillary tangles, which are associated with amyloid- β and tau hyperphosphorylation respectively. The PI3K/Akt signaling pathway regulates tau phosphorylation and plays a pivotal role in the development of pathology in Alzheimer's disease. Therefore, we try to investigate the effects of aerobic exercise on tau phosphorylation and examined whether these effects were mediated by the PI3K/Akt pathway in the hippocampus of APP/PS1 and C57BL/6J mice.

METHODS: 40 male APP/PS1 mice and 40 male C57BL/6J mice were randomly divided into four groups respectively: sedentary group, exercise group, sedentary with GNE-317 treatment group and exercise with GNE-317 treatment group. The mice in the exercise group and exercise with GNE-317 treatment group were given exercise training on a treadmill for 8 weeks. After 8 weeks of treadmill exercise, the morris water maze, immunohistochemistry and western blot analysis were performed.

RESULTS: We found out that 8 weeks of aerobic exercise enhanced PI3K expression and increased phosphorylation of Akt at Thr308 and Ser473 and of GSK3 β at Ser9. Furthermore, 8 weeks of aerobic exercise reduced tau phosphorylation at multiple sites including Ser202, Thr231 and Ser396. In the morris water maze test, the exercise group showed a reduced escape time and distance compared with those of the sedentary group, suggesting that aerobic exercise improved the cognitive ability in mouse. While the above-mentioned results were attenuated in the PI3K/Akt inhibitor GNE-317 treatment groups.

CONCLUSIONS:

Our study demonstrated that 8 weeks of aerobic exercise could inhibit tau hyperphosphorylation and improve cognitive function through activation of the PI3K/Akt pathway in the hippocampus of APP/PS1 and C57BL/6J mice.

388 Board #226 May 29 9:30 AM - 11:00 AM
Cutaneous Sensitivity Increases During an Ultra-Marathon

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Very little data is available on variation in cutaneous sensation that occurs during an ultra-marathon competition. Decreased sensory activity may be a factor in gait deterioration that may lead to injury during ultra-endurance activities. **PURPOSE:** We hypothesized that cutaneous sensation, assessed with two-point discrimination tests (2PD), may be altered by running in an ultra-marathon. **METHODS:** Twenty-one male and female ultra-marathoners who completed the Keys-100 ultra-marathon on a flat course in hot, humid conditions, gave informed consent and volunteered for this study that was previously approved by Indian River State College Institute Review Board. To measure 2PD calipers were set at 5mm, 10mm, 15mm, 20mm,

and 25mm apart. Calipers were placed on the calcaneal plantar surface of the foot before the ultra-marathon and again immediately after the runners completed their ultra-marathon distance. The different width calipers were placed randomly either in a horizontal or vertical position. Subjects were in a prone position and were unable to observe caliper placement. Subjects were asked to indicate caliper placement position. Technicians used hand signals to indicate to the recorder: 1. caliper position and 2. the subject's response either correct or incorrect. This was repeated 5 times randomly for each caliper setting and their respective answers were recorded as: correct=1 and incorrect=0. Two-Way ANOVA was used to analyze the overall Pre vs. Post accuracy difference ($p<.05$). Pre vs. post accuracy differences between each specific caliper distance were analyzed with a paired t-test ($p<.05$). **RESULTS:** A significant increase in 2PD was observed after completing the ultra-marathon across all caliper distances ($p<.05$). While the 2PD across all caliper distances increased in accuracy only the two widest caliper settings 20mm and 25mm were significantly more accurate ($p<.05$). **CONCLUSION:** The increased 2PD suggests an increase in cutaneous sensitivity after an ultra-marathon. We have previously found increased sensitivity in pain threshold after an ultra-marathon. There, and in this present study, it is likely that the inflammatory response from ultra-endurance activity has a sensitizing effect on nociceptors and cutaneous receptors, respectively, thus increasing pain and cutaneous sensitivity.

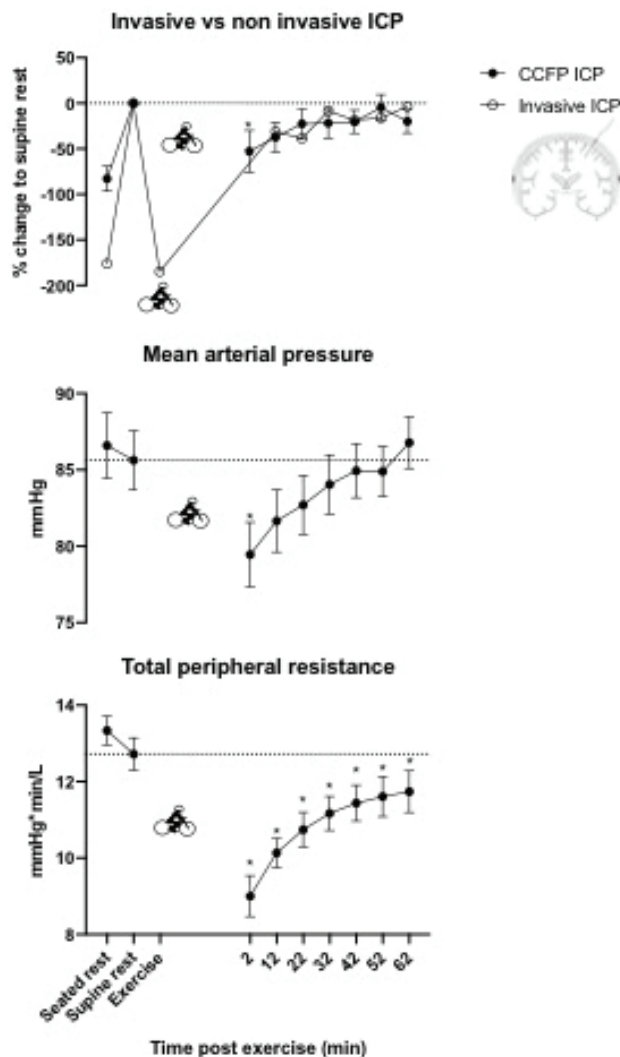
389 Board #227 May 29 9:30 AM - 11:00 AM

Postexercise Intracranial Hypotension

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(No relevant relationships reported)

Arterial hypotension, minutes to hours after exercise, is a well described phenomenon. The drop in mean arterial blood pressure (MAP) likely results from a combination of sustained vasodilation of the previously active muscles, centrally mediated reduction in sympathetic nervous activity and resetting of thermo-, chemo-, and baroreceptors. Despite decreased MAP, cerebral blood flow is generally well maintained. **PURPOSE:** To characterize effects of moderate aerobic exercise on intracranial pressure (ICP) as a mechanism for maintaining cerebral perfusion pressure during and following exercise. **METHODS:** Sixteen healthy volunteers completed 30-min exercise at 70% estimated $\text{VO}_2\text{-max}$ on an upright ergonomic bicycle followed by a one-hour recovery phase in supine position. MAP, heart rate, stroke volume, and total peripheral resistance (TPR) were recorded continuously (Nexfin). In 15 subjects (8 female, 20±2 years, height 169±10 cm, weight 64±12 kg) ICP was estimated non-invasively by evoked tympanic membrane displacement (Cerebral Cochlea Fluid Pressure device). Invasive parenchymal ICP recordings were performed in one, cerebrally intact, former patient (male, 74 years, 176 cm, 80 kg) via a permanently implanted tip-transducer telemetric ICP-sensor (Neurovent-P-tele). **RESULTS:** 30 min moderate exercise did not increase ICP (-6.1mmHg during seated rest vs -6.8mmHg during exercise). Invasive (N=1) and non-invasive (N=15) ICP recordings followed the same trend, demonstrating a 52.8±22.9% ($P<0.005$) decrease immediately postexercise and gradually returned to baseline (fig). ICP was correlated to MAP ($r^2=0.8$, $P<0.05$) and TPR ($r^2=0.9$, $P<0.005$). **DISCUSSION:** Postexercise decrease in ICP is a potential factor for maintaining cerebral perfusion pressure during arterial hypotension. Future analysis and ongoing trials are stratifying these responses according to responsiveness, gender and age. Supported by Novo Nordic Foundation (NNF150C0019196)



390 Board #228 May 29 9:30 AM - 11:00 AM

Concussion History Does Not Predict Pupillary Light Reflex or Visual Sensory Performance in Young Adults

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(No relevant relationships reported)

Visual sensory performance (VSP) tasks may dynamically assess deficits following concussion, as these tasks reflect visual and cognitive function and motor response. The pupillary light reflex (PLR) represents autonomic nervous system activity, and is inexpensive and noninvasive to assess. This activity may be compromised following concussion; however, deficits in young adults are currently unknown. The relationships among PLR and VSP outcomes are interesting given these metrics may reflect different but overlapping visual domains.

PURPOSE: To investigate the effects of concussion history on the relationships between PLR and VSP outcomes in young adults. **METHODS:** Participants [$n = 89$, age = 21.0 ± 1.5 years, concussion history = 19 (21.3%)] completed a test battery including PLR and VSP. Seven PLR parameters included initial and final pupil diameters, constriction and dilation velocities, constriction latency, time to 75% initial diameter recovery (T75), and average maximum constriction velocity. VSP tasks included visual clarity, contrast sensitivity, depth perception, near-far quickness, perception span, multiple object tracking, reaction time, target capture, eye-hand coordination, and go/no-go. Regression models tested concussion history effects on PLR controlling for age; and whether history moderated relationships between

PLR and VSP outcomes. **RESULTS:** The PLR and VSP outcomes did not differ by concussion history ($P > 0.05$). We found a negative relationship between reaction time and T75 ($r_{88} = -0.30$, $p = 0.005$) which was not moderated by concussion history ($t = -0.97$, $p = 0.33$), indicating that people with faster PLR recovery times also had faster reaction times. No other significant relationships were observed ($P > 0.01$). **CONCLUSION:** Our PLR and VSP measures did not differ by concussion history. These measures may be insensitive to long-term physiological and behavioral deficits due to prior concussion injury, or no such long-term deficits exist in young adults. It is worth further studying the inverse relationship between reaction time and time to diameter recovery, providing a possible link between an involuntary process supporting vision with visual-sensory task performance.

391 Board #229 May 29 9:30 AM - 11:00 AM
Working Memory Differences Between Fallers and Non Fallers

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(No relevant relationships reported)

Falls are a major concern for older adults and their quality of life. Cognitive impairment is associated with falls in older adults; however, the electrophysiology while performing a working memory task has not been investigated. Working memory is a necessity for everyday function (walking, postural control, conversing), and the processing of a stimulus to elicit the appropriate response might lead to important insights into potential causes for falls and help us identify older adults at risk or develop future intervention strategies. **PURPOSE:** To examine differences between Non-Fallers and Fallers in performance on a working memory task and corresponding electrophysiology. **METHODS:** Older adults ($n=38$, female= 23) aged 60 - 80 years ($m=68.8$, $SD=4.7$) completed two separate sessions on two separate days. The first session incorporated general demographic questionnaires and mobility and neuropsychological assessments. Participants were classified as Non-Fallers or Fallers based on their self-reported falls history over the past 12 months. In the second session we assessed working memory using the n-back (0-, 1-, 2-), while behavioural and electroencephalograms (EEG) results were recorded. **RESULTS:** In the 2-Back test, the EEG results showed that Fallers were more impaired in processing the stimuli, with earlier latencies for the N2 ($p<0.001$) and P3 ($p<0.001$) components in comparison to Non-Fallers. As well, delayed peak latencies in the N2 ($r=0.507$, $p=0.01$) and P3 ($r=0.451$, $p=0.024$) components were associated with increased accuracy in the working memory task. **CONCLUSIONS:** Fallers show processing impairments in working memory compared to Non-Fallers. Future studies should consider incorporating working memory as a component of falls risk screening for older adults.

392 Board #230 May 29 9:30 AM - 11:00 AM
Effects Of Different Load Forced Swimming On The Expression Of Psd-95 And Ncam In Hippocampus Of Rats

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(No relevant relationships reported)

OBJECTIVE: To investigate effects of different load forced swimming exercise on the spatial learning and memory ability of rats and to detect the expression of hippocampus PSD-95 and NCAM. **METHODS:** Thirty male 2-months old Sprague-Dawley rats were divided randomly into three groups: Control group (C), moderate load exercise group (M), overloading exercise group (O), 10 in each group. Group C rats were fed naturally for 8 weeks, and Group M rats were involved in 8 weeks of moderate load swimming intervention, and Group O rats were involved in 8 weeks of overload swimming intervention. Then, the Morris Water Maze (MWM) test was performed to estimate rats' learning and memory abilities and the Western Blot and Real-time PCR were used to determine the expression levels of PSD-95 mRNA, NCAM mRNA, PSD-95 and NCAM in the hippocampus. **RESULTS:** (1) In the process of navigation training, all animals' escape latencies gradually shortened. On the third day, the average escape latency of Group M was significantly lower than that of Group C and Group O ($p<0.05$), there were no significant difference in other days; in the navigation experiment, for the time of through the area of the original platform, Group M was significantly higher than Group C and Group O ($p<0.05$, $p<0.01$). (2) The expression of PSD-95 mRNA and PSD-95 protein in Group M was significantly higher than that in Group C ($P<0.05$), as well as the expression of PSD-95 mRNA in Group O was significantly lower than that in Group C and Group M ($P<0.05$); the expression of NCAM mRNA and NCAM protein in Group M was significantly higher than Group C ($P<0.05$), as well as the expression of NCAM protein in group O was significantly lower than Group M ($P<0.05$), but there was no significant difference with Group C ($p>0.05$). **CONCLUSION:** Moderate load swimming can improve the expression of

PSD-95 and NCAM in the rat hippocampus, as well as improve the spatial learning and memory ability of rats; overload swimming has little influence on PSD-95 and NCAM expression.

393 Board #231 May 29 9:30 AM - 11:00 AM
Protective Effects Of Treadmill Exercise On $\alpha\beta_{1-42}$ -induced Inflammation And Cognitive Impairment In Rat

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(No relevant relationships reported)

Many studies suggest that regular exercise could reduce memory impairment, the main symptoms of Alzheimer's disease (AD), but the underlying mechanisms has not been elucidated. Inflammation induced by β -amyloid (β) deposition has been shown to play an critical role in AD pathogenesis. Increasing evidence show that aerobic exercise has anti-inflammatory and neuroprotective effects. We hypothesized that aerobic exercise could attenuates memory deficits by regulating inflammatory status. **PURPOSE:** To investigate whether regular aerobic exercise regulate inflammation and attenuate memory deficits induced by β -amyloid (β) in rat. **METHODS:** Sprague-Dawley rats were divided into 3 groups: control group (C), β -amyloid (β) infusion group (A), β -amyloid (β) infusion with exercise group (E). Rats in group A and E were injected 10 μ g β -amyloid (β) oligomer (1 μ g/ μ l saline) into their hippocampus, and rats from group C were injected with a same volume of saline. The rats in group E underwent aerobic exercise training on a leveled motorized treadmill at a moderate speed for consecutive 5 weeks (once a day, 6 days/week) starting at the 2nd day after β -amyloid (β) injection. The memory ability was evaluated by Morris Water Maze (MWM) and the inflammatory status was analyzed by expressions levels of proinflammatory cytokines (TNF- α , IL-1 β) and anti-inflammatory cytokine (TGF- β , IL-10) in hippocampus using Western Blot. **RESULTS:** MWM test showed that memory functions of rats were impaired by β -amyloid (β) infusion, but this impairment was ameliorated by aerobic treadmill exercise. Compared with group C, both pro-inflammatory and anti-inflammatory cytokines in group A increased by different degrees (TNF- α : 306.9%, IL-1 β : 255.6%, TGF- β : 78.3%, IL-10: 80.0%). Compared with group A, the expression of TNF- α and IL-1 β in group AE decreased by 31.4% and 25.0%, whereas TGF- β and IL-10 increased by 68.5% and 39.0% respectively. **CONCLUSIONS:** The findings demonstrated that treadmill exercise could adjust inflammation status in hippocampus and attenuate the cognitive impairment of rats induced by β -amyloid (β).

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394 Board #232 May 29 9:30 AM - 11:00 AM
Treadmill Exercise Alters Microglia Phenotype via Inhibiting NF- κ B Signaling in Rats Hippocampally Injected With $\text{A}\beta_{1-42}$

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Microglia has been shown to play a pivotal role in the pathogenesis and prognosis of Alzheimer's disease (AD) for its' distinct activation phenotype, including pro-inflammatory, neurotoxic M1 and anti-inflammatory, neuroprotective M2. Previous studies have showed that regular exercise has anti-inflammatory effect and can reduces the memory deficit of AD rats induced by β -amyloid (β), but whether exercise modulates microglial phenotype remain unclear.

PURPOSE: To evaluate the impact of a moderate treadmill exercise program on activation of microglial M1/M2 phenotype in the hippocampus of rats injected with β -amyloid (β) and to probe the underlying molecular mechanism. **METHODS:** Health Sprague-Dawley rats were randomly separated into sham (S), β -amyloid (β) (A) and β -amyloid (β) exercise (AE) groups. Rats in group A and AE were bilateral hippocampally injected with 10 μ l β -amyloid (β) solution (1 μ g/ μ l), and rats in group S were injected with 10 μ l saline. Rats in group AE performed running on a treadmill for 5 weeks (6 days/week, once a day, 8-10 min/min for 10-20 min at a time in the first week, 15 min/min for 30 min at a time in the next 4 weeks) starting 1 day after β -amyloid (β) injection. The microglial M1/M2 phenotype in the hippocampus were determined by flow cytometry (FC) and immunofluorescence (IF). The expression of nuclear factor-kappa B (NF- κ B/p65), which has been shown to be involved in the regulation of microglial phenotype, was measured using western blotting (WB) and quantitative real-time PCR (qRT-PCR). **RESULTS:** Both FC and IF showed that the number of M1 microglia (CD11b+CD86+ cell, Iba-1+iNOS+ cell) increased markedly in comparison with group C ($P<0.01$), but no significant change was observed in M2 microglia (CD11b+CD206+ cell, Iba-1+Arg-1+ cell), and that the number of M1 microglia in group AE was significantly lower than group A ($P<0.01$), whereas that of M2 microglia was increased ($P<0.01$). WB and qRT-PCR analysis suggested that the expression of NF- κ B/p65 in the hippocampus was significantly increased after β -amyloid (β) injection ($P<0.01$), which was

down-regulated by exercise ($P<0.05$). **CONCLUSIONS:** These results indicated that the treadmill exercise could suppress the M1 phenotype activation of microglia following A β 1-42 insult and effectively promote microglia toward M2 polarization, which may relate with inhibition of NF- κ B pathway.

395 Board #233 May 29 9:30 AM - 11:00 AM
Brain Modulation For Perceived Exertion Processing After Different Cycling Exercise Intensities: An fMRI Study

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Ratings of perceived exertion (RPE) during exercise is processed in the brain, however, the modulation of the associated areas at different intensities levels remains unclear. **PURPOSE:** To verify the brain modulation while RPE processing immediately after cycling exercise performed at different intensities.

METHODS: 24 healthy adults (77.6 \pm 9.4 kg; 176 \pm 7.2 cm; 25.9 \pm 5.9 years old) performed an incremental load test on an adapted cycling ergometer attached to a MRI scanner. The workload started at 25 W and increased 25W after every four blocks of 30 s of cycling and 30 s rest. At the end of each block, participants had four seconds to report their RPE based on the 6-20 Borg scale presented on a screen. The RPE processing periods for RPE responses from 6 to 12 were labeled as LOW intensity while those from 13 to 18 were considered as HIGH intensity. To identify the common areas associated to RPE processing, the one sample t-test was used for each condition (all RPE, LOW and HIGH intensities). The statistical threshold established was family-wise error corrected (FWE<0.05).

RESULTS: When grouping all RPE responses throughout exercise intensities, we found an activation of several areas related to motor control (primary motor cortex, primary somatosensory cortex and cerebellum), homeostatic regulation (insular cortex) and cognition for executive functions (dorsolateral and anterior prefrontal cortex), spatial cognition (superior parietal lobule), reflective self-awareness (precuneus), and others (T=5.33; FWE<0.05). For the inhibited areas, we observed brain structures located in occipital lobe, prefrontal cortex, and thalamus, angular gyrus, Wernicke's area, associative visual cortex, premotor cortex and supplementary motor cortex (T=5.44; FWE<0.05). At LOW, the somatosensory cortex and cerebellum (T=6.46; FWE<0.05) were activated and at HIGH, only the cingulate gyrus was activated (T=6.53; FWE<0.05). **CONCLUSIONS:** By using a gold standard technique to analyze brain activity, we described here the modulation of brain areas to the RPE processing immediately after exercise cessation performed at different intensities. The integration of motor control, homeostatic regulation and cognitive related areas seems to, together, process the RPE responses after exercise.

396 Board #234 May 29 9:30 AM - 11:00 AM
Different Characteristics Of Brain Function Between Endurance And Sprinting Athletes: A Resting State fMRI Study

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Long-term motor training has been shown to create adaptations in regional brain plasticity, including brain structure and function, and this has been demonstrated by a number of studies. However, different influences on brain characteristics caused by different specific physical ability like endurance or sprinting still remain unknown.

PURPOSE: To investigate spontaneous brain activity characteristics of national level endurance and sprinting athletes, as well as different pattern of brain functional connectivity between these two groups.

METHODS: Fifty-seven Chinese national level athletes were recruited and assigned to the endurance group (n=29) and the sprinting group (n=28) according to their physical fitness. Their resting functional magnetic resonance imaging data were acquired by Philips Achieva 3.0T Trio scanner with a standard 32 channel head coil for all subjects. Amplitude of low frequency fluctuation (ALFF) was used to evaluate the intensity of regional spontaneous brain activity. Based on the ALFF results and previous studies, six region of interests (ROIs) were defined, including the cingulate gyrus (6, -21, 27) and right SMA (4, -12, 74). Then whole-brain seed based-functional connectivity analysis was conducted to examine characteristics of brain activation

pattern. SPM8 was used for preprocessing and statistical analysis of the images, and DPARSF was used to acquire the ALFF and FC maps for each individual. Two-sample t-tests were used to analyze differences between the groups.

RESULTS: 1. Compared to the sprinting group, the endurance group demonstrated higher ALFF in the right cingulate gyrus (peak t= 4.20) and lower ALFF (peak t= 4.5) in the left precuneus ($p<0.001$, cluster size>6). 2. The sprinting group showed higher functional connectivity between right cingulate gyrus and left Temporal Lobe (peak t=3.83), as well as right SMA and lateral prefrontal cortex (peak t= 4.06) ($p<0.001$, cluster size>25).

CONCLUSIONS: Long time specialized training seems associated with the changes in athletes' regional spontaneous brain activity and patterns of brain functional connectivity.

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397 Board #235 May 29 9:30 AM - 11:00 AM
Changes in Inhibitory Markers of Neuronal Plasticity Following Exercise and Intermittent Hypoxia

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Studies exploring the effects of exercise in the brain mainly focus on exercise induced modulation of growth factors, whereas research regarding inhibitory factors of plasticity in the brain such as Nogo-A and chondroitin sulfate proteoglycans (CSPGs) is limited. **PURPOSE:** To determine the expression of CSPGs and Nogo-A in selected brain areas after treadmill exercise training or intermittent hypoxia.

METHODS: Male Wistar rats (228g \pm 12.63) underwent six weeks of moderate intensity continuous training (MICT), high intensity interval training (HIIT), intermittent hypoxia (IH), IH and HIIT simultaneously (IH+HIIT), or remained sedentary (CON). MICT animals trained for 3 minutes at 25 cm.s⁻¹ followed by 30 minutes at 32 cm.s⁻¹. HIIT animals trained for 3 minutes at 25 cm.s⁻¹ followed by five cycles of 3 minutes at 50 cm.s⁻¹ and 3 minutes at 15 cm.s⁻¹. MICT and HIIT protocols were matched for duration and distance. IH animals were exposed to five cycles of 3 minutes of hypoxia (FiO₂ 15%) and 3 minutes of normoxia (FiO₂ 20.95%). The IH+HIIT animals were exposed to the IH and HIIT protocols simultaneously, training at the higher speeds during the hypoxic intervals. Hindlimb muscles were snap frozen and citrate synthase activity was measured. Brains were harvested following transcardial perfusions and fixation in 4% paraformaldehyde. 25 μ m coronal brain sections were immunohistochemically stained for Nogo-A and CSPGs. **RESULTS:** Preliminary results show that MICT reduced the average staining intensity of Nogo-A in the dentate gyrus (DG) (99%), CA1 (51%) and CA3 (98%) regions of the hippocampus compared to the CON group. HIIT reduced the intensity of Nogo-A to a larger extent than MICT in the CA1 region (62%). However, HIIT only slightly reduced the intensity of Nogo-A in the DG (22%) and CA3 (9%) regions. MICT increased the expression of CSPGs in the CA1 (300%) and CA3 (27%) regions and reduced the expression of CSPGs in the DG (77%) compared to CON. HIIT reduced the intensity of CSPGs in the DG (73%), CA1 (62%) and CA3 (61%) regions compared to the CON group. **CONCLUSIONS:**

These results show that MICT and HIIT have the capacity to reduce inhibitory molecules within the brain which may contribute to enhancing plasticity.

398 Board #236 May 29 9:30 AM - 11:00 AM
Age-Related Variation of Pressure Pain Threshold and Condition Pain Modulation During an Ultra-Marathon

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There is insufficient data available on age related variation in pain mechanisms during ultra-marathon competitions.

PURPOSE: We examine pressure pain threshold (PPT) and condition pain modulation (CPM) in older versus younger age groups during an ultra-marathon. **METHODS:** Informed consent was obtained from all subjects prior to their participation. Age groups were formed from the mean age of 41years-old in our subject population: n=21 for <40 years and n=23 for >40 years. PPT was measured using a Baseline® Dolorimeter. The dolorimeter was placed equidistant to the radial and the ulna styloid processes. A trained technician applied consistent, gradual pressure until the subject indicated that they felt a change from pressure to pain. This was repeated three times and the mean score was used for statistical analysis. CPM was measured with the same technique while subjects placed the opposite hand in cold water (20°C). During this process neither the technician nor the subjects were able to see the dolorimeter. Another technician recorded the results to maintain double blinding of data collection. To investigate any differences between the pre versus post changes during the ultra-marathon "Delta" PPT and CPM values were calculated by subtracting the Post PPT

and CPM from the Pre PPT and CPM, respectively. Independent sample t-tests were used to assess differences in Delta values for PPT and CPM between the two age groups. **RESULTS:** The Post PPT and CPM were significantly decreased ($p < 0.05$) for both age groups, indicating greater pain sensitivity. The age group analysis (< 40 versus > 40) showed a decrease in Delta PPT in the older age group: (Mean Delta < 40 years = 149.40 kPa, Mean Delta > 40 years = 48.38 kPa ($t(42) = 2.69$; $p < 0.05$). A similar decrease was found in Delta CPM: (Mean Delta < 40 years = 31.75 kPa, Mean Delta > 40 years = 11.69 kPa ($t(42) = 2.03$; $p < 0.05$). **CONCLUSION:** Previous research from our group has shown a decreased PPT and CPM, indicating greater pain sensitivity, across all ages during an ultra-marathon. In this present study we have seen similar decreases in PPT and CPM but clearly a difference between age groups in the degree of these changes. Further research is required to determine how factors of immunosenescence, directly or indirectly, may affect the age group variations in pain during an ultra-marathon.

399 Board #237 May 29 9:30 AM - 11:00 AM
Impact of a Carbohydrate Mouth Rinse on
Corticomotor Excitability after Mental Fatigue.

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Mental Fatigue (MF) has been associated with reduced physical performance. Carbohydrate (CHO) mouth rinse (MR) has been shown to be effective at increasing corticomotor excitability. **PURPOSE:** The purpose of this study was to determine if CHO MR positively impacts corticomotor excitability and cognitive function after MF. **METHODS:** Nine subjects (6 females, 3 males; Age = 23 ± 1 years; Height = 170 ± 3 cm; Weight = 68 ± 4 kg) completed 2 experimental sessions under different MR conditions (Placebo (PLAC), 6.4% glucose (CHO)) each separated by at least 48 hours and applied in a random fashion. Motor-evoked potential (MEP) of the left first dorsal interosseus (FDI) was determined at rest by transcranial magnetic stimulation (TMS) before and immediately after completion of a task designed to cause MF. The MF task required the subjects to complete six blocks (448 trials each) of the Stroop Color Word Test (SCWT). MR was applied between each SCWT block and held in the mouth for 20 sec. Perceived MF was recorded before and after the MF task using a 100 mm VAS. **RESULTS:** Perceived MF increased from pre (PLAC = 16 ± 6 mm; CHO = 19 ± 7 mm) to post (PLAC = 41 ± 5 mm; CHO = 46 ± 4 mm) in both conditions ($p < 0.001$) but no differences were seen between the groups. Overall reaction time during SCWT was better ($p = 0.03$) in CHO (698 ± 10 ms) compared to PLAC (738 ± 16 ms), but correct response rate was not different between the groups (PLAC = 97.5 ± 0.4 ; CHO = 98.1 ± 0.2). MEP improved ($33 \pm 9\%$) ($p = 0.03$) after the MF task in CHO (Pre = 2241 ± 633 μ V; Post = 2704 ± 606 μ V) and declined ($-28 \pm 6\%$) ($p = 0.02$) after the MF task in PLAC (Pre = 1810 ± 389 μ V; Post = 1208 ± 244 μ V). **CONCLUSIONS:** CHO MR was successful at preventing a reduction in corticomotor excitability subsequent to MF. CHO MR also had a positive impact on some measures of cognitive performance during the MF task. CHO MR did not impact perceived MF. These results suggest that CHO MR may be a valuable tool at combating the negative consequences of MF.

400 Board #238 May 29 9:30 AM - 11:00 AM
The Influence Of Transcranial Direct Current
Stimulation On Skill Acquisition In A Complex Motor
Task.

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INTRODUCTION: A single application of transcranial direct current stimulation (tDCS) delivered to motor cortex improves skill acquisition in relatively simple motor tasks performed unilaterally with the hand and arm. **PURPOSE:** The purpose of this study was to examine the acute effects of tDCS on skill acquisition in a complex, multi-joint arm movement in healthy young adults. **METHODS:** The study employed a double-blind, SHAM-controlled, between-subjects experimental design. Twenty-two right-handed adults were randomly assigned to either a tDCS or a SHAM group. Subjects participated in one experimental session that involved overhead throws to a target in a baseline-test block, 5 practice blocks, and a post-test block (10 trials per block). After the baseline-test block, transcranial magnetic stimulation (TMS) was used to locate the first dorsal interosseus muscle (FDI) motor representation area (motor hot spot) of the left hemisphere. Subsequently, motor evoked potentials (MEP) were obtained in the resting FDI muscle prior to and after 5 minutes of tDCS (current: 1 mA). After a 20 minute rest period, tDCS was applied again for 20 minutes to the FDI hot spot while subjects performed the 5 practice blocks of overhead throws. Finally, subjects performed a post-test block of overhead throws

5 minutes after the tDCS/practice session ended. Motor performance was quantified as the endpoint error, whereas MEP amplitude was used to quantify cortical excitability. Percent change in endpoint error between the baseline-test block and the post-test block for the two groups was compared with an unpaired t-test. Similarly, percent change in MEP amplitude before and after the 5 minutes of tDCS for the two groups was compared with an unpaired t-test.

RESULTS: The percent change in endpoint error (decrease) was greater for the tDCS group compared to the SHAM group, but this difference just failed statistical significance (-16.9 vs. -5.2% ; $P = 0.127$), whereas the percent change in MEP amplitude was significantly greater for the tDCS group compared to the SHAM group (49.7 vs. -13.5% ; $P = 0.012$).

CONCLUSION: These findings indicate that a single-session of tDCS enhances cortical excitability and appears to improve motor skill, although there was high inter-individual response variability to tDCS for this difficult motor task.

401 Board #239 May 29 9:30 AM - 11:00 AM
Impact of Acute Aerobic Exercise on Cue Reactivity in
Heavy Episodic Drinkers

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Physical exercise has been shown to reduce craving for alcohol in alcoholics. There is a high prevalence of heavy episodic drinking in college-aged adults (18-29 years of age). This can be predictive of an alcohol or other substance use disorder developing later in life. **PURPOSE:** The purpose of this investigation is to examine the impact of acute aerobic exercise on cue reactivity to alcohol in heavy episodic drinkers. **METHODS:** Seven participants (6 females, 1 male) (Age = 20 ± 0.44 years, BMI = 22.6 ± 0.59 , $VO_{2Max} = 32.014 \pm 2.14$ ml/kg⁻¹min⁻¹) completed 2 experimental sessions. Heavy episodic drinking was identified using an adapted version of the CAGE questionnaire. During one session subjects rested for 30 minutes and during the other session subjects exercised for 30 minutes at a moderate exercise intensity ($77 \pm 1\%$ of Peak HR). Sessions were randomized for each participant. Prior to and immediately following each session, EEG data were collected using a 64-channel system while subjects were exposed to 180 images (90 alcoholic drinks (ALC), 90 non-alcoholic drinks (NON)). Images were presented in a random order and preceded by a fixation stimulus using a variable time span (0.5 to 1.5 sec). Mean amplitude and peak latency was calculated for P300 (300-380 ms post stimulus) in parietal-occipital electrodes. **RESULTS:** Before exercise, subjects had a greater response ($p = 0.002$) to ALC (1.85 ± 0.20 μ V) as compared to NON (1.47 ± 0.21 μ V). After exercise the response to ALC (1.62 ± 0.37 μ V) was similar to that seen for NON (1.72 ± 0.31 μ V). Before exercise the peak latency was shorter ($p = 0.025$) for ALC (325 ± 32 ms) compared to NON (366 ± 25 ms). After exercise, the peak latency was similar for ALC (313 ± 26 ms) and NON (323 ± 27 ms). **CONCLUSION:** These findings suggest that acute aerobic exercise of moderate intensity attenuates cue reactivity to images of alcoholic beverages in heavy episodic drinkers.

402 Board #240 May 29 9:30 AM - 11:00 AM
Effect of High Intensity Aerobic Training on Fitness and
Health in Individuals with Parkinson's Disease

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Parkinson's disease (PD) is a neurodegenerative disorder characterized by motor dysfunction. Impaired mitochondrial capacity, as well as glucose and lipid toxicity, have been linked to neuronal dysfunction and apoptosis. Although aerobic exercise impacts these outcomes, few data exist in PD. **PURPOSE:** We tested the hypothesis that high intensity aerobic exercise (AEX) would improve aerobic fitness and metabolic outcomes. **METHODS:** Nineteen subjects (11 female, age: 67.5 ± 1.4 yrs) with idiopathic PD (Hoehn and Yahr stage 2 or 3) were enrolled in a 16-week supervised aerobic exercise program. Subjects exercised 3d/wk at a rating of perceived exertion (RPE) of 15-17 for 30 min. They also performed 30 min. of unsupervised exercise 2d/wk at an RPE of 10-12. Paired sample t-tests were used to assess maximal oxygen consumption, 6 min. walk, body weight (kg), body fat % (BIA), respiratory exchange ratio (RER; indirect calorimetry), blood pressure (BP), heart rate (HR), as well as fasting glucose and free fatty acids (FFA) pre/post intervention. **RESULTS:** AEX increased VO_{2peak} (PRE: 22.6 ± 1.6 vs. POST: 25.1 ± 1.4 ml/kg/min., $p = 0.004$) and distance covered during the 6 min. walk (PRE: 470 ± 19.3 vs. POST: 539.7 ± 24.3 m, $p = 0.0001$). AEX also reduced systolic BP (PRE: 119 ± 3.1 vs. POST: 106.7 ± 2.6 mmHg, $p = 0.007$) and fasting FFA (PRE: 0.40 ± 0.07 vs. POST: 0.3 ± 0.07 , $p = 0.03$). There were no statistical change in body weight, body fat %, diastolic BP, HR, RER or fasting glucose. **CONCLUSIONS:** An AEX intervention improves fitness and

metabolic health independent of weight loss in PD. Whether AEX improves metabolic health and PD related clinical outcomes more than other exercise prescriptions awaits further investigation. Supported by a grant provided by The Manning Foundation.

403 Board #241 May 29 9:30 AM - 11:00 AM
Dopaminergic Receptor and Transporter Densities in Nucleus Accumbens Are Not Altered by a Western Diet

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Multiple studies have indicated that physical activity regulation may be largely controlled by central neural factors, such as dopamine (DA) signaling in the nucleus accumbens (NAc). DA signaling has been shown to be altered by nutritional interventions. The key identified proteins involved with DA signaling are DA receptors one and two (DRD1, DRD2), tyrosine hydroxylase (TH), vesicular monoamine transporter (VMAT), and DA transporter (DAT).

PURPOSE: To determine if a high fat/high sugar (HFHS) diet alters DA signaling in the NAc of male and female C57Bl/6J mice. **METHODS:** Mice were randomly assigned to either a HFHS diet or a standard CHOW diet (C) at three weeks of age for a total of nine weeks. The C diet consisted of 4% fat, 25.2% protein, 39.5% carbohydrate, and 23.2% fiber, while the HFHS diet consisted of 45% fat, 20% protein, and 35% carbohydrate along with a 20% fructose solution replacing drinking water. Physical activity was measured using a running wheel for three days during the last week. Mice were sacrificed at 12 weeks, the NAc was dissected on ice, and flash frozen in liquid nitrogen. Immunoblotting was performed using NAc lysate probed with the following antibodies; DRD1, DRD2, TH, VMAT, DAT. Bands were analyzed after normalization using Welch's t-tests to compare target protein densitometries between the HFHS and C diet conditions. **RESULTS:** There were no significant differences in protein densitometries in male mice for DRD1, TH, VMAT, DAT, or DRD2 ($p = 0.85; 0.46; 0.38; 0.38; 0.36$ respectively) or in female mice ($p = 0.16; 0.39; 0.31; 0.33; 0.83$ respectively). **CONCLUSION:** A HFHS diet did not alter dopaminergic receptor or transporter densities in the NAc. Previous analyses revealed the HFHS group had greater kcal consumption and decreased physical activity while the C diet group had lower kcal consumption and higher physical activity. Thus, we conclude that each group mediated DA activity via separate mechanisms; the HFHS through diet and the C through physical activity.

404 Board #242 May 29 9:30 AM - 11:00 AM
Changes in Cue Reactivity to Fatty Foods After Exercise

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Acute aerobic exercise has been shown to reduce craving for various addictive substances like cigarettes and alcohol. A similar effect has been seen in children when examining brain fMRI responses to fatty foods. **PURPOSE:** The purpose of this investigation is to examine the impact of acute aerobic exercise on cue reactivity to fatty and healthy foods in college-aged women. **METHODS:** Sixteen women (Age=21±1 years, BMI=22.1±0.5, $VO_{2peak}=39.1\pm1.5$ ml kg⁻¹ min⁻¹) completed 2 experimental sessions. During one session subjects rested for 30 minutes and during the other session subjects exercised for 30 minutes at a moderate exercise intensity (77±2% of Peak HR). Treatments were applied in a counter-balanced fashion and subjects fasted for 4 hours prior to each session. Prior to and immediately following each session, EEG was collected using a 64-channel system while subjects were exposed to 280 images (40 Distractor (DIS), 120 Fatty Foods (FAT), 120 Healthy Foods (HEALTHY)). Images were presented in a random order and proceeded by a fixation stimulus using a variable time span (0.5 to 1.5 sec). Adaptive mean and peak latency for N100 (100-130 ms post stimulus) and P300 (240-300 ms post stimulus) were determined in parietal-occipital electrodes. **RESULTS:** Before exercise, subjects had a greater P300 response ($p=0.001$) to FAT (5.68±0.46 μV) as compared to HEALTHY (5.23±0.48 μV). After exercise the response to FAT (4.92±0.45 μV) was similar to that seen for HEALTHY (4.94±0.54 μV). The N100 response to FAT (Pre=3.48±0.24 μV ; Post=2.96±0.28 μV) was greater than the response to HEALTHY (Pre=3.20±0.22 μV ; Post=1.96±0.42 μV) before ($p=0.001$) and after ($p=0.005$) exercise. No differences in peak latency were seen for N100 or P300 at either time point. **CONCLUSION:** These findings suggest that acute aerobic exercise of moderate intensity can influence cue reactivity to images of fatty and healthy foods in college-aged women.

405 Board #243 May 29 9:30 AM - 11:00 AM
Changes in Analgesia, Hyperphagia and Depression are Mediated by Endogenous Opioids Following Forced Swimming Exercise

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Exercise is specifically linked to at least three phenomena that are likely to involve opioid release; the 'athlete's high', increased pain tolerance, and addiction to exercise. Exercise studies that have examined the effects of the opiate receptor blocker naltrexone, found that its administration prior to exercise alter these before mentioned phenomena. **PURPOSE:** The purpose of this study was twofold: 1) to establish an exercise modality that is sufficient to stimulate the release of endogenous opioids and 2) to examine the role endogenous opioids play in post-exercise pain tolerance and depression. **METHODS:** Following a week of familiarization, mice underwent a 50-minute (min) bout of forced swimming (FS). Mice were injected with either saline (S; 0.9%) or the opioid blocker naltrexone (NTX; 4g/kg) 15 mins prior to exercise. Following exercise mice were challenged with a tail suspension test (TST), pain tolerance test or monitored for post exercise food consumption for 2 hours. **RESULTS:** NXT injection decreased total FS time (46 ± 1.2 mins. vs. 35 ± 1.6 mins; $p<0.05$). Forced swimming increased food consumption by 88% ± 11 ($p<0.05$) two hours following exercise but was abolished by NXT ($p<0.05$), verifying an increase in opioid mediated hyperphagia. An increase in hot water tail immersion time following exercise ($S = 2.72 \pm 0.13$ vs. $FS = 4.28 \pm 0.19$; $p<0.05$) demonstrated an improvement in pain tolerance. Pain tolerance decreased by 20% ± 0.05 with the addition of NXT ($P<0.05$). Finally, a TST demonstrated that following a bout of exercise, mice spent 49 ± 3.1% less time immobile ($p<0.05$), signifying lower depression levels. This effect was reversed with the opioid blockade ($p<0.05$). **CONCLUSIONS:** Fifty minutes of forced swimming is an effective stimulus for the release of endogenous opioids and modulates behavioral changes specific to the release endogenous opioids in mice.

406 Board #244 May 29 9:30 AM - 11:00 AM
Endurance Exercise-induced Autophagy Coincides With Anabolic Activation And Neurogenesis In The Hippocampus Of The Mouse Brain

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PURPOSE: Autophagy and neurogenesis play a pivotal role in maintaining cellular homeostasis of neurons in the brain. Endurance exercise (EXE) serves as a potent activator of both autophagy and neurogenesis in the hippocampus of the brain; however, the molecular mechanisms of the dual activation remains unclear. We investigated EXE-induced molecular signaling nexus of autophagy and neurogenesis pathways in the hippocampus.

METHODS: C57BL/6 mice (8 weeks old, male, $n=24$) were randomly divided into two groups: control (CON, $n=12$) and endurance exercise (EXE, $n=12$). Animals performed treadmill running exercise at 13 m/min (65-70% VO_{2max}) for 60 min/day for 6 weeks. 24 hours after the last session of EXE, whole brains were excised, and the hippocampi were isolated for Western blot analysis. For immunofluorescence microscopy, the excised whole brains were frozen. A student t-test was used for statistical analysis ($p<0.05$).

RESULTS: EXE significantly increased autophagy evidenced by an increase in LC3II, ATG7, BECLIN1, and phosphorylation of BCL-X_L by JNK activation along with an increase in lysosomal proteins (LAMP2, CATHEPSIN L and TEEB, $p<0.05$). Intriguingly, EXE-induced autophagy coincided with activation of anabolic signaling cascades (AKT-mTOR-p70s6k, $p<0.05$), known to interfere in autophagy. This autophagy promotion was associated with activation of endoplasmic reticulum stress adaptors (p-PERK, ATF6, and p-IRE1, $p<0.05$). Interestingly, EXE-mediated neurogenesis was induced, despite the downregulation of canonical neurotrophic factors (BDNF, GDNF, and NGF, $p<0.05$). Instead, EXE promoted neuroregulin-mediated neurotrophic signaling (p-ERK, p-RSK, and p-CREB, $p<0.05$).

CONCLUSIONS: EXE-induced coactivation of autophagy and anabolism suggest that enhanced recycling of damaged molecules along with increased anabolism in the hippocampus may confer neuroprotective phenotypes of the brain. Furthermore, EXE-mediated improvement in neurogenesis devoid of canonical neurotrophic factors suggests that there exists a potential modulatory mechanism regulating the optimal levels of neurogenesis, which prevents undesired excessive chronic neurogenesis. Our results suggest that coactivation of autophagy and neurogenesis via EXE is critical for maintaining optimal neuronal homeostasis.

A-54 Free Communication/Poster - Mental Health through the Lifespan

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

407 Board #245 May 29 11:00 AM - 12:30 PM Suicidality, Physical Activity and Sport Participation in US Middle and High School Students

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PURPOSE: Exercise is inversely related to both sadness and suicidality in developing adolescents. To date, the literature has addressed neither the contextual factors nor the dynamic fluctuations of these relationships in middle and high school children over time. The purpose of this study is to examine the temporal changes in the relationship between physical activity, sport participation, sadness, and suicidality in students in grades 6-12 in the U.S.

METHODS: Using the 2015 National Youth Risk Behavior Survey (N=199,194), regression models adjusted for age, sex, and race estimated the odds ratios between sadness, suicidal ideation, and suicidal attempts, stratified by exercise and sports participation.

RESULTS: Overall, 19.7% of students in grades 6-12 reported suicidal ideation or attempt. Only 68.4% of students reported ≥ 60 minutes of physical activity on four or more days of the week, and 55.2% reported sport team participation. Physical activity on four or more days per week was associated with a 27% reduction in the odds of suicidality, and sport team participation was associated with 17% reduction in suicidality.

CONCLUSIONS: Exercise and sport team participation are inversely related to sadness and suicidality in adolescents and this relationship persists throughout adolescence. Future research should examine the influence of exercise and sport participation on a longitudinal basis and identify other biopsychosocial factors that may be contributing to these results in developing adolescents.

408 Board #246 May 29 11:00 AM - 12:30 PM Device-based Sedentary Time And Executive Function Among African-american Children With Behavior Disorders

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Screen time in children with ADHD can exacerbate symptoms and affect self-regulation and attention. **PURPOSE:** To test relationships between device-based ST and children's executive function (EF) with behavior disorders. **METHODS:** Eleven African-American girls and 12 boys (mean age = 9.3 ± 1.9 -years) wore a triaxial accelerometer for 5-consecutive-days at the beginning of an intervention trial. Evenson (2008) cut-points were used to determine ST (min/day), sedentary breaks (min/day), and ST% (% per day) during weekdays and a filter to remove intervention time and non-wear time during the night was applied. Data was included if a participant wore the accelerometer ≥ 3 weekdays for ≥ 8 hrs/day. EF was assessed through parental-report of behavioral manifestation of EF (BRIEF-GEC score) and children underwent neuropsychological tests of verbal and visuospatial working memory (AWMA verbal and AWMA visuospatial scores). ST (min/day) was reciprocal by 100 transformed to achieve normality. Bivariate correlations and multiple regression analyses tested relationships between EF and ST, controlling for wear-time and moderate-to-vigorous physical activity. **RESULTS:** On average, children spent 295.60 ± 67.17 min/day in ST, 417.60 ± 120.78 min/day in sedentary breaks, and $49.31 \pm 7.11\%$ of the day in ST. Children obtained an average score of 59.21 ± 10.42 points in BRIEF-GEC, 32.70 ± 25.68 points in AWMA verbal score, and 38.05 ± 23.31 points in AWMA visuospatial score. BRIEF-GEC, AWMA verbal, and AWMA visuospatial scores were low. In this case, BRIEF-GEC scores indicate a better EF, while AWMA verbal and visuospatial scores represent a less fewer difficulties in working memory and a less problematic behavior in the classroom. In bivariate correlations, a significant relationship was observed between ST% and AWMA visuospatial score ($r(17) = -0.49$, $p = 0.04$). None of the regression analyses, controlling for wear-time and moderate-to-vigorous physical activity, showed significant results, though there was a trend for all ST variables to explain $\geq 15\%$ of the variance in AWMA visuospatial scores after controlling for wear-time. **CONCLUSIONS:** Few significant relationships were evident between objectively-measured ST and assessments of African-American children's EF with behavior disorders.

409 Board #247 May 29 11:00 AM - 12:30 PM**Exercise Group In a Geriatric Psychiatry Clinic - Improving Physical Strength and Mental Health**

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(No relevant relationships reported)

Introduction: Exercise has wide range of health benefits, more than any other single intervention. It improves depression and anxiety symptoms, attention and other cognitive functions. Exercise is recommended for common chronic diseases, such as diabetes, hypertension, coronary heart disease, osteoporosis, insomnia and more. Benefits to exercise include low cost, social interactions, no drug interactions or drug metabolism, improved physical health, and positive stigma.

Methods: We designed an exercise group for patients followed at our geriatric-psychiatry clinic. We recruited older adults age ≥ 60 with any type of major mental disorder, followed at the tertiary-care geriatric psychiatry clinic, Jewish General Hospital, Montreal.

Intervention of Exercise Group: Aerobic and anaerobic exercise, for 50 minutes, twice a week, total of 12 weeks, at medium intensity which gradually increased. Groups included 6-12 participants every 3 months and led by an exercise instructor. We ran four groups during 2017-2018.

Results: We had 24 individual participants in 4 groups, among them we had 9 patients who joined the group during the first 4 weeks of the 12-week session, completed at least 75% of the exercise sessions, and completed both pre- and post questionnaire (PHQ-9) were included in the final analysis.

Quantitative results:

We used the PHQ-9 to examine depressive symptoms, analysis by Wilcoxon signed rank test.

Pre and post intervention analysis showed improvement in depressive symptoms with a significant $P = 0.03$

Qualitative results:

We conducted a focus group at the end of the fourth group. Repeated themes were: feeling more confident, stronger, more energetic, and more calm. Most patients described the exercise environment as positive, non-judgmental, and supportive. Quality of sleep during the night was not improved, though most patients mentioned feeling much less sleepy during the daytime.

Conclusions: Exercise could potentially help number of outcomes for older adults with mental illness. It has been shown to significantly improve depressive symptoms, and qualitative results show improvement in general well-being. Our results and future research in this field will help establish an evidence base to tailor this promising intervention to this vulnerable population of older adults with mental illness.

410 Board #248 May 29 11:00 AM - 12:30 PM Functional Capacity, Cognition And Spatial Navigation In Older Adults With Mild Cognitive Impairment

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Spatial navigation is a complex and fundamental cognitive ability that allows an individual to maintain independence and, combined with episodic memory, emerges as one of the first deficits in patients with Alzheimer's disease (AD). A successful spatial navigation depends on an interaction between physical (mobility, balance and aerobic capacity) and cognitive ability (memory and executive function). However, although Mild Cognitive Impairment (MCI) typically precedes AD, the mechanisms of spatial navigation in real environment in this population are still not well understood, especially the influence of physical variables.

Purpose: To compare spatial navigation performance through use of the Floor Maze test (FMT) - an easy-to-apply two-dimensional maze - on healthy elderly individuals and those with MCI. A secondary objective we examined which cognitive and functional functions were associated with performance in this task.

Methods: We evaluated 62 older adults (> 60 years) (healthy=39; MCI=23). Spatial navigation was evaluated through the FMT (Planning (PMT), Immediate (IMT) and Delayed Maze Time (DMT)). Functional capacity was evaluated through the Sit to Stand, 8 Foot up and go and STEP (Senior Fitness Test battery). Cognitive functions were evaluated through MMSE, clock-drawing test, Verbal Fluency, RAVLT, Digit Span and Trail Test (A and B). The relationship and possible association between FMT performance and independent variables were analyzed using multiple and logistic regression models.

Results: The group with MCI was significantly slower in all stages of the FMT. PMT performance was associated with clock drawing test ($R^2 = 0.26$ $p < 0.001$). Performance in the IMT was associated with STEP ($R^2 = 0.15$ $p = 0.02$), while DMT was influenced by the STEP and clock drawing test ($R^2 = 0.33$ $p < 0.001$). Logistic regression analysis

showed that older adults with low aerobic capacity are 18 times more likely to have a worse performance in the DMT ($O.R=18.76$ $p=0.04$). Conclusion: Older adults with MCI presented significant spatial navigation deficits. Their performance on the FMT is mainly influenced by spatial orientation and aerobic capacity. Elderly people should be encouraged to practice physical exercises, aiming to maintain cardiorespiratory levels and spatial navigation.

411 Board #249 May 29 11:00 AM - 12:30 PM

Do Aerobic Exercise And Mindfulness Act Synergistically To Mitigate Psychological Distress In High-stress College Students?

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(No relevant relationships reported)

Mindfulness meditation (MM) and aerobic exercise (AE) decrease stress, but the combined effects are unknown. **Purpose:** Assess effects of AE plus MM, compared to effects of MM alone, on stress in young adults. **Methods:** High-stress, sedentary ($N=32$, 27 F, 20.5 ± 2.7 years, 23.9 ± 5.0 kg/m²) individuals were randomized to a 4-week MM, AE+MM, or control group. MM and AE+MM groups participated in 200 minutes/week of guided MM or AE+MM. MM consisted of present moment, non-judgmental awareness. AE consisted of moderate-intensity (40 - 60% heart rate reserve) exercise. Stress (PSS) and anxiety/depression symptoms (DASS) were measured at baseline, and after weeks 1 and 4. An analysis of variance assessed effects of group and time on PSS and DASS. **Results:** There were no group x time interactions for PSS ($p=0.12$) or DASS ($p=0.21$). There were main effects of time in which PSS and DASS were significantly lower after week 1 (PSS: $p=0.04$; DASS: $p=0.01$) and at post-intervention (PSS: $p<0.001$; DASS: $p=0.004$) compared to baseline. There were large effect size (ES; Cohen's d) changes in the pre to post PSS and DASS scores for the MM (PSS: -1.33 ; DASS: -1.03) and AE+MM (PSS: -1.24 ; DASS: -0.97) groups, and small ES changes in the PSS and DASS scores for the control group (PSS: -0.45 ; DASS: -0.13). **Conclusion:** MM may be as effective as AE+MM in combatting psychological distress in high-stress young adults. Further research should compare AE-only to AE+MM.

412 Board #250 May 29 11:00 AM - 12:30 PM

The Feasibility Of Pilates To Improve Mental Health Outcomes Among People With Multiple Sclerosis: An 8-week Randomized Controlled Pilot Trial

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(No relevant relationships reported)

Evidence supports positive effects of exercise on mental health outcomes among people with Multiple Sclerosis (PwMS). However, non-traditional exercise modes like yoga, tai chi, and Pilates remain understudied. **Purpose:** Thus, this 8-week feasibility trial examined the effects of supervised or home-based Pilates compared to a wait-list control on mental health outcomes among PwMS. **Methods:** Nineteen PwMS were recruited; one refused randomization and the one male was omitted from analyses. Seventeen females (49.8 ± 8.4 y) were randomised to two weekly sessions of supervised Pilates ($n=5$), two weekly home-based Pilates sessions guided by a DVD ($n=6$), or wait-list control ($n=6$). Pilates sessions involved 60min sessions of 14 mat-based beginners' level exercises; repetitions progressed from 4-10 for each exercise across eight weeks. Feasibility was assessed relative to recruitment, retention, compliance with the Pilates intervention, and the presence/absence of adverse events. Well-validated questionnaires assessed symptoms of anxiety, depression, and fatigue, and mood states at baseline and weeks two, four, six, and eight. Differences in outcome change were examined with 3 group X 4 time ANCOVAs adjusted for baseline. Significant interactions were decomposed with simple effects analysis. Hedges' d effect sizes quantified magnitude of change.

Results: Attrition was high for supervised Pilates ($n=2$ of 5; 40%); no home-based or wait-list participant withdrew. Compliance was high across groups ($>80\%$). No adverse events were reported. Group X time interactions were significant for feelings of depressed mood ($F_{(6,33)}=2.80$, $p<0.03$), physical symptoms of fatigue ($F_{(6,33)}=4.92$, $p<0.001$), and total fatigue ($F_{(6,33)}=3.76$, $p<0.006$). Compared to wait-list, scores for home-based Pilates were significantly lower (all $p<0.02$) for feelings of depressed mood at weeks 4 ($d=1.25$), 6 ($d=0.47$), and 8 ($d=0.90$), physical symptoms of fatigue at weeks 4 ($d=0.84$) and 8 ($d=0.82$), and total fatigue at weeks 4 ($d=0.60$) and 8 ($d=0.57$). **Conclusions:** Findings support the feasibility of home-based Pilates to improve mental health outcomes among women with MS. These results support development of larger randomized controlled trials to better understand Pilates' clinical effectiveness and plausible mechanisms of action.

413 Board #251 May 29 11:00 AM - 12:30 PM

Physical Activity and Sedentary Behaviors Influence Executive Function and Psychological Well-being in Chinese University Students

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PURPOSE: To investigate the associations of physical activity and sedentary behaviors with executive function and psychological well-being in Chinese university students.

METHODS: Participants were 214 college students (aged 19.0 ± 1.1 yrs, 46.3% women) recruited from Shanghai, China. Executive function was assessed using a task switching paradigm. The outcomes of the task were global switch costs and local switch costs. The self-rating anxiety scale (SAS) and the self-rating depression scale (SDS) were used to measure anxiety and depressive status, respectively. Sleep quality was assessed by the Pittsburgh sleep quality index (PSQI). Physical activity was objectively measured using hip-mounted accelerometry monitors (Actigraph wGT3X-BT, Pensacola, FL, USA). Time spent on TV viewing, computer use, and smartphone use was used as indicators of sedentary behaviors, which were surveyed by a questionnaire. Linear regression modelling was conducted to assess the associations of physical activity and sedentary behavior with executive function and psychological variables.

RESULTS: Female students accumulated more time spent on light physical activity (LPA) (157.2 ± 37.7 vs. 131.1 ± 48.0 min, $P<0.01$) and moderate-to-vigorous physical activity (MVPA, 49.6 ± 22.3 vs. 38.6 ± 17.0 min, $P<0.01$), and had higher total PA (326.9 ± 119.6 vs. 271.7 ± 114.8 CPM, $P<0.01$) than males. After adjustment for wear time of accelerometers, age and gender, MVPA ($\beta=-0.19$, 95% CI, -0.35 to -0.03 , $P=0.02$) and LPA ($\beta=-0.17$, 95% CI, -0.34 to -0.01 , $P=0.04$) were associated with smaller global switch costs, which indicated that higher levels on MVPA and LPA were associated with better task switching performance. Longer time spent on smartphone use was associated with worse scores on depression ($\beta=0.31$, 95% CI, 0.15 to 0.47 , $P<0.001$), anxiety ($\beta=0.29$, 95% CI, 0.13 to 0.45 , $P<0.001$) and sleep quality ($\beta=0.29$, 95% CI, 0.14 to 0.44 , $P<0.001$). No other significant associations were observed.

CONCLUSIONS: Participation in physical activity was associated with better performance on a test of executive function. Longer time on smartphone use was associated with worse scores on depression, anxiety and sleep quality. Therefore, interventions targeting college students should be developed to increase physical activity and reduce smartphone use.

414 Board #252 May 29 11:00 AM - 12:30 PM

High Intensity Interval Training Is Associated With Decreased Negative Affect In Individuals With Anxiety Disorders

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(No relevant relationships reported)

INTRODUCTION: Exercise has been shown to reduce negative affect (NA) in people with anxiety.

PURPOSE: To investigate associations between 2 heart rate (HR)-derived indices of exercise volume and change scores on NA measures using a novel high intensity interval training (HIIT) protocol administered at home with remote coaching in people with anxiety disorders.

METHODS: In a pilot study, eleven insufficiently active people (Chester Step Test estimated baseline VO_{2peak} 33.18 ± 5.89 ml·kg⁻¹·min⁻¹) diagnosed with an anxiety disorder and State-Trait Anxiety Inventory (STAI) score >44 performed a 6-week, 4 days/week HIIT program using a stepper machine. Each session included 8 to 12-minutes of HIIT (20/40 sec ratio - target HR 85% of estimated maximal HR) and data were uploaded to a cloud server. Questionnaires were collected at baseline, 3, and 6 wks. Continuous HR was recorded, producing an HR curve. Amount of exercise was computed as the sum (AUC_s) and average (AUC_a) area under these HR curves above the baseline resting HR. For each combination of the 6 clinical outcomes (STAI, Depression, Anxiety, and Stress Scales and Quality of Life Questionnaires) and 2 AUC measures, nonparametric correlations were calculated and adjusted by Bonferroni correction for multiple comparisons (significant if $p<0.014$). Correlations were calculated for change scores from baseline to wk 6, baseline to wk 3, and wk 3 to 6.

RESULTS: 2 males and 9 females aged 25.05 ± 2.82 years, BMI 23.95 ± 4.27 completed the study. Adherence was 88%. AUC_s and AUC_a in the first 3 wks were negatively associated with wk 3-baseline change in state anxiety ($r=-.95$, $p<0.001$ and $r=-.84$, $p<0.014$ respectively), indicating that patients with greater volume of exercise experienced greater state anxiety reductions over the same period. AUC_s and AUC_a

variance explained 90.25% and 70.56% of the variance in state anxiety change over the same period, respectively. Correlations between AUC indices and other NA measures also were negative but nonsignificant, possibly due to small sample size.

CONCLUSIONS: AUC indices were significantly and inversely associated with changes in state anxiety from baseline to wk 3 and the remaining outcomes showed nonsignificant associations in the predicted directions. HIIT could be a promising intervention to reduce NA in anxiety disorders.

415 Board #253 May 29 11:00 AM - 12:30 PM
Examination of Eating Disorder Risk among Female College Athletes and Performers

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(No relevant relationships reported)

The demands of being a female college athlete/performer may create mental and physical stress that may increase the likelihood of eating disorders and disordered eating. **PURPOSE:** The overall purpose was to examine the prevalence of Eating Disorder (ED) risk among female college athletes/performers across academic status and sport type (equestrian, volleyball, beach volleyball, women's soccer, softball, and ballet). **METHODS:** Data from a larger cross sectional was used. A convenience sample of NCAA Division I female athletes/performers ($n=127$; age: 19.8 ± 2.0 years; weight: 63.6 ± 9.2 kg, height: 163.9 ± 28.8 cm) from a University in the southeastern region of the United States participated in the study. Participants completed a basic demographic survey, the Eating Disorder Inventory-3 (EDI-3), and the EDI-3 Symptoms Checklist (SC). Basic descriptive stats were used for demographic information. Cross-tabulations were used to examine the proportion of participants classified as "at risk for EDI-3 and EDI-3 SC" across sport and academic status.

RESULTS: Significant differences [$X^2(15, N=127) = 25.2, P=0.04$] were found between the distribution of ED risk and sport with 18.9% ($n=24$) at risk for EDI-3; 29.9% ($N=38$) EDI-3 SC, and 31.5% ($n=40$) were at risk for both EDI-3 and EDI-3 SC. Overall, pathogenic behaviors revealed: 52.8% ($n=66$) dieting, 13.6% ($n=17$) exercise 50-100% of the time to lose weight, 20% ($n=25$) binge eating, 13.6% ($n=17$) purging, 4.0% ($n=5$) laxatives, 7.2% ($n=9$) diet pill use, and 1.6% ($n=2$) use diuretics. A significant difference between dieting and sport [$X^2(5, N=125) = 12.2, P=0.03$] was found with the highest prevalence within equestrian (16%, $n=20/28$) and ballet (13.6%, $n=17/29$). Sport type and exercise to control weight more than 50-100% of the time was significantly different [$X^2(20, N=125) = 54.1, P\leq 0.01$] with the highest prevalence within equestrian (10.4%, $n=13/29$). **CONCLUSIONS:** Athletes in the college setting are at risk for eating disorders. Medical professionals such as athletic trainers who work within this setting need to be educated on the potential risk factors that can lead to EDs. There should be a referral process in place for those athletes who are at risk. Those involved in the screening, prevention, and treatment of at-risk athletes should understand the sensitive nature of the topic.

416 Board #254 May 29 11:00 AM - 12:30 PM
The Relationship Between Physical Activity, Sleep Quality, and Subjective Well-being in College Students

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(No relevant relationships reported)

While previous studies have well documented the beneficial effects of physical activity (PA) and sleep quality on mental disorders (e.g., depression and anxiety), relatively few have explored their relationship with subjective well-being (SWB), which is a core construct in positive psychology and is linked with various health outcomes.

Purpose: To examine the associations between the PA, sleep quality, and SWB in college students while controlling for gender and age.

Methods: 726 college students (41.1% female, mean age = 19.28 years) voluntarily completed a set of questionnaires assessing the life satisfaction (Satisfaction with Life Scale), happiness (Subjective Happiness Scale), positive affect and negative affect (Scale of Positive and Negative Experience), walking, moderate-intensity PA (MPA), and vigorous-intensity PA (VPA; International Physical Activity Questionnaires), and sleep quality (Pittsburgh Sleep Quality Index). Four multiple regression models were performed with happiness, life satisfaction, positive affect, and negative affect as the outcome variables, respectively. Walking, MPA, VPA, and sleep quality were predictor variables for each model. Age and gender were controlled in each model as covariates.

Results: The regression models indicated that the predictors significantly explained the variance for each outcome with R^2 being 15.68% for life satisfaction, 19.43% for happiness, 22.32% for positive affect, and 24.81% for negative affect (p 's < 0.001). Higher levels of VPA were associated with higher levels of life satisfaction ($\beta = 0.09, p = 0.008$), happiness ($\beta = 0.26, p < 0.001$), and positive affect ($\beta = 0.13, p < 0.001$), and lower levels of negative affect ($\beta = -0.10, p = 0.003$). However, MPA and walking were associated with none of the outcome variables (p 's > 0.05). This emphasized the importance of the intensity of physical activity in advancing SWB. Better sleep quality

was associated with higher levels of life satisfaction ($\beta = 0.37, p < 0.001$), happiness ($\beta = 0.36, p < 0.001$), and positive affect ($\beta = 0.43, p < 0.001$), and lower levels of negative affect ($\beta = -0.47, p < 0.001$).

Conclusion: For college students, better sleep quality and regular participation in VPA are beneficial for SWB while increased levels of walking and MPA might not be helpful in improving SWB.

417 Board #255 May 29 11:00 AM - 12:30 PM
Patterns of Physical Activity and Mental State Among College-Aged Men and Women

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(No relevant relationships reported)

PURPOSE: Increasingly, mental health is a concern among young adults. It is known that physical activity can improve mental health. The present investigation sought to examine the associations of physical activity on mental health by sex. **METHODS:** Eighty-one young adults (20.5 ± 1.5 years) took part in the investigation. The participants underwent body fat percentage assessment and completed the Depression, Stress and Anxiety Scale (DASS 21) and the Leisure and Physical Activity Survey (LPA). Data were analyzed for associations between sex, physical/sedentary activities, body composition and mental health via multiple linear regression analysis. **RESULTS:** Female participants ($n=49$) reported less weightlifting exercise ($p < 0.001$, 55% 0-2 days, 41% 3-5 days, 4% 6-7 days) compared to males (23% 0-2 days, 61% 3-5 days, 16% 6-7 days); however, no significant sex differences were noted for aerobic exercise. Physical activity by sex was regressed against scores from the DASS 21. Significant interactions were noted between sex and min/day of aerobic exercise ($F=6.26, p=0.003$) and days/week engaged in weightlifting exercise ($F=5.46, p=0.006$) for anxiety. In contrast to males, females engaged in higher numbers of weight training sessions and reported increased anxiety (0-2 days: 5.33 ± 4.28 ; 3-5 days: 5.65 ± 5.51 ; 6-7 days: 7.50 ± 9.19). Whereas increasing time of aerobic exercise among females was associated with lower anxiety (0-15 min per session: 12.5 ± 5.0 ; 16-30 min per session: 4.65 ± 4.74 ; >30 minutes per session: 4.47 ± 2.87), male students who engaged in more days per week of weight lifting exercise reported lower levels of anxiety (0-2 days: 10.00 ± 5.88 ; 3-5 days: 4.52 ± 2.98 ; 6-7 days: 3.6 ± 3.21). **CONCLUSIONS:** For college-aged females, a focus on time engaged in aerobic exercise may produce not only cardiovascular benefits, but also psychological, and encouraging resistance exercise among college males may have similar results. University and college communities should encourage different patterns of exercise for male and female students to reduce anxiety.

418 Board #256 May 29 11:00 AM - 12:30 PM
Moderate and Intense Exercise not Modify Anxiety Scores but Promote Different Affective Answers in Adults

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It is well known that moderate exercise can positively modulate mood states; however, few studies have shown the effects of intense exercise. **PURPOSE:** Compare the impact of moderate and intense exercise on anxiety, affective and positive subjective experience answers in healthy adults.

METHODS: Ten healthy male subjects (28.70 ± 6.25 yrs; 72.51 ± 10.68 kg; 175 ± 4.38 cm; 23.60 ± 2.66 kg/m²; 16.56 ± 6.38 % Fat mass), were submitted to two intensities based on maximal treadmill test separated by 7 days: 1) 60%; 2) 85%. For these conditions, the subjects answered a Subjective Exercise Experiences Scale (SEES) and IDATE-State scale in the following time-courses: baseline (B), immediately after (IA) and 30 minutes after (R) finishing of the exercise. The Feeling Scale (FS) was recorded at 1, 5, 10 and last minutes of exercise. The situations were compared by two-way ANOVA with post-hoc Duncan test, with significance $p\leq 0.05$. The protocol was approved by Unifesp Ethics Committed (#2.381.537).

RESULTS: We didn't observe differences in anxiety comparing groups or time-courses, however, SEES Positive well-being subscale show lower scores at IA during 85% when compared with 60% (19.90 ± 2.23 vs 17.40 ± 2.95 ; $p=0.02$). The increase of fatigue was observed at B when compared IA in 60% (6 ± 3.83 vs 11.10 ± 7.64 ; $p=0.01$). Similar data was observed in 85%, with increase in B when compared to IA (8.80 ± 6.39 vs 14.40 ± 7.41 ; $p=0.006$) and remain higher at R ($p=0.03$). The FS on 60% show a significant decrease at last minute compared to 1 ($p=0.0002$), 5 ($p=0.002$) and 10 ($p=0.009$) minutes; on 85%, similar data was observed. The last minute was lower when compared to 1 ($P<0.001$), 5 ($p<0.001$), 10 ($p<0.001$); but the 10 minute was

lower compared to 1 ($p < 0.001$) and 5 ($p < 0.001$). When comparing intensities 60% showed higher scores at the FS at the 10 ($p < 0.001$) and the last minute ($p < 0.001$) compared to 85%.

CONCLUSIONS: The comparison between the exercise intensities show that, there was no difference between anxiety scores, on the other hand, moderate exercise presented better IA well-being response, faster fatigue recovery and maintained affectivity with positive values indicating pleasure from the beginning to the end of the test.

419 Board #257 May 29 11:00 AM - 12:30 PM
Impact of Wearing Graduated Compression Stockings on Psychological and Physiological Responses during Prolonged Sitting

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PURPOSE: Links between a prolonged sitting and increased risk of cardiovascular diseases or poor mental health have been found. A usage of compression garment may have some potential psychological and physiological benefits during prolonged sitting.

METHODS: We investigated the impact of with or without wearing graduated compression stockings on psychological and physiological responses in 18 healthy young people (12 men and six women) during 3 h prolonged sitting. Heart rate (HR) was measured throughout the sitting time, and heart rate variability (HRV) was analyzed to evaluate sympathetic and para-sympathetic nerve activity at pre, 1h, 2h, and 3h during the sitting for 5-min each. To assess psychological stress-related variables, Profile of Mood States (POMS) and saliva cortisol were evaluated before and after 3 h sitting. Visual analogue (VAS) scale was also assessed for whole body and lower limbs uncomfortable feelings.

RESULTS: POMS scores did not show marked differences between with and without stockings. A 3 h sitting significantly decreased saliva cortisol in both conditions ($P < 0.05$) with no differences between conditions (0.263 ± 0.108 mg dl⁻¹ vs. 0.189 ± 0.075 mg dl⁻¹ without stockings at pre vs. post; 0.267 ± 0.100 mg dl⁻¹ vs. 0.186 ± 0.081 mg dl⁻¹ with stockings at pre vs. post). Wearing stockings suppressed a subjective uncomfortable sensation (e.g., pain; swelling) in the lower limbs assessed by VAS (58.2 ± 23.3 mm without vs. 39.3 ± 24.4 mm with stockings, $P < 0.001$). HR at 1 h and 3 h was significantly greater without than with stockings (77 ± 8 bpm without vs. 74 ± 6 bpm with stockings at 1h, and 80 ± 9 bpm without vs. 75 ± 6 bpm with stockings at 3h, $P < 0.05$, respectively). High-frequency oscillations (0.15-0.4 Hz) showed higher values with than without stockings throughout the 3 h sitting period, and it was significantly higher at 1 h (229 ± 169 m sec without vs. 324 ± 251 m sec with stockings, $P < 0.05$). When data for both conditions were pooled, pre-to-post changes in saliva cortisol were positively associated with higher VAS in the lower limbs and negatively associated with changes in the Vigor subscale of POMS ($P < 0.05$, respectively).

CONCLUSIONS: These findings suggest that wearing graduated compression stockings may benefit from subjective comfort and increased parasympathetic nerve activity.

420 Board #258 May 29 11:00 AM - 12:30 PM
Psychosocial Mechanism of Adolescents' Physical and Mental Health: A Self-Determination Health Behavior Perspective

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PURPOSE: Research indicates that adolescents' health can be promoted by satisfying their basic psychological needs through a supportive social environment in school physical education (PE; Ryan & Deci, 2017). Guided by the Self-Determination Health Behavior Model (SDHBM; Ryan et al., 2008), this study aimed to examine the relations among perceived need support (i.e., autonomy support, competence support, and relatedness support), need satisfaction (i.e., autonomy, competence, and relatedness), physical health (i.e., physical fitness [PF]), and mental health (i.e., health-related quality of life [HRQOL]) among adolescents. The mediation models were conducted to specify relations among psychosocial processes toward PE, adolescents' PF and HRQOL, respectively. **METHODS:** A prospective correlational design was used across one academic school year. Participants were 198 adolescents (58.6% female; $M_{age} = 12.63$) recruited from three schools in the south region of the U.S. At the beginning of school year, participants completed previously validated questionnaires assessing their perceived need support and need satisfaction toward PE. At the end of school year, they self-reported their HRQOL using the PedsQLTM inventory, which included measures of physical, emotional, school, and social functioning. Finally, FitnessGram® test battery was used to measure their PF including body composition,

aerobic fitness, and muscular fitness. **RESULTS:** Correlation analysis revealed positive associations among the study variables (r s ranged from .19 to .83). Using structural equation modelling (AMOS 22.0), the hypothesized model resulted with a good fit to the data ($\chi^2/df = 130.46/61$; IFI = .93; CFI = .93; RMSEA = .076; 90% CI [.058, .094]). The need support had a direct influence on need satisfaction ($\beta = .79$, $p < .01$), and need satisfaction had a direct contribution on PF ($\beta = .23$, $p < .05$). The psychosocial process from need support to need satisfaction had no direct influence on HRQOL, but had an indirect influence through PF ($\beta = .34$, $p < .01$). **CONCLUSION:** The findings supported the theoretical tenets of SDHBM in adolescents, particular on their physical health. Creating a need-supportive environment in PE is critical in order to enhance adolescents' need satisfaction, which ultimately indirectly influence their HRQOL.

421 Board #259 May 29 11:00 AM - 12:30 PM
Differences in Depressive Symptoms across Physical Activity Levels Based on Comorbid Anxiety and Depression Status

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Research supports inverse associations between physical activity (PA) and depressive symptoms and status among adolescents. However, the degree to which comorbid anxiety and depression status may influence relations of PA with depressive symptoms is unknown. **PURPOSE:** This study investigated differences in depressive symptoms across low, moderate, and high PA frequencies among adolescents with no anxiety or depression, anxiety-only, depression-only, and comorbid anxiety and depression.

METHODS: Adolescents ($N=481$; 200 female) aged 15.1 ± 1.7 y self-reported PA frequency (modified PACE+); low, moderate, and high PA were classified as engaging in ≥ 60 mins of PA 0-2, 3-4, and ≥ 5 d/wk, respectively. Depressive symptoms were assessed with the Quick Inventory of Depressive Symptomatology (≥ 6 indicated depression status). The Trait subscale of the State-Trait Anxiety Inventory assessed trait anxiety (≥ 50 indicated high trait anxious status). Two-way ANCOVA examined variation in depressive symptoms according to the interaction of PA and comorbid anxiety and depression status. Covariates were age, sex, rural or urban residence, and school sex-type (i.e., female only, male only, or mixed sex). Bonferroni-adjusted simple effects analysis decomposed significant interaction. **RESULTS:** The two-way interaction between PA and comorbid status was statistically significant ($F_{(6,385)} = 4.69$, $p < 0.001$, $\eta_p^2 = 0.07$). Depressive symptoms were significantly lower among those with comorbid anxiety and depression with moderate PA compared to low PA (mean difference = -2.29, $p \leq 0.007$) and high PA (mean difference = -2.65, $p \leq 0.003$). Depressive symptoms were significantly higher for comorbid anxiety and depression compared to depression-only for those engaged in low PA (mean difference = 3.73, $p < 0.001$) and high PA (mean difference = 3.40, $p < 0.001$), and non-significantly higher among those engaged in moderate PA (mean difference = 1.26, $p > 0.30$). This finding may be due partly to the smaller number of comorbid anxiety and depression participants with moderate PA (22 vs. 48). **CONCLUSIONS:** Depressive symptoms differed across PA levels based on comorbid anxiety status. Though the exact role of comorbid anxiety is not clear, it may be important to consider relative to relations of PA with depressive symptoms among adolescents.

422 Board #260 May 29 11:00 AM - 12:30 PM
Improving Acute Exercise Prescription In Depression: Predictors Of Optimal Intensity For Improving Depressive Mood

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Overall mood improves following acute exercise for people with major depressive disorder (MDD), yet it is unclear how to maximize this effect. Determining factors that predict what the most beneficial intensity of exercise is for an individual could lead to prescriptions that maximize the positive effects of each session potentially leading to increased exercise participation. **PURPOSE:** To explore potential factors influencing the most effective exercise intensity for improving mood in individuals with MDD. **METHODS:** Women with MDD ($n=24$) were prescribed 20-minute sessions of light (L), moderate (M), and hard (H) intensity exercise (rating of perceived exertion: 11, 13, 15, respectively) in a counterbalanced, within-subject design. The most effective session was defined as the one resulting in the greatest reduction in depressive mood (measured via depression subscale of Profile of Mood States) from pre- to post-exercise for each participant [L ($n=10$), M ($n=9$), and H ($n=5$)]. Potential individual factors related to these effects were age, body mass index (BMI), objectively measured minutes of total daily moderate to vigorous physical activity as well as weekly physical activity in bouts ≥ 10 min, and total sedentary time and prolonged sedentary time

(PSED; time in bouts ≥ 30 min). Kruskal-Wallis tests compared all groups for each predictor, with the Dunn test and effect sizes (Cohen's d) comparing each group pair (L:M, M:H, L:H). **RESULTS:** Potential predictive factors did not differ significantly based on group (all $p > 0.05$). However, effect sizes showed large differences for L:H comparisons in: PSED (pairwise $p = 0.021$; $d = -1.23$), age ($d = 1.08$), and BMI ($d = 0.81$). While effect sizes comparing L or H to M were smaller, PSED, age and BMI generally followed a linear pattern L-M-H. **CONCLUSIONS:** While there were no overall differences across groups, effect sizes indicated that light intensity led to the greatest improvement for people who were younger, had lower BMI, or spent more hours in PSED, while hard exercise was most beneficial for the reverse (i.e. older, high BMI, low PSED). The large effect sizes in the present sample suffering from MDD suggest personal characteristics may influence the affective response to acute exercise, yet more research is required to determine the reliability and magnitude of these effects.

423 Board #261 May 29 11:00 AM - 12:30 PM
Impact of a Simulated Workday of Sit-stand Desk Use on Sleep Among Adults Screened as High Risk for Sleep Apnea

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Exercise improves sleep and reduces apnea severity in adults with obstructive sleep apnea (OSA). However, whether reducing sedentary behavior impacts sleep and apnea severity is unknown. **Purpose:** To examine whether reducing prolonged sitting during a simulated workday by use of a sit-stand desk leads to changes in sleep compared to a sedentary workday in a sample of adults at high risk for OSA. **Methods:** Eight inactive adults (5 males, 53.8 \pm 8.5 yr, body mass index: 29.8 \pm 5.5 kg/m²) who were classified as 'high risk' for OSA based upon the STOP-BANG screening algorithm participated in a randomized crossover trial consisting of two simulated 8-h workdays: (1) continuous sitting (SIT); and (2) alternating periods of sitting and standing every 30 min (SIT-STAND). Sleep and apnea were assessed on the night following each simulated workday by wrist-worn actigraphy and a portable OSA testing device, respectively. Actigraphic measures of total sleep time (TST) and wake after sleep onset (WASO) served as the primary sleep variables, while the apnea-hypopnea index (AHI) assessed OSA severity from the OSA testing device by a blinded assessor. Natural logarithm transformation of AHI was performed due to non-normality. Effect sizes (Hedges' g) and Pearson correlations evaluated differences in sleep following each condition and associations between changes in sleep measures, respectively. **Results:** In the full sample, trivial improvements in WASO ($g=0.16$) and TST ($g=0.03$) were observed following SIT-STAND compared to SIT. In contrast, a small increase in AHI (i.e., worsening of OSA) was observed following SIT-STAND compared to SIT ($g=0.31$). The change in AHI was associated with the change in actigraphic WASO ($r=.63$, $P=.09$). Four of the 8 adults had clinically significant OSA (i.e., mean AHI ≥ 10 across conditions). Among those with clinically significant OSA, large increases in WASO and AHI were seen following SIT-STAND relative to SIT ($g=1.16$ and 0.89, respectively). In those without significant OSA, small- to moderate-sized reductions in WASO and AHI were observed following SIT-STAND compared to SIT ($g=0.68$ and 0.30, respectively). **Conclusion:** Following sedentary behavior reduction during a simulated workday, changes in sleep and apnea seemed to differ based upon the presence of clinically significant OSA.

424 Board #262 May 29 11:00 AM - 12:30 PM
Effectiveness Of Short-term Yoga Interventions For Stress Of College Students: A Meta-analysis

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Effectiveness of Short-Term Yoga Interventions for Stress of College Students: A Meta-analysis

Liwen Ju, Weimo Zhu (FACSM), Hai Yan, Zhenglun Wang

Purpose:

To determine the effectiveness of yoga interventions for the stress management of college students using a meta-analysis.

Methods:

Key words, such as "yoga," "stress," "college students", etc. were searched in a number of databases such as PubMed/Medline, Scopus, Cochrane Library, PsycINFO, WebScience and Google through Dec., 2018. Only randomized controlled trials of yoga

based stress interventions for college student were included for the meta-analysis. Risk of bias the studies were independently assessed by two of the authors using the Risk of Bias Tool by the Cochrane Back Review Group. Effectiveness of Yoga intervention was determined by computing standardized mean differences (SMD), in which the difference in the means of pre- and post-test difference between groups was divided by the pooled standard deviations.

Results:

12 studies (Total college students = 763, Male% = 16.64, Intervention length = 8.79 \pm 3.96 wk.) were included in the final analysis. Main outcomes included self-reported anxiety, depression, stress, as well as objective measures of heart rate and blood pressure. The yoga interventions were found effective in reducing anxiety, depression, stress and heart rate:

	Anxiety	Depression	Stress	Heart Rate
SMD	-0.995,	-1.708	-0.953	-1.623
95% CI	[-1.762 -0.227]	[-2.005 -1.412]	[-1.707 -0.199]	[-2.911 -0.334]
P	0.011	0	0.013	0.01

Due to the paucity and heterogeneity of the researches, the long-term effects could not be examined.

Conclusion:

Short-term yoga intervention has been found effective in helping the stress management of college students. Studies with longer intervention, with a comparison with other exercise mode, are needed

Key Words: stress, yoga, college students, meta-analysis, review

425 Board #263 May 29 11:00 AM - 12:30 PM
Potential Effects of Mediators on Health Perception in Older Adults

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Several aspects could influence mental and physical components of subjective quality of life perceptions. In particular, healthy diet and physically active lifestyles could play a crucial role for successful aging and sustainable quality of life in advancing years.

PURPOSE: To determine the mediating effects of energy expenditure (EE) and intake (EI), body composition (BC) and dissatisfaction (BD) on the relation between age and health and quality of life perception. **METHODS:** 42 senior athletes, 55 physically active, and 61 sedentary adults (aged 55-85 years) were submitted to anthropometric (body mass, height - Body Mass Index [BMI]), weekly energy expenditure (EE), and dietary intake (EI) evaluations, and administered Body Image Dimensional Assessment (BDI), Short Form Health Survey - Physical (PCS) and Mental Component Summary (MCS) questionnaires. Two serial multiple model mediation analyses were applied to assess whether mechanisms involving diet-related and physical activity-related personal characteristics and behaviors (4 mediators: EE, EI, BMI, BDI) mediated the relation between age and PCS or MCS health-related quality of life perception.

RESULTS: Only for MCS the mediation analysis showed: a) a direct effect of age on MSC ($c'=0.31$, $p=0.002$; CI(95%)=0.12; 0.50); b) a mediation path by EE, EI, BMI, and BDI (-0.0027, Bootstrap CI(95%)=-0.0105; -0.0002); and c) a positive total effect ($c=0.22$, $p=0.02$; CI(95%)=0.04; 0.39). **CONCLUSIONS:** The combination of positive and negative effects throughout the mediation path of mental health perception of older individuals underlined that the maintenance of adequate level of physical activity could influence the body image and, in turn, positively impact mental health with advancing age. Supported by MIUR Grant 2010KL2Y73

426 Board #264 May 29 11:00 AM - 12:30 PM
Cardiorespiratory Fitness Moderates the Relation Between Years of Drug Use and Stress in Drug Abusers

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Substance use disorders (SUD) have increased worldwide and is currently a major global issue. In SUD, stress is linked to drug-seeking behaviors and greater rates of relapse. Physical activity has been related with increased self-esteem, mood and reduced stress levels in SUD. However, it remains unclear whether the relation between the time of drug use over the years and stress might be under influence

of cardiorespiratory capacity. **PURPOSE:** This study investigated whether cardiorespiratory fitness has a moderate function over the relation between years of drug use and stress levels. **METHODS:** Sixth-two male SUD individuals (34.17 ± 8.82 years; 24.62 ± 2.91 m/kg²) have participated in the study. We took a collection of measures in one visit including: (1) anthropometric measures of height and weight to compute BMI; (2) self-reported demographics and drug use history, including years of drug use, days of abstinence, and number of hospitalizations; (3) a questionnaire to measure negative emotional states; and (4) a shuttle run test to estimate the maximum consumption of oxygen ($\text{VO}_{2\text{max}}$). For this study, we tested a moderation analysis using the Macro PROCESS plugin for SPSS (Model 1), in which the independent variable was the years of drug use, the dependent variable was stress levels and the moderator was $\text{VO}_{2\text{max}}$. The moderation analysis was adjusted for age, days in abstinence, BMI and number of hospitalizations. **RESULTS:** It was found that $\text{VO}_{2\text{max}}$ moderates the relation between years of drug use and stress levels ($\beta = -0.82$, $p = 0.03$, 95% confidence interval $(-0.15$ to $-0.007)$). The conditional effect at each level of the moderator (one SD below the mean, at the mean and one SD above the mean) showed that for those individuals with lower $\text{VO}_{2\text{max}}$ the negative relation between years of drug use and stress was not significant ($\beta = -0.23$, $p > 0.05$), for those with an average $\text{VO}_{2\text{max}}$ it was significant ($\beta = -0.81$, $p = 0.04$) and for those with higher $\text{VO}_{2\text{max}}$ the relation was even more significant ($\beta = -2.03$, $p < 0.01$). **CONCLUSION:** For those SUD individuals with an average and higher $\text{VO}_{2\text{max}}$, the negative relation between years of drug use and stress is more pronounced. Therefore, fitness level seems to have a protective effect over stress in SUD individuals, which may minimize the chances of relapse and enhance the rehabilitation process.

427 Board #265 May 29 11:00 AM - 12:30 PM
Identifying Mental Health Risks through Screening among Collegiate Ethnic-Minority Athletes

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Ethnic minority student-athletes are under immense amounts of pressure to perform, meet academic requirements for scholarships, and maintain relationships with peers, coaches, and parents. A change in stressors can cause physiological disturbances and mental health disorders such as depression (DEP), eating disorders (ED), low self-esteem (LSE) and body image dissatisfaction (BID). **PURPOSE:** To examine the prevalence of DEP, ED, LSE, and BID in ethnic minority student-athletes. A secondary purpose examined mental health risks across sex, academic status, and sport type. **METHODS:** Student-athletes ($n = 274$) were recruited from multiple Ethnic Minority Universities to participate in an online study. Demographic information, Center for Epidemiologic Studies Depression Scale. Eating Attitudes Test. Rosenberg Self-Esteem Scale, and Standard Figural Stimuli were completed. **RESULTS:** Overall prevalence was 31.8% for DEP, 18.1% for ED, and 8.4% for LSE. Chi-square analysis revealed no significant differences between mental health risks and sex, academic status and sport type. A 2 sex (female, male) x 2 clothing type (daily clothing, competitive uniform) x 2 perceptions (perceived, desired) repeated measures ANOVA indicated a main effect ($P \leq 0.01$) with significant interactions for perceptions ($F_{1,208} = 4.586$, $P < .033$, $n_2 = .022$) and perceptions by gender interactions ($F_{1,208} = 7.384$, $P < .007$, $n_2 = .034$). Body image results revealed female athletes desired to be smaller than their perceived image in both daily clothing and uniforms, whereas males desired to be larger. A 2-sex x 3 meta-perceptions (peers, parents, coaches) x 2-perceptions repeated measures ANOVA indicated a main effect ($P \leq 0.01$) with significant interactions between perceptions by gender ($F_{1,208} = 5.896$, $P < .016$, $n_2 = .028$), meta-perceptions by perceptions ($F_{1,208} = 2.382$, $P < .001$, $n_2 = .037$), and perceptions by meta-perceptions and gender ($F_{1,416} = 4.923$, $P < .009$, $n_2 = .023$). **CONCLUSIONS:** Although no significant associations were found for gender, academic status or sport type, both male and female athletes demonstrated a high risk of DEP, ED, BID, and a lower risk for LSE. Future research is necessary to further examine mental health risks, screening, prevention strategies, and intervention in ethnic minority student-athletes.

428 Board #266 May 29 11:00 AM - 12:30 PM
Prevalence of Low Self-esteem and Weight Pressures among Collegiate Male Athletes

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(No relevant relationships reported)

Previous studies have examined mental health disorders in female athletes, but very few have examined the prevalence of signs and symptoms of sub-clinical mental health conditions (i.e., low self-esteem [LSE], and weight pressures [WP]) in male athletes. Understanding these sub-clinical mental health conditions may aid in preventing mental health disorders.

Purpose: Examine the prevalence of low self-esteem (LSE) across academic status and the effects LSE on weight pressures (WP) in sport among male collegiate athletes.

Methods: As part of a larger study, collegiate male athletes ($n = 238$; age: 19.7 ± 1.3 years; males: $n = 234$, height: 184.3 ± 7.5 cm, weight: 91.5 ± 19.4 kg) were recruited over a 3-year period from a NCAA Division I Institution. Demographic information (e.g., age, self-reported height, self-reported weight, ideal weight, mental weight, sex, academic status, and sport type), the Rosenberg's Self-Esteem scale, and the Weight Pressures in Sports-Males surveys were collected via SurveyMonkey. Cross tabulations and chi square analyses examined the relationship and distribution of general weight pressures, LSE and WP risk and academic status. One way ANOVA examined LSE risk and WP Total score and subscales.

Results: A total of 95 athletes (39.9%) reported feeling pressure to change their weight and/or eating habits for their sport and 18.5% ($n = 44$) revealed they felt pressured to meet a target weight with routine weigh ins. More specifically, athletes wanted to weigh 2.4 ± 4.1 kg more than their current weight. Overall, Prevalence of LSE for all male athletes was 9.4% ($n = 22$). No differences were found between academic status and prevalence of LSE, WP total score, Coach/Teammate Pressure subscale and Appearance Pressure subscale. Significant differences were found between Coach/Teammate Pressure subscale and LSE prevalence (LSE risk: 2.4 ± 1.1 vs. Not at Risk: 2.6 ± 0.86 ; $P = 0.019$).

Conclusion: Although there was a relatively low number of male athletes at risk for LSE, male athletes still displayed weight pressures for their sport. Healthcare professionals working with male athletes need to be aware of these sub-clinical mental health concerns to ensure that prevention and treatment can occur before the onset of issues such as eating disorders and depression.
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429 Board #267 May 29 11:00 AM - 12:30 PM
Characterization of Potential for Relationship between Anxiety and Cardiovascular Health in Different Racial Groups

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 (Sponsor: Micheal Brown, FACS⁶)
(No relevant relationships reported)

There are a multitude of factors that contribute to cardiovascular (CV) health. Psychosocial factors contribute to CV risk, and anxiety is one of the psychological disorders diagnosed in CV patients. It is unclear whether there is a potential relationship between inflammation and anxiety.

PURPOSE: 1) To compare CV health between Caucasian (C) and Mixed-Race (MR) adults, and 2) to explore the relationship between anxiety levels and CV health measures across these populations. This pilot study is the first step in our clinical trial to investigate the relationship between anxiety measures and CV risk factors across racial differences. **METHODS:** Thirty-two young adults (C: $N = 16$, 22.94 ± 7.4 yrs; $N = 16$, 22.813 ± 7.51 yrs) underwent 2 test visits. First, CV health was assessed by fasting glucose, lipids, blood pressure (BP), carotid artery intima media thickness (IMT), body fat (BF) measured by bioelectrical impedance, and flow-mediated dilation (FMD). At the second visit, ECG, clinic BP and $\text{VO}_{2\text{max}}$ were measured. Anxiety measurements using the DASS-21 scale are ongoing. **RESULTS:** Pilot data on physiological outcomes show no differences between groups. Compared to C adults, the adults in MR group show a small trend towards having worse CV profiles. In the MR group, we found higher levels of cholesterol (156.4 ± 27.2 vs. 144.2 ± 36.6 mg/dL), BF (31.1 ± 9.7 vs. 28 ± 9.2 %), and lower levels of FMD (7.1 ± 4.3 vs. 8.7 ± 4 %) and $\text{VO}_{2\text{max}}$ (42.95 ± 8.8 vs. 38.65 ± 10.6 ml/kg-min). Within groups, we found significant ($p < 0.05$) race-related relationships between several variables. In C, we found an inverse relationship between IMT and HDL ($R = -0.654$). In MR, we found an inverse relationship between BF and FMD ($R = -0.832$), BF and HDL ($R = -0.836$), and BF and $\text{VO}_{2\text{max}}$ ($R = -0.741$). Also, we found direct relationships between BF and glucose ($R = 0.834$) and BF and DBP ($R = 0.751$). Data from DASS-21 is being analyzed between groups. **CONCLUSION:** We found relationships with BF in the MR group that did not exist in the C group. Considering that literature suggests that young adults of color tend to have higher levels of anxiety, we hypothesize that we will find relationships between anxiety and CV measures in the MR group that are different than that in the C group.

430 Board #268 May 29 11:00 AM - 12:30 PM
Effect Of Aerobic Exercise On Depression In Rats: Role Of Mitophagy

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(No relevant relationships reported)

Abstract:

Depression is a common health problem and a major cause of agrypnia and disability. Recent evidence supports an anti-depressive effect of aerobic exercise on unpredictable chronic mild stress (UCMS)-induced depression in rats; however, the biological mechanism remains to be investigated.

Purpose: To investigate whether aerobic exercise could improve UCMS-induced depression and alter mitophagy in depressive rats.

Method: Thirty-six male Sprague-Dawley rats were randomly divided into three groups: a control group (Con, n=12), a UCMS-induced depression group (UCMS, n=12), and a UCMS-induced depression plus aerobic exercise group (UCMS+E, n=12). After 4 weeks of UCMS stimulation, rats in the UCMS+E group carried out 3 weeks (60 min/day) of swimming exercise. A sucrose preference test (SPT) was performed, and the content of 5-hydroxytryptamine (5-HT) was measured to verify whether the depression model was successful. A Morris water maze (MWM) test was used to evaluate spatial learning and memory ability. The expression levels of mitophagy-related proteins (Beclin1, LC3-I, LC3-II and P62) were determined by Western blot. Statistically significant group differences were assessed by using one-way ANOVAs and post-hoc tests.

Results: Based on the change of sucrose consumption and the expression level of 5-HT following UCMS treatment, the depression model was successfully established in the rats. Spatial learning and memory ability were lower in the UCMS group than the Con group (both $p < 0.05$), but improved in the UCMS+E group (both $p < 0.05$). According to the Western blot results, the expression levels of Beclin1 (Con: 0.37 ± 0.02 , UCMS: 0.26 ± 0.04 , UCMS+E: 0.43 ± 0.07) and P62 (Con: 0.34 ± 0.03 , UCMS: 0.20 ± 0.02 , UCMS+E: 0.31 ± 0.05), as well as the LC3-II/LC3-I ratio (Con: 0.36 ± 0.05 , UCMS: 0.19 ± 0.04 , UCMS+E: 0.33 ± 0.04) were significantly lower in the UCMS group than the Con group (all $p < 0.05$), but were significantly higher in the UCMS+E group than the UCMS group (all $p < 0.05$).

Conclusion: This study suggests that rats with UCMS-induced depression presented alterations in mitophagy. Three weeks of aerobic exercise significantly up-regulated mitophagy in depressive rats. Therefore, mitophagy may play an important role in the biological mechanism underlying the anti-depressive effect of aerobic exercise.

A-55 Exercise is Medicine®/Poster - EIM - Mental Health

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

431 Board #269 May 29 11:00 AM - 12:30 PM
Exercise And Physical Activity Promotion Improves Cardiorespiratory Fitness, Symptoms Of Disease And Well-being In Patients With Schizophrenia

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(No relevant relationships reported)

Patients suffering from Schizophrenia (SZ) show low fitness, a sedentary lifestyle and comorbidities like diabetes and cardiovascular diseases, resulting in 20 years less of life expectancy.

Purpose: To evaluate the impact of an intervention combining exercise and physical activity promotion (PAP) on cardiorespiratory fitness (CRF), severity of SZ, symptoms of disease and well-being.

Methods: 35 patients were randomized into an intervention (n=19, aged 39.0 ± 13.6 years, BMI 28.3 ± 7.3) or control group (n=16, aged 36.0 ± 9.3 years, BMI 25.7 ± 5.2), directly after inpatient treatment for SZ. Intervention included two sessions of high intensity indoor cycling (IC; each 45min), and one session of PAP (60min) per week for three months. In months 4-6, the intervention was reduced to one session IC and one session PAP per week. The control group received a physiologically ineffective control intervention. Measurements were conducted at baseline (t0), after three (t1)

and 6 months (t2) of intervention, and after 12 months (six-month follow up, t3). Measurements included CRF (bicycle ergometry), severity of SZ (PANSS-Score), well-being (SF-36), and psychological distress (SCL-90).

Results: The intervention improved significantly severity of SZ (t0: 55.4 ± 16.3 , t2: 34.8 ± 3.3 , $p < .05$), well-being (t0: 50.4 ± 10.1 , t2: 60.5 ± 7.1 , $p < .05$) and psychological distress (t0: 159 ± 47.4 , t2: 119.8 ± 34.3 , $p < .05$). For CRF, patients were able to improve their physical capacity, expressed as W/kg (t0: 1.85 ± 0.6 , t2: 2.13 ± 0.6 , $p < .05$), but did not significantly improve their peak oxygen uptake, expressed as ml/min/kg (29.0 ± 7.0 , t2: 30.5 ± 8.7 , n.s.). Six month after the intervention, only improvements in severity of SZ, well-being and psychological distress remained statistically significant (PANSS: 38.0 ± 9.0 , SF-36: 59.2 ± 8.0 , SCL-90: 119.2 ± 36.6 , all $p < .05$).

Conclusion: Exercise and PAP significantly improves CRF, severity of SZ, well-being and psychological distress in SZ patients. Effects on CRF are declining shortly after the end of the intervention. We recommend the implementation of exercise and PAP into the post-acute care of SZ patients. Moreover, it is necessary to further strengthen the sustainability of effects with respect to CRF, in order to prevent fall-backs and health detriments caused by low physical fitness.

432 Board #270 May 29 11:00 AM - 12:30 PM
Fitness, Fatness And Survival In Older Adults With Intellectual Disabilities. Which One Is Key?

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(No relevant relationships reported)

Older adults with intellectual disabilities have very poor physical fitness levels. Additionally, overweight and obesity are highly prevalent in this population, even more prevalent than in the general population. Both fitness and fatness have been found to be related to survival in the general population. To improve healthy ageing and survival of older adults with intellectual disabilities we need to know which problem requires our main focus. **PURPOSE:** To determine whether fitness or fatness is more important for survival in older adults with intellectual disabilities. **METHODS:** As part of the Healthy Ageing and Intellectual Disabilities (HA-ID) study, fitness (comfortable gait speed) and fatness (Body Mass Index) of 874 older adults with intellectual disabilities (≥ 50 years; 61.4 ± 7.8 years) was measured at baseline. All-cause mortality was collected over a 5-year follow-up period. The relationship between fitness, fatness, and survival was analysed with Kaplan-Meier curves and Cox proportional hazard models. **RESULTS:** Fitness was significantly related to survival (HR = 0.21, 95% CI = 0.09 - 0.48, $p < 0.001$), while fatness was not related to survival. People who were unfit and fat were 4.6 (95% CI = 2.0 - 10.7) times more likely to die, and people who were unfit and not fat were 3.6 (95% CI = 1.7 - 7.5) times more likely to die within the follow-up period, than people who were fit, regardless of their fatness. **CONCLUSIONS:** Being fit is key for survival in older adults with intellectual disabilities. Our results therefore do not support the emphasis seen in research and practice on reducing weight. The focus should primarily be on improving the fitness of older adults with intellectual disabilities to improve healthy ageing and survival.

433 Board #271 May 29 11:00 AM - 12:30 PM
The Effect Of Moderate-intensity Physical Activity On Biopsychosocial Factors Among Veterans With Symptoms Of Ptsd

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(No relevant relationships reported)

Physical activity has been shown to have a positive impact on biopsychosocial variables among individuals who may be experiencing symptoms related to PTSD.

PURPOSE: The purpose of this study was to evaluate the impact of a moderate-intensity physical activity regimen on aerobic endurance, barriers to accessing health care, and symptom severity of PTSD among military veterans. **METHODS:** Participants of this study (n=4) engaged in a 4-week physical activity regimen that met two times per week. The dependent variables were aerobic endurance, measured with the Cooper 12 Minute Walk test, barriers to accessing health care, measured with the BACE, and symptoms of PTSD, measured with the PCL-5. **RESULTS:** Descriptive statistics and a paired samples *t*-test were utilized to analyze data. There were statistically significant differences for all dependent variables at the post-assessment level, indicating statistically significant improvements in the PCL-total score ($p = .032$), BACE-total score ($p = .043$), BACE-stigma score ($p = .032$), VO_{2max} ($p = .014$), and METS ($p = .014$). **CONCLUSION:** Researchers concluded that a moderate-intensity physical activity regimen may be effective at improving aerobic endurance, perceived barriers to accessing health care, and symptom severity of PTSD among military veterans. Future studies should aim to increase sample size and utilize a laboratory grade assessment for capturing changes in VO_{2max} and METS. Additionally, future

research should aim to investigate the dose-response effect on dependent variables based on varying physical activity intensity levels, duration of intervention, and the duration of acute bouts of physical activity.

434 Board #272 May 29 11:00 AM - 12:30 PM

Exercise Is Medicine And Could Improve Your Gpa

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(No relevant relationships reported)

Purpose: The aim of this study is to evaluate the impact of physical activity (PA) on academic performance. Several studies have already confirmed the importance of physical activity for the life quality and health. Several health problems can be avoided with the regular practice of PA, which is why it can be said that "exercise is medicine". The question in this work is to seek key points in order to evaluate whether PA positively impacts academic activity. Will the practice of PA bring a positive impact on academic performance, will it entail a higher grade point average (GPA)? The final objective will be to present a framework with potentially impacting variables, within an physiological elements.

Methods: An initial research was done on academic bases to raise academic articles on the subject. The base consulted was PubMed. Keywords used were physical activity and academic performance. There was no concern in evaluating studies relating PA and health, because we assumed such a relationship as true in this review.

Summary of Results: From a physiological standpoint there are some important studies showing the impacts on cognitive and motor functions coming from the practice of PA. Through a dynamic interaction, regular PA can lead to a cerebral capillary growth, with the increase in blood flow and oxygenation. The growth of nerve cells in the hippocampus, that have a great function as a center of memory and learning, is another important effect of PA. The production of neurotrophins and the development of new connections, with the increase of density of neural network could have a positive impact in attention, cognition and academic performance.

Conclusion: There are good reasons to be physically active. Including reducing developing heart disease and diabetes, for example. So, it's possible to say: Exercise is medicine. It's a good point you can be healthy, lose weight, lower your blood pressure. But, maybe we have another one great reason to be physical active. Some studies show us that physical activity can improve academic performance and it's great. You can be healthy, feel better and improve your GPA.

435 Board #273 May 29 11:00 AM - 12:30 PM

Effects of Alternative Treatments on Behavioral Outcomes In Patients with Mild Cognitive Impairment, Alzheimer's Disease and Dementia: A Comprehensive Summary of Evidence and Meta-analysis

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(No relevant relationships reported)

Purpose: Mild cognitive impairment, Alzheimer's disease (AD) and dementia are associated with onset behavioral disturbances such as depression, psychosis, and anxiety. These ailments affect overall outcomes, decrease quality of life, and are primarily treated with antidepressants. However, there are additional therapies available to alleviate and mitigate these onset disturbances. Based on published clinical data, this comprehensive review and meta-analysis evaluates the effects of alternative therapies and treatments on behavioral outcomes in patients with mild cognitive impairment (MCI), mild or moderate AD, and dementia. **Methods:** We applied novel clinical data extraction and aggregation technologies developed by MedAware Systems, Inc. It is a patent-pending process where two scientists, blinded to each other, extract data from the same study. Intelligent software compares each data field for matches (or mismatches). A senior scientist reconciles data mismatches. Where pre- and post-treatment outcomes are available, a standardized mean difference is calculated as the MedAware Standardized Index of treatment effect (MSI-E). This methodology was used to examine differences in efficacy and behavioral outcomes among the alternative treatments (supplements, therapy and counseling, exercise, education and training, and rehabilitation) to identify efficacious treatments for behavioral outcomes.

Results: A total of 89 studies reporting anxiety and depression outcomes in patients with MCI, AD or dementia were located. There were no significant differences in MSI-E among treatments. Cognitive and behavioral showed the most efficacy (MSI-E = 0.023 ± 0.002). Among alternative treatment categories, there were no significant differences, with rehabilitation showing the most efficacy (MSI-E = +0.254 ± 0.063), and exercise showing the least (MSI-E = -0.105 ± 0.013). **Conclusions:** Using the MedAware Systems, Inc. literature database and meta-analytic methodology, we found that rehabilitation therapy may decrease anxiety and depression, while exercise has almost no effect. Overall results for alternative therapies were not significant. Because the number of studies within each therapy is small, additional research on alternative therapies is warranted.

Supported by MedAware Systems, Inc.

436 Board #274 May 29 11:00 AM - 12:30 PM

Mental Health in First Responders and Military Personnel: Is Physical Activity A Viable Option?

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(No relevant relationships reported)

Mental Health (MH) is a growing concern among first responders and military personnel, with a relatively large percentage presenting with disorders. However, many avoid or remove themselves from treatment, which may be related, in part, to treatment stigmas. **PURPOSE:** Compare physical health (PH) and MH stigmas, and explore whether physical activity is a viable option for treatment. **METHODS:** The Perceived Stigma and Barriers to Care for Psychological Problems and Self Stigma of Seeking Help questionnaires were provided through an online survey, along with researcher developed questions regarding physical activity behavior. Separate paired-samples *t*-tests were used to compare PH versus MH treatment stigmas, and descriptive statistics were used to denote interest in physical activity for mental health treatment. **RESULTS:** First responders and/or military personnel (*N* = 35; 36.2 ± 11.6 yrs; 80% male) currently residing in the United States completed the survey. When comparing PH and MH, differences (*P* < 0.001) were observed between perceived (PH = 1.99; MH = 2.56) and self-stigmas (PH = 2.17; MH = 2.52). The majority (91.4%) of participants indicated interest in using physical activity for MH improvement. Additionally, 29 participants (82.9%) indicated they would be more willing to undergo physical activity as a treatment mechanism for MH than traditional methods (e.g., medication, psychotherapy). **CONCLUSIONS:** This study expands upon previous stigma literature by emphasizing the discrepancies between physical and mental health stigmas. Additionally, these findings suggest physical activity as a viable option to circumnavigate MH stigmas in first responders and military personnel.

437 Board #275 May 29 11:00 AM - 12:30 PM

Effects Of Physical Activity On Cognitive Function In Alzheimer's Disease: A Comprehensive Meta-analysis

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Purpose: Global cognitive function is associated with increased physical activity, physical frailty is associated with increased risk of Alzheimer's disease (AD), and can predict future cognitive decline in adults. We performed an exhaustive literature review and meta-analysis of the effects of physical activity on cognitive functions in adults with AD and dementia, based on the published clinical data. **Methods:** We applied novel clinical data extraction and aggregation technologies developed by MedAware Systems, Inc. It is a patent-pending process where two scientists, blinded to each other, extract data from the same study. Intelligent software compares each data field for matches (or mismatches). A senior scientist reconciles data mismatches. Where pre- and post-treatment outcome data are available, standardized mean differences are calculated as the MedAware Standardized Index of treatment effect (MSI-E). This methodology is used to capture the published literature, with physical activity as the intervention, reporting cognitive functions as outcomes, in AD patients. **Results:** A total of 2,201 studies were screened for possible inclusion. 34 studies reported the use of some form of physical activity interventions, such as aerobic exercise (9 studies), other types of physical activity (23 studies), and strength training (5 studies) in AD and dementia patients, and were included in the meta-analysis. Instruments such as the ADAS-cog and the MoCA measured cognitive outcomes. Overall, there appears to be little to no cognitive decline over time (MSI-E = 0 indicates no change) in the aerobic exercise group (MSI-E = -0.08 ± 0.003), other physical activity group (MSI-E = -0.015 ± 0.001), and a slight improvement in the strength training group (MSI-E = +0.016 ± 0.005). **Conclusions:** Using the MedAware Systems, Inc. literature database and meta-analytic methodology, we found that physical activity appears to mitigate cognitive declines in AD and dementia patients, with strength training having a small beneficial effect. Although these findings are based on a small number of studies in each physical activity category, results of this meta-analysis should provide investigators with evidence to further explore the use of physical training in AD and dementia patients.

Supported by MedAware Systems, Inc.

- 438** Board #276 May 29 11:00 AM - 12:30 PM
Depression and Fitness Level in College Students Attending a Diverse University
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 (No relevant relationships reported)

PURPOSE: The purpose of the study was to determine the association between estimated cardiorespiratory fitness (eCRF) and moderate to severe depression (MS_DEP) in college students. The relationships between MS_DEP and age, sex, race, sexual/gender orientation, and grade point average (GPA) were examined.

METHODS: This cross-sectional study occurred at a public university via electronic survey. Participants ($n=438$) reported their age, height, weight, race, sex, sexual orientation, GPA, resting heart rate, exercise habits (frequency, intensity, and duration), and completed the Patient Health Questionnaire (PHQ-9), a standard depression survey. A validated regression model (Nes et al., 2011) was used to calculate eCRF (ml/min/kg). The difference between eCRF and age-predicted CRF was used for analyses. Chi square and independent t-tests determined differences in demographic characteristics between students who reported MS_DEP and students who reported no depression. For odds ratio analyses, MS_DEP was dichotomized (yes/no) and fitness was categorized as FIT (reference), LOW-FIT, and HIGH-FIT. The reference (FIT) represented those with eCRF within ± 1 , LOW-FIT was <1 , and HIGH-FIT >1 of their age-estimated CRF.

RESULTS: Chi square analyses indicated fit individuals (\Rightarrow age-predicted CRF) were less likely than unfit ($<$ age-predicted CRF) to have MS_DEP (36.4% vs. 63.6% respectively) ($P = 0.02$). Belonging to a sexual gender minority (SGM) ($P < 0.01$) or to the Hispanic race ($P = 0.04$) were also significant for MS_DEP. T-tests revealed that individuals who reported depression were more likely to be younger ($P = 0.04$) or have a lower GPA ($P < 0.01$) than those who reported no depression. Odds ratio analyses found that those with LOW-FIT were 2.39 times more likely to report MS_DEP when compared with the reference (95% CI=1.17-4.87). HIGH-FIT compared with FIT was not significant.

CONCLUSION: Students with low fitness are at a higher risk for depression. However, fitness above age-predicted CRF did not decrease susceptibility indicating that an age-appropriate level of fitness is sufficient to reduce depression risk. Also, Hispanic, SGM, and younger students may be more vulnerable. Those with depression have a lower GPA. Estimated CRF could provide a simple method to identify students at-risk for depression.

- 439** Board #277 May 29 11:00 AM - 12:30 PM
Comparison Between Pilates And Home-exercises On Health-related Outcomes In Individuals With Chronic Low Back Pain
 Caroline Ribeiro Tottoli, Yara Marques, Katharina Mascarenhas, Laís Medeiros, Isabela Costa, Elaine Oliveira, Everton Nunes, Wagner Martins, Rodrigo Luiz Carregaro. *Universidade de Brasília (UnB), Brasília, Brazil.*
 (No relevant relationships reported)

Chronic non-specific low back pain (CNLBP) is a major cause of disability and absenteeism. Pilates is commonly adopted in the treatment of CNLBP, though the evidence is controversial. Low-cost interventions such as home-exercises are prominent and considered effective to improve disability. **Purpose:** To compare the efficacy of Pilates and home-exercises on disability and utility (health states). **Method:** Randomized controlled trial with blind assessor. Thirty-one participants with CNLBP for at least 12 weeks were randomly assigned to the Pilates (PT; $n=16$) or Home-Exercise (HE; $n=15$) groups. Allocation was concealed. The intervention lasted 6 weeks (two times/week), and 4-months follow-up. The PT was composed by fifty-minutes sessions (seven to ten exercises; two sets of 8 to 12 repetitions). The HE was composed by prescribed postural, muscle stretching and strengthening exercises (booklet, instructions to perform 2 times/week, weekly monitored by text message). Disability was measured by the Quebec Back Pain Questionnaire. The score ranges from no disability (0) to worst disability (100). Health states were measured by the EQ-5D-3L (mobility, self-care, usual activities, pain/discomfort, anxiety/depression; final utility score ranging from 0 to 1). A linear mixed-model was used to analyze the global effect over time and separate effects at baseline, post-intervention and follow-up. Significance was set at 5%. **Results:** No significant differences were found between PT vs HE (global effects). Both groups showed a significant improvement only for disability (post-intervention and follow-up, compared to baseline). **Conclusion:** Both PT and HE were effective and improved the disability of individuals with CNLBP. However, the utility was not influenced by the interventions.

Table. Effects of PT (Pilates) and HE (Home Exercises)

Disability	PT	HE	Effects	
	Mean (ste)	Mean (ste)	B (CI95%)	P-value
Baseline	26.6 (2.9)	28.0 (2.9)	-	-
Post-intervention	11.9 (3.2)	13.3 (3.0)	-14.7 (-20.8; -2.0)	<0.02
Follow-up	15.2 (4.3)	16.6 (4.6)	-11.4 (-21.4; -7.9)	<0.01
Global Effect	n.a	n.a	-3.3 (-10.0; 3.2)	0.3
Utility				
Baseline	0.60 (0.04)	0.61 (0.04)	-	-
Post-intervention	0.67 (0.05)	0.68 (0.04)	0.06 (-0.003; 0.13)	0.06
Follow-up	0.62 (0.05)	0.63 (0.06)	0.02 (-0.08; 0.13)	0.6
Global Effect	n.a	n.a	-0.01 (-0.13; 0.11)	0.8
Ste: standard error				

- 440** Board #278 May 29 11:00 AM - 12:30 PM
Do Pilates And Home-exercises Improve Balance And Kinesiophobia Of Individuals With Low Back Pain?
 Rodrigo Luiz Carregaro, Caroline Tottoli, Yara Marques, Katharina Mascarenhas, Laís Medeiros, Isabela Costa, Elaine Oliveira, Wagner R. Martins, Everton Nunes. *Universidade de Brasília (UnB), Brasília, Brazil.*
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Chronic non-specific low back pain (CNLBP) is the main cause of years lived with disability, and can be associated with strength deficits and postural instability. Pilates exercises are deemed to be useful in the management of CNLBP and improvement of outcomes such as flexibility and postural control, though evidence is controversial.

Purpose: To compare the efficacy of Pilates and home-exercises on kinesiophobia and postural balance. **Method:** Randomized controlled trial with blind assessor and concealed allocation. Thirty-one participants of both sexes, with CNLBP for at least 12 weeks were randomly assigned to Pilates (PT; $n=16$) or Home-Exercise (HE; $n=15$) groups. PT group was composed by sessions of fifty-minutes (seven to ten exercises; two sets of 8 to 12 repetitions). The HE was prescribed to the participants (characterized by general exercises - postural, muscle stretching and strengthening) within a booklet, and they were instructed to exercise 2 times/week, weekly monitored by text messaging. The intervention lasted 6 weeks (two times/week). Outcomes were assessed on baseline, post-intervention and after 4-months follow-up. Kinesiophobia was measured by the Tampa Scale. The score ranges from 17 to 68 (higher scores meaning a worse fear of moving). Balance was measured by the limits of stability (challenge to move and control the center of gravity within the base of support). A linear mixed-model was used to analyze the global effect over time and separate effects at baseline, post-intervention and follow-up. Significance was set at 5%. Dropouts were included by multiple imputation. **Results:** No significant differences were found between PT vs HE (global effects). Likewise, no separate effects were found for balance and kinesiophobia. **Conclusion:** An intervention of Pilates and home-exercises did not improve the balance and kinesiophobia.

Table. Effects of PT (Pilates) and HE (Home Exercises)

Kinesiophobia	PT	HE	Effects	
	Mean (ste)	Mean (ste)	B (CI95%)	P-value
Baseline	42.7 (1.9)	42.2 (2.0)	-	-
Post-intervention	38.7 (2.3)	38.2 (2.3)	-3.9 (-8.1; 0.2)	0.06
Follow-up	38.8 (3.0)	38.3 (3.1)	-3.8 (-10.6; 2.9)	0.2
Global Effect	n.a	n.a	0.51 (-4.3; 5.3)	0.8
Balance				
Baseline	52.4 (4.2)	55.9 (4.3)	-	-
Post-intervention	57.3 (4.6)	60.8 (4.6)	4.9 (-3.3; 13.1)	0.2
Follow-up	56.0 (5.7)	59.4 (5.8)	3.5 (-8.8; 15.9)	0.5
Global Effect	n.a	n.a	-3.4 (-13.5; 6.6)	0.5
Ste: standard error				

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Effect Of Core Strength Training On Dysfunction And Rehabilitation Of Patients With LBP

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 (No relevant relationships reported)

PURPOSE: To observe the effect of core strength training on dysfunction and rehabilitation of patients with chronic low back pain.

METHODS: 120 patients diagnosed as LBP in the affiliated sports hospital of Chengdu Sport Institute are divided into core strength training group, regular gymnastics group and general treatment group (40 in each) by using randomized, controlled, single-blind experimental methods. The patients in the first group (group A) use basic treatment (acupuncture, massage, TDP irradiation) and core strength training. Basic treatment and gymnastics training are applied for the patients in the second group (group B), while basic treatment is used for the third group (group C). All the trainings continue 8 weeks. Spss 19.0 is used for statistics analyses. Efficiency, VAS score, JOA score are tested before treatment, 3 and 8 weeks after treatment. The overall scores before and after treatment are measured, the efficiency is calculated by Redit analysis.

RESULTS: 106 patients participate the whole process and the baseline data before intervention are basically the same. After intervention, all the indicators have changed as follows: 1.Efficiency: The total effective rate is 94.1% in group A, 88.6% in group B, 86.5% in group C. There is a significant difference between group A,B and C by Redit analysis($P<0.01$). There is no difference between group B and C ($p>0.05$). 2.VAS score: There is no significant difference before intervention. After intervention, the VAS scores are reduced significantly. The score of group A decreased by 4.68 points, 3.77 points in group B and 3.81 points in group C. There is a significant difference in three groups ($p<0.01$), while there is no significant difference between group B and C($p>0.05$). The difference indicates that the improvement of this index in group A is better than others. 3.JOA score: There is no significant difference before intervention. The average of group A decreased by 6.74 points, 4.34 points in group B, 4.16 points in group C. After 8 weeks, there is a significant difference between group A and B and C ($p<0.01$). There is no significant difference between group B and C($p>0.05$).

CONCLUSIONS: After 8 weeks intervention, basic treatment and core strength training can significantly improve the dysfunction and rehabilitation of patients with pain and activity limitation.

442 Board #280 May 29 11:00 AM - 12:30 PM
Dose-related Effects of Moderate Intensity Walking Exercise on Sensitivity to Pain in Healthy Humans

Anna M. Polaski, Amy L. Phelps, Matthew C. Kostek, FACSM, Kimberly A. Szucs, Benedict J. Kolber. *Duquesne University, Pittsburgh, PA.*

(No relevant relationships reported)

Increasing evidence implicates exercise as a front-line adjuvant therapy for the treatment of nearly all forms of chronic pain. Knowledge of efficacious dosing respective to exercise type and pain condition is extremely limited in the literature. This leaves both clinicians and patients less informed with regard to the best practice.

PURPOSE: To determine the optimal dose of moderate intensity treadmill walking necessary to reduce acute pain in healthy human participants. **METHODS:** After screening, 40 female participants (21.6±0.4 yrs) were pseudo-randomized into 1 of 4 groups: control (no exercise), low dose exercise (3x/wk), moderate dose exercise (5x/wk) and high dose exercise (10x/wk). Over a 7-day period, participants performed moderate intensity walking on a treadmill during assigned exercise days (days 1-5). Quantitative measures of pain were measured at baseline (day 0), 5- and 30-min post intervention on days 1, 3, and 5 and 24 hrs post-final intervention session (day 6) via sensitivity thresholds to painful thermal stimulation and painful pressure stimulation. Subjects also rated the intensity and unpleasantness of both thermal and pressure stimuli qualitatively on a visual analog scale (VAS). **RESULTS:** One-way ANOVA revealed a significant analgesic effect of treatment for constant pressure pain intensity ($F_{3,36}=6.2, p<0.01$) and constant pressure pain unpleasantness rating ($F_{3,36}=6.4, p<0.01$) as measured by VAS. Tukey post-hoc tests showed significant differences between the control and moderate dose groups (157.6±20.8 vs. 49.6±6.9%baseline, $p<0.01$) and control and high dose groups (157.6±20.8 vs. 67.3±25.8%baseline, $p<0.01$) for constant pressure pain intensity rating and significant differences between control and moderate dose groups (127.9±19.3 vs. 46.6±9.4%baseline, $p<0.01$) and control and high dose groups (127.9±19.3 vs. 46.6±14.6%baseline, $p<0.01$) for constant pressure pain unpleasantness rating. **CONCLUSION:** In healthy adults, we have identified a dose response of exercise-induced analgesia. Our study suggests that a low dose of exercise is insufficient to induce analgesia. The moderate dose of exercise may be an appropriate starting dose for exercise-based adjuvant pain therapy. Future studies include applying these results and techniques in chronic pain groups.

443 Board #281 May 29 11:00 AM - 12:30 PM
The Efficacy of Qigong on the Main Symptoms of Fibromyalgia. A Randomized Clinical Trial

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(No relevant relationships reported)

Some of the most debilitating symptoms of fibromyalgia (FM) include widespread chronic pain (WCP), sleep disturbances (SD) and chronic fatigue (CF) all that negatively impact health status (HS) in individuals with FM. Yet, there's a lack of effective self-management exercise interventions capable of alleviating FM symptoms.

PURPOSE: To examine the efficacy of a 10-week daily practice qigong program on WCP, SD, CF, and HS in individuals with FM. **METHODS:** 20 individuals with FM were randomly assigned to one of two groups with participants blinded to the intervention allocation. The experimental group learned, and practiced mild body movements synchronized with deep diaphragmatic breathing and meditation. The control group learned and practiced only the mild body movements (same movements as the experimental group). Both groups were asked to practice the interventions for 10-week, two times per day at home plus one weekly group practice with a qigong instructor. Clinical assessments collected at baseline and upon completion of the intervention were: Short-Form McGill Pain Questionnaire, a visual analog scale for pain graded from 0 (no pain) to 10 (worst possible pain), Pressure Pain Threshold measured by a dolorimeter, the Pittsburgh Sleep Quality Index and the Revised Fibromyalgia Impact Questionnaire. WCP score comparisons were made using MANOVA. SD, CF and HS were compared with *t*-tests. **RESULTS:** The experimental group experienced greater clinical improvements when compared to the control group with the mean scores differences of WCP, SD, CF, and HS all being statistically significant at $p<.05$. Within group analysis revealed that the experimental group improved WCP by 35% ($p<.01$), SD by 34 % ($p<.01$), CF by 30% ($p<.05$) and HS by 31 % ($p<.01$) The control group only presented significant improvement in HS by 21% ($p<.05$). **CONCLUSION:** Daily practice of Qigong might have a positive impact on the main FM symptoms that is beyond group interaction and solely mild exercise.

444 Board #282 May 29 11:00 AM - 12:30 PM
Effect Of Core Strength Training On Efficiency, Core Strength Of Patients With LBP

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(No relevant relationships reported)

PURPOSE: To observe the effect of core strength training on rehabilitation and core strength of patients with chronic low back pain.

METHODS: 120 patients diagnosed as LBP in the affiliated sports hospital of Chengdu Sport Institute are divided into three groups by using randomized, controlled, single-blind experimental methods. The patients in the first group (group A) use basic treatment (acupuncture, massage, TDP irradiation) and core strength training. Basic treatment and gymnastics training are applied for the patients in the second group (group B), while basic treatment is used for the third group (group C). All the trainings continue 8 weeks. Spss19.0 is used for statistics analyses. Efficiency analysis, VAS score and core strength are tested before treatment, after 3 and 8 weeks of treatment. The efficiency is calculated by Redit analysis.

RESULTS: 106 patients participate the whole process and the baseline data before intervention are basically same, and there is no difference in three groups. After 8 weeks training, all the test indicators have changed as follows: 1.Efficiency: The total effective rate is 94.1% in group A, 88.6% in group B, 86.5% in group C. There is a significant difference between group A,B and C by Redit analysis($P<0.01$). There is no difference between group B and C ($p>0.05$). 2.VAS score: There is no significant difference before intervention. After intervention, the score of group A decreased by 4.68 points, 3.77 points in group B and 3.81 points in group C. There is a significant difference in three groups ($p<0.01$), while there is no significant difference between group B and C($p>0.05$). 3.core strength: the strength of group A has a significant improvement between three groups($p<0.01$). There is no significant difference in the ratio of extension/flexion strength, left/right flexural force($p>0.05$). After 8 weeks, The ratio of extension/flexion strength changes significantly in group A ($p<0.01$); the ratio of muscle strength in left/right curve shows that group A and B has significant differences ($p<0.05$) while highly significant difference C ($p<0.01$).

CONCLUSIONS: After 8 weeks intervention, basic treatment and core strength training can significantly improve the rehabilitation and the core strength, reduce pain and optimize the efficiency of LBP patients.

- 445** Board #283 May 29 11:00 AM - 12:30 PM
The Mapping Knowledge Analysis of Exercise Intervention for Drug Dependence Research at Home and Abroad
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 (No relevant relationships reported)

Based on the 542 articles with the theme of "exercise intervention and drug dependence" from 1991 to 2018 included in WOS core collection database, this study analyzed the annual output quantity, country/region, high-yield authors, subject distribution, high-frequency keywords, keywords time zone view, high-frequency classical literature, etc. by using CiteSpace, as a mean of visualization. The purposes of this study were to analyze structural characteristics, quantitative relation, research hotspots and evolution in the field of exercise intervention and drug dependence. Results: The number of publications on exercise intervention and drug dependence was on the rise. The United States, the United Kingdom and Canada were in the world leading position in the exercise intervention and drug dependence, and Shanghai University of Sport occupied the dominating position in China. Universities and hospitals were the important positions. The research involved several interdisciplinary subjects, such as neuroscience, drug abuse, public environment and occupational health, pharmacology and sports science, etc. The research hotspots focused on tobacco and alcohol-dependent population, mainly taking exercise intervention or physical activity as the independent variable, withdrawal symptoms, behavioral cognition, craving degree, health risk and other indicators as the dependent variable, with little research on drug dependence population, especially the optimal form and neural mechanism of exercise intervention were still unclear.

- 446** Board #284 May 29 11:00 AM - 12:30 PM
Exercise As An Adjuvant For Post-acute Withdrawal Syndrome In Substance Use Disorder
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 (No relevant relationships reported)

Title: Exercise as an adjuvant to Post- Acute Withdrawal Syndrome in Substance Use Disorder

The role of exercise to prevent SUD, and as a component of conventional treatment for SUD has been described before by others.

Purpose: Our study purpose was to explore the relationship between exercise and Post-Acute Withdrawal Syndrome symptomatology.

Study Design: 26 clients with documented history of SUD involving methamphetamine, heroin or both were enrolled in the study at a regional licensed behavioral healthcare facility outpatient recovery program. 17 male and 9 female clients ranging in age from 17-41 were enrolled. 13 were enrolled in traditional recovery plans (Counseling, recovery coaching, and 12 Step meetings), and 13 were enrolled in the exercise arm of the study which included structured resistance training, aerobic exercise along with the traditional recovery plan modalities. Study duration was 6 weeks.

The study specifically measured symptoms of Post-Acute Withdrawal at weeks 1-6 utilizing the Addiction Severity Index (ASI) and Post-Acute Withdrawal Symptom Index (PAWSI). The researchers utilized the indices by self-report surveys conducted at enrollment and at the end of weeks 1-6.

Results: By Week 6 symptom reduction (see table)

Discussion: Post-Acute Withdrawal syndrome is well described in early recovery from SUD and has been shown to be a significant factor in relapse. The role of dopamine depletion has been well described as the neurophysiologic correlate of Post-Acute Withdrawal Syndrome. The use of a structured exercise program including resistance training coupled with aerobic exercise can be a useful adjuvant to potentiate early recovery, reduce symptoms of Post-Acute Withdrawal Syndrome and to mitigate early relapse.

Symptom Reduction By Week 6						
PAWS Symptom	Restless Leg	Sleep	Energy	Mood	Concentration	Engagement in therapy
Conventional Arm	30%	17%	22%	26%	15%	25%
Exercise Arm	55%	43%	76%	71%	46%	80%

Conclusion: Exercise significantly reduces the symptoms of Acute Post-Withdrawal Syndrome in clients with SUD, and is should be considered an important adjunct to treatment.

- 447** Board #285 May 29 11:00 AM - 12:30 PM
Physical Activity, Physical Function And Quality Of Life In Patients With Single And Multiple Chronic Diseases
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 (No relevant relationships reported)

PURPOSE: An estimated 50 million people in the Europe live with multi-morbidity (MM). Research has found that those with MM have a greater risk of physical function (PF) decline and poorer quality of life (QoL) than those with a single chronic disease (SCD). The aim of this study was to compare the physical activity (PA) levels and sedentary behavior (SB) in patients with MM and SCD and to investigate the association between PA and PF and QoL. **METHODS:** Subjects (n=229, 54.4% female, age (mean±SD) 62.2±11.1 yr) were recruited at induction to a community-based exercise program for chronic disease. Medical history was obtained from a referral letter provided by a healthcare professional. Subjects with a single diagnosis of a chronic disease, primarily including cardiovascular, respiratory disease, cancer, diabetes, were classified as SCD. Participants with ≥2 of these diagnoses were classified as MM. BMI and waist to hip ratio (WHR) were measured and calculated using standard procedures. Upper and lower body strength, flexibility and cardiorespiratory fitness were assessed using a hand-grip test, sit-to-stand test (STS), sit and reach test (SRT), and 6-min time trial (6MTT), respectively. PA and SB were recorded using an activPAL³ micro accelerometer. QoL was assessed using the EQ5D VAS. Independent sample T tests were used to compare MCD with SCD on measures of PA, SB, PF and QoL. General linear models were used to investigate the association between PA and SB and PF and QoL.

RESULTS: 102 (44.5%) participants were defined as MM. Participants with MM had higher waking SB (9.3 ± 1.8 vs 9.9 ± 1.9 hrs/d, p=.013), lower MVPA (0.3 ± 0.2 vs 0.4 ± 0.2 hrs/d, p=.001) and daily step count (6185 ± 3016 vs 7270 ± 3196 steps/d, p=.009) compared with SCD. MM had higher BMI (31.6 ± 7.3 vs 28.0 ± 5.3 kg/m², (p=.000 for all). MM achieved significantly poorer results for the STS (23.8 ± 9.6 vs 21.2 ± 7.3 s, p=.021) and 6MTT (453.3 ± 118.9 vs 514.4 ± 113.2 m, p=.000). There were no differences between groups for WHR, SRT and QoL. MVPA was significantly related to weight, BMI, 6MTT, daily step count was related to STS, 6MTT and QoL and waking SB was related to WHR. **CONCLUSIONS:** Individuals with MM had greater SB and less PA than those with SCD. PF was poorer for individuals with MM. There were significant associations between PA with physical function and QoL in a CD population.

- 448** Board #286 May 29 11:00 AM - 12:30 PM
Physical Activity and Quality of Life: Using Exercise as Treatment in Primary Care
 Stefanie M. Meyer, Mary Larson, Joe Deutsch. *North Dakota State University, Fargo, ND.* (Sponsor: Donna J. Terbizan, FACS)M)
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 (No relevant relationships reported)

Physical inactivity is linked to a reduced quality of life (QOL) and is more pronounced in those living with chronic health conditions. The use of exercise referral as a therapeutic treatment by healthcare providers may be an important clinical tool in improving QOL in the chronic disease population. **PURPOSE:** To explore differences in QOL and physical activity (PA) of patients who were medically referred to an exercise-as-treatment (EAT) program. Secondly, to explore factors that contribute to QOL.

METHODS: A Midwest healthcare system referred 213 chronic disease patients to an on-site EAT program. A total of 59 patients (64y ± 12; 64.4% female) responded to a follow-up survey that included the eight-scale RAND-36 item health questionnaire to assess QOL and the Physical Activity Vital Sign questions to determine average PA level in minutes per day. Respondents were categorized into 1) did not engage in the exercise program 2) engaged in up to two sessions 3) engaged in three or more sessions. ANOVA was conducted to test for between-group differences, Pearson correlations between QOL and exercise visits, independent samples t-test for influence of PA behavior on general health QOL, and forward selection to explore a model to best inform general health QOL.

RESULTS: No significant differences were found between exercise visit categories, QOL scales, and PA. Number of exercise visits was found significantly negatively correlated with emotional well-being QOL (r = -.350, p<.01) and with pain QOL (r = -.326, p<.01). A significant difference was found (SF-36 score) in general health QOL for patients who met the PA guideline of 150 minutes per week (M=68.81, SD=22.299) versus those who did not meet the guideline (M=53.71, SD=17.382; t(54)=2.827, p=.007. Forward selection chose social functioning, energy, minimal role limitations due to physical health, and PA minutes as contributors to patient general health QOL with adjusted R²=.714 (p=.004).

CONCLUSIONS: Results support the positive influence of exercise behavior on QOL. Using the healthcare system to assess PA behavior, such as including exercise as a vital sign, is a strategy that will enable providers to refer and deliver an EAT approach. Future research should include comparison of PA behavior as well as exercise program visits with specific chronic diseases and QOL.

449 Board #287 May 29 11:00 AM - 12:30 PM
Effects Of Cooled Compression Exercise Technology On Health, Sleep, And Quality Of Life In Veterans.

Chloe Wernecke¹, Pat Marques², Grove Higgins², Sara Webb², Lindsay Haughton², Liz Grimm², Mary Wilson², Aaron Black², Cristian Torres¹. ¹Vaspar Systems, Moffett Field, CA. ²Colorado Springs Center for Human Performance and Rehabilitation, Colorado Springs, CO. (Sponsor: 7960, FACSM)
 (No relevant relationships reported)

Veterans are disproportionately affected by physical and emotional functional disorders compared to their civilian counterparts, a discrepancy that is deepened by delay to care within the Veterans Health Administration. Research has supported use of compression exercise in physically limited populations and demonstrated physiological responses at lower intensities (10-20% one repetition maximum vs 70% for hypertrophy in resistance exercise). Combination of low-pressure compression exercise and cooling has shown elevated growth hormone and testosterone and depressed nighttime cortisol, indicating this may be beneficial for addressing emotional and sleep dysfunctions.

PURPOSE: To determine the safety and efficacy of an accessible cooled compression exercise system on markers of physical and emotional function in veterans.

METHODS: 14 veterans completed 24 sessions in 12 weeks. Baseline and endpoint questionnaires validated for clinical significance were administered to determine sleep quality (Pittsburg Sleep Quality Index), quality of life (RAND Short Form 36), and respiratory dysfunction related to stress and anxiety (Nijmegen Questionnaire).

RESULTS: Two-tailed T-tests were performed on the data. Sleep quality improved in 71% of subjects (9.15 ± 6.87 vs 5.57 ± 3.74 , $p = 0.0232$), 57% improved quality of life (73.45 ± 17.17 vs 84.46 ± 9.27 , $p = 0.0316$), and 71% decreased adverse respiratory symptoms (11.29 ± 8.38 vs 7.86 ± 6.26 , $p = 0.0594$) compared to baseline. Increases were seen in all 8 sub-scores of quality of life, with statistically significant improvements in social functioning (75 ± 28.17 vs 94.64 ± 11.62 , $p = 0.0058$), energy and fatigue (48.93 ± 25.21 vs 65.63 ± 19.26 , $p = 0.0426$), emotional wellbeing (66 ± 24.29 vs 85.14 ± 14.16 , $p = 0.0054$), and general health (72.14 ± 15.78 vs 79.64 ± 12.78 , $p = 0.0497$). For sleep quality, those subjects with baseline scores defined as clinically disturbed sleep ($n=8$, 58%) all (100%) experienced sleep improvements (9.14 ± 6.87 vs 5.57 ± 3.74 , $p = 0.00301$), with 25% resolving below clinical delineation.

CONCLUSION: These findings suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.

A-56 Exercise is Medicine®/Poster - EIM -
Miscellaneous Health Problems/Diseases

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

450 Board #288 May 29 11:00 AM - 12:30 PM
Enjoyment Responses to High Intensity Interval and Moderate Intensity Continuous Training in Crohn's Disease Patients

Lindsay Bottoms¹, Dean Leighton², Roger Carpenter³, Simon Anderson⁴, Louise Langmead⁵, John Ramage⁶, James Faulkner⁷, Elizabeth Coleman⁸, Caroline Fairhurst⁸, Michael Seed⁸, Garry A. Tew¹⁰. ¹University of Hertfordshire, College Lane, United Kingdom. ²Queen Mary University, London, United Kingdom. ³University of East London, Water Lane, United Kingdom. ⁴Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom. ⁵Barts and the London NHS Trust, London, United Kingdom. ⁶Hampshire Hospitals NHS Foundation Trust, Winchester, United Kingdom. ⁷University of Winchester, Winchester, United Kingdom. ⁸University of York, York, United Kingdom. ⁹University of East London, London, United Kingdom. ¹⁰Northumbria University, Newcastle Upon Tyne, United Kingdom. (Sponsor: Dr Mark Glaister, FACSM)
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 (No relevant relationships reported)

PURPOSE: The aim of this study was to undertake secondary data analysis from a three-arm feasibility trial of high intensity interval training (HIIT), moderate intensity continuous training (MICT), and usual care, in Crohn's disease (CD) patients ($n=36$), with a primary focus on exploring affective and enjoyment responses to the two types of exercise training. **METHODS:** Twenty-five participants with quiescent or mildly-active CD were randomised to one of the two active groups: HIIT ($n=13$) and MICT ($n=12$). Both groups were offered three exercise sessions per week for 12 weeks. MICT consisted of cycling for 30 minutes at 35% peak power (Wpeak), whereas HIIT involved ten 1-minute bouts at 90% Wpeak, interspersed with 1-minute bouts at 15% Wpeak. Peak power was determined prior to the intervention and reassessed at weeks 4 and 8 to adjust training load. Heart rate (HR) and differentiated ratings of perceived exertion (RPE) for legs (RPE-L) and central (i.e. ventilatory and circulatory; RPE-C), along with feeling state (Feeling Scale; FS) were measured at regular time intervals during each exercise session. In addition, enjoyment was measured at the end of the training programmes using the Physical Activity Enjoyment Scale (PACES). Post-hoc exploratory analysis involved a mixed-model two-way ANOVA to compare HR, RPE-C, RPE-L and FS at weeks 1, 6 and 12 between groups. An independent t-test was used to assess between-group differences in PACES scores. **RESULTS:** HR was greater ($p < 0.01$) during HIIT (168 ± 20 bpm) compared with MICT (124 ± 18 bpm). Similarly, RPE-L and RPE-C responses were greater ($p = 0.03$ and $p = 0.03$, respectively) during HIIT (5.5 ± 1.6 and 5.1 ± 1.7 i.e. 'hard', respectively) compared to MICT (3.3 ± 1.5 and 2.9 ± 1.5 i.e. 'moderate', respectively). Overall, FS recorded was 2.2 ± 1.8 (i.e. 'fairly good') for HIIT and 2.1 ± 1.3 (i.e. 'fairly good') for MICT with no effect of condition ($P=0.25$) or time ($P=0.94$). There was also no statistically significant difference in PACES scores between HIIT (99.4 ± 12.9) and MICT (101.3 ± 17.4 ; $p = 0.78$). **CONCLUSION:** Despite the differences in HR and RPE responses, the findings suggest that the HIIT and MICT protocols elicited similar enjoyment and affective responses in adults with quiescent or mildly-active CD.
 Support by CCUK Grant SP2015/1.

451 Board #289 May 29 11:00 AM - 12:30 PM
High-intensity Interval Training And Moderate-intensity Continuous Training In Adults With Crohn'S Disease: A Pilot Trial

Garry A. Tew¹, Dean Leighton², Roger Carpenter³, Simon Anderson⁴, Louise Langmead⁵, John Ramage⁶, James Faulkner⁷, Elizabeth Coleman⁸, Caroline Fairhurst⁸, Michael Seed³, Lindsay Bottoms⁹. ¹Northumbria University, Newcastle-upon-Tyne, United Kingdom. ²Queen Mary University of London, London, United Kingdom. ³University of East London, London, United Kingdom. ⁴Guy's and St Thomas' NHS Foundation Trust, London, United Kingdom. ⁵Barts and the London NHS Trust, London, United Kingdom. ⁶Hampshire Hospitals NHS Foundation Trust, Basingstoke, United Kingdom. ⁷University of Winchester, Winchester, United Kingdom. ⁸University of York, York, United Kingdom. ⁹University of Hertfordshire, Hatfield, United Kingdom. (Sponsor: Prof Glyn Howatson, FACSM)
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(No relevant relationships reported)

PURPOSE: To assess the feasibility and acceptability of two common types of exercise training—high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT)—in adults with Crohn's disease (CD).

METHODS: In this mixed-methods pilot trial, participants with quiescent or mildly-active CD were randomly assigned 1:1:1 to HIIT, MICT or control (usual care). The HIIT and MICT groups were offered three exercise sessions per week for the first 12 weeks and followed up for 6 months. Feasibility outcomes included rates of recruitment, retention, outcome completion, and exercise attendance. Data were collected on cardiorespiratory fitness (e.g., peak oxygen uptake), disease activity, fatigue, quality of life, adverse events, and intervention acceptability (via interviews).

RESULTS: Over 17 months, 53 patients were assessed for eligibility and 36 (68%) were randomised (47% male; mean age 36.9 [SD 11.2] years); 13 to HIIT, 12 to MICT, and 11 to control. The overall exercise session attendance rate was 68% (608/891), and 64% (16/25) of participants completed at least 24 of 36 sessions. One participant was lost to follow-up. Outcome completion rates ranged from 89 to 97%. The mean increase in peak oxygen uptake, relative to control, was greater following HIIT than MICT (2.4 vs. 0.7 mL/kg/min). There were three non-serious exercise-related adverse events, and two exercise participants experienced disease relapse during follow-up.

CONCLUSIONS: The findings support the feasibility and acceptability of the exercise programmes and trial procedures. A definitive trial is warranted. Physical exercise remains a potentially useful adjunct therapy in CD. Supported by CCUK Grant SP2015/1.

452 Board #290 May 29 11:00 AM - 12:30 PM
Metabolic Profile And Myocardial Performance Of Renal Transplant Recipients Adherent To Unsupervised Exercise As Prescription Program.

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(No relevant relationships reported)

Purpose : Renal transplant recipients (RTR) are at elevated cardiovascular mortality in comparison with the general population especially after surgical treatment. Literature supports the role of the supervised exercise intervention, however few data are available about the potential impact of the unsupervised exercise . We investigated whether a home-based program of exercise could reduce CV risk in RTR by evaluating the changes in renal and cardiometabolic parameters and myocardial performance measured by echocardiography. **Methods:** From a large cohort of 60 RTR, 30 RTR (12 females and 18 males, aged 47.9 ± 12.3 y) participated in individualized and unsupervised exercise programs for 6 months, at moderate intensity. Cardiometabolic risk factors, anthropometrics parameters, lipid and glucose blood sample profile were studied as well the myocardial performance by the 2D echo examination at T₀, T₆, months. **Results:** lipid profile maintained in the range of a low risk level, despite without significant improvement. the myocardial performance, especially EF was significantly (p<0.05) ameliorated (EF^{RTR}: 60.2±5¹⁰ vs 62.0±3.7¹⁶ ; EF^{HC}: 63.6±3.8¹⁰ vs 62.4±3.3¹⁶). **Conclusions:** an home based exercise program has a positive impact on myocardial function and maintains low cardiovascular risk profile since 6 months of exercise. The trend support the importance to highlight the role of a correct reconditioning of the lifestyle in RTR, by the unsupervised exercise program at moderate intensity, where well tolerated . **Table 1: Characteristics of renal transplant recipient (RTR) and healthy controls (HC)**

RTR (n =30)	RTR T ₀	RTR T ₆	P value
Weight (kg)	70.6±15.6	70.7±15.3	0.830
BMI (kg/m ²)	24.3±3.8	24.9±4.4	0.631
Creatinine (mg/dL)	1.5±0.5	1.5±0.7	0.808
Urea (mg/dL)	66±0.26	71±0.43	0.787
Cholesterol (mg/dL)	187.0±55.7	194.7±47.8	0.688
HDL (mg/dL)	54.9±22.4	54.1±16.0	0.218
LDL (mg/dL)	130.6±95.0	134.5±93.0	0.655
Triglycerides (mg/dL)	198.1±152.4	193.3±127.6	0.951
Glucose (mg/dL)	1.01±0.25	0.94±0.25	0.550

453 Board #291 May 29 11:00 AM - 12:30 PM
The Effect Of Traditional Chinese Exercise On early Diabetic Nephropathy

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(No relevant relationships reported)

PURPOSE: It was reported that early diabetic nephropathy (DN) is associated with sedentary lifestyle, and proper exercise can improve its symptoms and prognosis. However, limited data evaluated the effects and safety of traditional Chinese exercise in patients with early DN. This study was aimed at observing the effects and safety of traditional Chinese exercise on early DN.

METHODS: Participants (n=21) were divided into the traditional Chinese exercise group (A group, n=12) and the control group (B group, n=9) for 12 weeks. On the basis of foundation treatment, group A was given the exercise 30 minutes per day, 4 times a week while no exercise intervention was given in group B. Fasting blood glucose, glycated hemoglobin (HbA1c), serum creatinine, urea, and the MUNSH scale were taken at baseline and 12 weeks later.

RESULTS: 1) Significant differences were found in group A in HbA1c (6.90±0.92 vs 6.43±0.78, P<0.05), BMI (26.30±3.49 vs 25.83±3.06, P<0.05) and VO₂peak (15.43±1.49 vs 16.14±1.89, P<0.05) compared with group B (Ps>0.05). The differences of MUNSH scale were significantly greater: positive emotion (6.75±3.14 vs 7.92±2.97, P<0.01), positive experience (8.08±4.03 vs 10.00±3.77, P<0.05), total score (32.67±11.28 vs 38.33±12.27, P<0.01). 2) No adverse reactions were observed during the trail. Few changes were found in renal function and urinary protein in two groups (P>0.05).

CONCLUSIONS: Traditional Chinese exercise therapy was safe and effective in treating early DN patients. It also has effects on improving the physical and mental health. Supported by JDZX2015136

454 Board #292 May 29 11:00 AM - 12:30 PM
Overall Fitness Benefits In Individuals With HIV Participating In A Community- Based Exercise Program

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(No relevant relationships reported)

Exercise has been shown to improve the health of persons living with HIV.

PURPOSE: Identify the effects of a community-based exercise program on the immunity (CD4 cell count) and overall fitness (cardiovascular and strength) in individuals living with HIV in San Juan, Puerto Rico.

METHODS: Twenty-five adults with HIV age 59.2± 1.7 years participated in this study. Individuals were recruited by word of mouth to a Community Based Exercise Program (La Perla de Gran Precio). A Certified Personal Trainer performed all the exercise testing. Cardiovascular fitness was assessed using a submaximal treadmill test (Ross). Strength was assessed by determining the 1 repetition maximum (1RM) for bench press and leg press and the maximum number of push-ups and sit-ups that could be completed in 1 minute. Flexibility was tested using the Sit and Reach Test. Participants were asked to bring in the most recent lab for the CD4 data. This same evaluation was administered three times to track each participant's progress over a year.

RESULTS: A repeated measures ANOVA was used to determine whether there was a statistically significant mean difference in CD4 count, cardiovascular fitness (time

completed and cardiac frequency), 1RM bench press and leg press, the maximum number of push-ups and sit-ups that could be performed in 1 minute, and flexibility between evaluations. There was a statistically significant difference ($p<0.05$) between CD4 count from evaluation 1 (695 ± 318.58) to evaluation 4 (945.57 ± 433.12) and the most significant mean difference was noted between evaluation 1 (695 ± 318.58) to evaluation 3 (932.85 ± 408.42). The data showed the steady improvement in strength (bench press, leg press, push-ups, and sit-ups) occurred between evaluation 1 and evaluation 3; however, the gains were not statically significant ($p>0.05$). Time completed during the submaximal test improved most between evaluation 1 and evaluation 2 but did not demonstrate the statistically significant mean difference ($p>0.05$).

CONCLUSION: Participation in a community-based exercise program can help significantly improve immunity (increase CD4 count) in people with HIV. Therefore, clinicians should encourage individuals with HIV to participate in regular exercise and introduce them to community/recreational programs.

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Web-based Individualized Exercise Intervention Improves Physical Performance and Hepatic Inflammation in Patients with NAFLD

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Non-alcoholic fatty liver disease (NAFLD) is the most frequent cause of liver disease with Non-alcoholic steatohepatitis (NASH) as a subtype showing lobular inflammation and ballooning as characteristic liver cell damage.

PURPOSE: Here we studied the impact of regular physical activity promoted and controlled by a novel Web-based approach on physical performance, liver inflammation, and histology. **METHODS:** We enrolled 44 Patients with NAFLD in a prospective, 8-week interventional single arm study with a 12-week follow-up period (NCT02526732). Peak oxygen uptake (VO₂peak) was measured by spiroergometry from baseline (T0) to post intervention (T1) and laboratory parameters for liver function (AST, ALT) and inflammation (CRP and Ferritin) as well as liver fibrosis non-invasively by Vibration Controlled Transient Elastography (VCTE) were also measured after follow-up (T2). Training consisted out of combined endurance and strength exercise 3-5 times a week under qualified instruction. Via an online support platform, weekly bidirectional feedback was provided. Differences between groups were calculated by Mann-Whitney-U-rank test.

RESULTS: A total of 44 patients with NAFLD were assigned and 41 patients, including 29 patients with NASH, completed the study protocol. Median VO₂peak increased significantly 6.6% from 27.0 ml/kg/min at T0 to 30.3 ml/kg/min ($p<0.001$) at T1. All laboratory values decreased significantly from T0 to T1 and T0 to T2. Median pressure measured by VCTE improved significantly from 7.4 kPa at T0 to T1 by 1.0 kPa ($p<0.05$) and also from T0 to T2 by 1.9 kPa ($p<0.05$). Interestingly, the subgroup of patients with NASH achieved better improvements of effect sizes for all measured parameters at all points in time. **CONCLUSIONS:** The current study demonstrates the feasibility and effectiveness of a Web-based individualized exercise program in patients with NAFLD. More severe liver inflammation and damage (NASH) does not compromise treatment effects. Sustained improvement in liver function tests and fibrosis marker support the concept of fibrosis resolution through decreasing hepatic inflammation during and following exercise intervention in this patient population.

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Exercise is Medicine®: Physical Activity Prescriptions and Behavior During Pregnancy

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Physical activity (PA) is beneficial to the health of both pregnant mother and unborn child, particularly when current PA guidelines are met (e.g., 150 min/week of moderate-intensity PA). The impact of PA prescriptions given by prenatal physicians, following the Exercise is Medicine® program, is currently unclear. **PURPOSE:** This study examined the relationship between healthcare provider PA prescriptions given at two prenatal healthcare visits and subsequent PA behavior of pregnant women.

METHODS: Prenatal healthcare providers in Cabarrus County, North Carolina assessed physical activity days/week and minutes/day among all prenatal patients (N=965) at two prenatal visits (V1: 20 weeks gestation; V2: 28 weeks gestation).

Minutes/week of physical activity were calculated, and providers were trained to provide physical activity prescriptions if the patient was not meeting current guidelines. Wilcoxon-Mann-Whitney tests were used to determine the association between healthcare provider PA prescription and self-reported physical activity from V1 to V2. **RESULTS:** The frequency of PA assessment at visits decreased as pregnancy progressed (V1=82.1%; V2=45.9%). Median PA minutes reported increased from V1 (25.0 min/wk) to V2 (60.0 min/wk). Likewise, the percentage of pregnant women receiving a PA prescription decreased from visit to visit (V1=68.6%; V2=56.3%). Women who received a PA prescription reported a greater increase in PA from V1 to V2 (117 min/wk) compared to women who did not receive a PA prescription (72 min/wk) ($p<0.001$). However, only 18.1% of PA prescriptions were consistent with current PA guidelines at prenatal visits. **CONCLUSIONS:** PA among pregnant women appears positively influenced by PA prescriptions provided by healthcare providers. Further training of healthcare providers is needed to increase the prevalence of prenatal exercise prescriptions consistent with PA guidelines.

457 Board #295 May 29 11:00 AM - 12:30 PM

Provider Advice on Weight Gain, Physical Activity, and Healthy Eating in Twin Pregnancies

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PURPOSE: To examine provider advice on gestational weight gain (GWG), physical activity (PA), and healthy eating (HE) during twin pregnancies, and to determine if advice on GWG is associated with women's GWG.

METHODS: Data are from 301 women, aged 21-43 years, who delivered twins in the prior 24 months and completed an online survey in 2018. The 2009 Institute of Medicine (IOM) provisional weight gain guidelines for twin pregnancies defined whether provider advice on GWG and women's GWG were below, within, or above guidelines. Content analysis described provider advice on PA and HE. Multinomial logistic regression examined the associations of provider advice on GWG with women's GWG, after adjustment for potential confounders.

RESULTS: Approximately 66% of women reported provider advice on GWG, 73% on PA, and 59% on HE during their twin pregnancy. Of those who reported GWG advice, 30% described advice below, 60% within, and 10% above the IOM guidelines. Women who were not on bedrest (15%) reported recommendations to engage in light- or moderate-intensity activities like walking or swimming, but cautioned to avoid overexertion. Advice on HE included recommendations to increase consumption of protein, fruits, vegetables and vitamins/minerals, with emphasis on increasing caloric intake. As seen in Table 1, compared to women who reported GWG advice within IOM guidelines, women who reported advice below guidelines or who reported no advice were 7.23 and 2.76 times more likely to gain less than recommended, respectively. Women who reported provider advice above guidelines were 5.05 times more likely to exceed guidelines (all $p<0.05$).

CONCLUSION: Forty percent of women reported GWG advice outside IOM guidelines, and inaccurate or no advice was strongly associated with inadequate or excessive GWG. There is a clear need for intervention strategies to educate providers about IOM guidelines, including how to counsel women on GWG, PA, and HE to optimize outcomes in twin pregnancies.

Table 1: Association Between Provider Advice on Gestational Weight Gain (GWG) and Compliance with the Institute of Medicine (IOM) Guidelines*

Provider Advised GWG	GWG Below IOM Guidelines		GWG Above IOM Guidelines	
	Adjusted OR [†]	95% CI	Adjusted OR [†]	95% CI
Below IOM guidelines	7.23	3.20, 16.33	1.86	0.75, 4.61
Above IOM guidelines	0.64	0.07, 5.81	5.05	1.61, 15.85
Within IOM guidelines	Reference	Reference	Reference	Reference
Did not discuss	2.76	1.32, 5.78	1.88	0.92, 3.85

*Due to differences in gestational age at delivery, a GWG ratio was calculated by dividing the lower and upper bounds of the IOM guidelines by 37 (guidelines created for women undergoing delivery ≥ 37 weeks gestation), to estimate GWG/week. The GWG ratios consistent with IOM guidelines for normal weight, overweight, and obese women were calculated as 1.00-1.46, 0.84-1.35, and 0.68-1.14 pounds per week, respectively.

[†]Model adjusted for maternal age at delivery, education, parity, twin type (dichorionic/diamniotic vs. dichorionic/monoamniotic or monochorionic/monoamniotic), assisted reproductive technologies (yes/no), and pre-pregnancy BMI category. Bolded values are statistically significant ($p < 0.05$).

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Lifestyle and Exercise Interventions for Lumbopelvic Pain and Pelvic Floor Dysfunction: A New Protocol

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to evaluate whether a protocol that included the implementation of lifestyle modifications and a specialized exercise program would improve the symptoms of pelvic floor dysfunction and mild pelvic organ prolapse in women.

METHODS: The five-week IRB-approved study included 23 female subjects aged 43.0 ± 9.0 years (Mean \pm S.D.) who exhibited symptoms of pelvic floor dysfunction as defined by 3 assessments (the Pelvic Floor Distress Inventory [PFDI-7], the Oswestry Low Back Pain Disability, and the Pelvic Floor Impact [PFDI-SF20] questionnaires). The study also included InBody570 body composition measurements, pelvic alignment assessments, diastasis recti assessments, and manual external pelvic floor muscle activation assessments. Participants were instructed in specific lifestyle modifications and participated in an exercise program over the course of seven live group sessions, 45 minutes each, led by one or both of the investigator clinicians. They were also taught to perform a home exercise program at least 5 days per week and completed compliance forms that were returned at the next live group session. The clinicians were a licensed physical therapist and a clinical exercise physiologist.

RESULTS: IBM SPSS version 24 statistical programming was utilized and non-parametric Wilcoxon "related-items" analyses were employed. A 0.05 level of significance was applied. The study results of the pre- and post- values indicated significant improvements of lower back pain (Oswestry, $z(23) = -3.67$, $p < .05$), significant improvements of the quality of life subjective emotional gauge (PFDI -20, $z(23) = -4.11$, $p < .05$), and significant improvements of bladder, bowel, and prolapse symptoms (PFIQ - 7, $z(23) = -3.74$, $p < .05$).

CONCLUSIONS: The study was highly labor- and time-intensive, and the sample was not large enough to eliminate statistical bias. However, the successful results warranted a continuation of the study to include 40 female volunteers with no modifications to the study's protocol using the same clinicians. Researchers are currently recruiting volunteers to complete the study.

459 Board #297 May 29 11:00 AM - 12:30 PM

Association Between Cognitive Function And Functional Capacity Of Patients With Peripheral Artery Disease

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Introduction: Patients with peripheral arterial disease (PAD) and symptoms of intermittent claudication present reduced mobility and decreased ability to exercise activities of daily living due to atherosclerotic plaques in the lower limbs that limit blood flow to the muscles. Because it is a systemic disease, PAD has been associated with cognitive decline, however, as far as functional impairment is related to cognitive impairment is still uncertain. **Purpose:** To analyze the association of cognitive function with the overall functional capacity and fragmented in three factors: (walking speed, muscle strength and balance) of patients with PAD. **Methods:** Two hundred and nineteen patients with PAD and symptoms of intermittent claudication were submitted to the MoCA test to evaluate cognitive function. Functional ability was assessed by the Short Physical Performance Battery consisting of balance tests, sit-up and stand-up tests, and 4-meter walk test. For analysis of the associations, the binary logistic analysis was used, using the sex and age adjustment of the patients. **Results:** There was no association between MoCA and sit-up (OR = -0.099, $P = 0.780$) as well as the test and balance (OR = -0.084, $P = 0.832$). The MoCA score was associated with performance on the test regardless of gender and age (OR = 1.186, $P = 0.007$). Despite the non-association in the first two tests, we found that cognitive function is associated with walking capacity. **Conclusion:** The cognitive function is associated with the ability to mobility in patients with PAD, based on these results we can assume that individuals physically active, yet affected by the disease, can slow cognitive decline.

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Correlates of Physical Activity in People With Heart Failure: Multivariable Analysis Based on REACH-HF Randomised Trials

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PURPOSE: To determine which patient demographics and patient reported outcomes (PROs) are associated with the average daily volume (ENMO) of accelerometer measured physical activity (PA) in people with heart failure (HF). **METHODS:** Baseline data was pooled from two studies which measured PA levels of people with both HF with reduced ejection fraction (HFrEF) and preserved ejection fraction (HFpEF) using 7-day wrist-worn accelerometry. Associations between PA volume, demographics and PROs were assessed using univariate linear regression. Variables with significant or close to significant associations ($p < 0.15$) with PA were subsequently entered into multivariable stepwise regression models; (1) a demographic model, (2) a PRO model, (3) an overall model consisting of all closely associated variables ($p < 0.15$), and (4) a final model consisting of all variables with $p < 0.05$ identified in the demographic and PRO multivariable models. **RESULTS:** 245 participants were included in the analysis and had a mean daily PA volume of 17.8 ± 6.6 mg, with no difference between HFrEF and HFpEF patients ($t(242) = 0.60$, $p = 0.55$). Univariate analysis showed age, body mass index (BMI), New York Heart Association (NYHA) class, ischaemic HF, NT-proBNP, living alone, chronic renal impairment, number of comorbidities, number of cardiorespiratory-metabolic comorbidities, incremental shuttle walk test (ISWT) distance, HEART QoL global and physical scores, EQ-5D-3L, MLHFQ overall, physical and emotional scores, and HADs depression scores were significantly associated with PA volume ($p < 0.05$). The overall multivariable analysis (3) showed that age, BMI, being employed, currently smoking, NT-proBNP and ISWT peak distance had the strongest association with PA volume ($R^2 = 0.42$, $p < 0.001$). **CONCLUSION:** Multivariable analysis identified factors which may be important for clinicians and researchers to consider when tailoring PA interventions. However, our results should be treated with a degree of caution due to a relatively small sample size in relation to the number of exploratory variables included. That $>50\%$ of the variance in PA volume remained unexplained indicates the need for further investigation in this area, with bigger data sets required to make firm conclusions.

461 Board #299 May 29 11:00 AM - 12:30 PM
Lifestyle and Exercise Intervention Reduces Blood Pressure: A Multiethnic Control Trial

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The effect of ethnicity and medication on blood pressure (BP) have been widely described; however, less is known about the interaction between ethnicity, BP medication and regular exercise on hypertensive patients. **PURPOSE:** This study was aimed to determine the effectiveness of an exercise training and healthy lifestyle education program to reduce BP levels and improve adherence to pharmacological therapy on a multiethnic group of hypertensive patients.

METHODS: An 8-month quasi-experimental longitudinal intervention with an exercise group (EG) and control group (CG) was designed. Five hundred and sixty-eight hypertensive patients (67.4±8.8 years; BMI, 26.4±3.1 kg/m²; systolic BP (SBP), 146±9 mmHg and diastolic BP (DBP), 95±7 mmHg; 18% Indigenous, 23% Colombian-African and 59% Hispanic) finalized the study (EG, n= 307 and CG, n= 261). EG participated in 3 weekly exercise training sessions (30 to 60 minutes of concurrent training), which were complemented by medication and lifestyle education. The average of three repeated measures of BP performed with an electronic sphygmomanometer was utilized as primary outcome. Health status, medication adherence, salt consumption, tobacco and alcoholic habits were recorded by questionnaires during clinic history assessment. Non-parametric tests were carried out to compare differences between EG and CG. Several logistic regression models were used to find independent variables predicting two levels (-3 or -5 mmHg) of reduction in systolic (SBP) or diastolic blood pressures (DBP).

RESULTS: We found significant reductions both SBP and DBP in EG (-5.92 mmHg and -5.0 mmHg, respectively, $P<0.001$ for both) but not in the CG. Also, prevalence of medication adherence was significantly improved in 28.7% ($P<0.001$) in the EG. In the logistic regression, all models confirmed the EG as the main explanatory variable of a 3 or 5 mmHg BP reduction, independently of other lifestyle risk factors and medication adherence. **CONCLUSIONS:** In accordance with other studies patients in EG showed more diminution in SBP and DBP than CG, which was independent of other risks factors. However, the main findings were that either ethnic or medication adherence did not influence statistically the reduction in BP associated with our exercise/lifestyle intervention.

462 Board #300 May 29 11:00 AM - 12:30 PM
Tai Chi as Antihypertensive Lifestyle Therapy: A Systematic Review and Meta-Analysis

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Due to limited evidence professional health organizations are reluctant to recommend Tai Chi to treat hypertension. **PURPOSE:** We conducted a systematic review and meta-analysis to examine the efficacy of Tai Chi as antihypertensive lifestyle therapy. **METHODS:** Tai Chi interventions published in English and Chinese were included when they involved healthy adults, reported pre-and post-intervention blood pressure (BP), and had a non-exercise/non-diet control group. We systematically searched 11 electronic databases through August 1, 2018, yielding 31 qualifying controlled trials. We: 1) evaluated the risk of bias and methodological study quality; 2) performed meta-regression analysis following random-effects assumptions; and 3) generated additive models representing the largest possible clinically relevant BP reductions. **RESULTS:** On average, participants ($N=3,223$) were middle-aged (56.6±15.1 years) adults with prehypertension (systolic BP [SBP] 136.9±15.2/diastolic BP [DBP] 83.4±8.7 mmHg). Tai Chi was practiced 4.0±1.4 sessions/week for 54.0±10.6 minutes/session for 22.3±20.2 weeks. Overall, Tai Chi elicited moderate to large reductions in SBP ($d=-0.75$, 95%CI: -0.97, -0.53; -8.7 mmHg) and DBP ($d=-0.53$, 95%CI: 0.71, 0.34; 4.7 mmHg) compared to control ($P<0.001$). Controlling for publication bias among samples with hypertension, Tai Chi interventions published in English elicited SBP reductions of 10 mmHg and DBP of 4 mmHg, half the magnitude of trials published in Chinese with SBP reductions of 19 mmHg and DBP reductions of 9 mmHg. **CONCLUSION:** Our results indicate that Tai Chi is viable antihypertensive lifestyle therapy that produces BP reductions that rival or exceed the antihypertensive

effects of aerobic exercise of 5-8 mmHg in both the English and Chinese literature. Further investigation is needed to explain the discrepancy in the magnitude of the antihypertensive effects between Tai Chi trials published in English and Chinese. Supported by a sub-contract from U.S. PHS grant 5U24AG052175, and University of Connecticut Center for Excellence in Teaching and Learning

463 Board #301 May 29 11:00 AM - 12:30 PM
Physical Activity Patterns Vary by BMI and Asthma Control in Patients with Asthma

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PURPOSE: Persons with chronic medical conditions, such as obesity and asthma, may be at higher risk for physical inactivity. In this analysis, we evaluated objectively-measured physical activity (PA) in a population of patients with asthma to determine whether physical activity varied by body mass index (BMI) or asthma control.

METHODS: We used data from a prospective cohort of English and Spanish speaking adults ≥21 years of age with physician diagnosis of asthma recruited from the outpatient practices of two health care systems located in New York, NY and Denver, CO. Exclusion criteria included history of other chronic pulmonary conditions or smoking >15 pack-years. Physical activity was objectively measured using Actigraph wGT3X-BT accelerometers. BMI (kg/m²) was measured by trained research staff and the Asthma Control Questionnaire (ACQ) was used to assess asthma control. We used Kruskal-Wallis tests to compare physical activity measures among obese (≥30 kg/m²), overweight (<30-25 kg/m²) and normal or underweight (<25 kg/m² and <18.5 kg/m²) individuals, as well as among subgroups by asthma control: good (ACQ ≤ 0.75), poor (ACQ > 0.75, but <1.5) and very poor (ACQ ≥ 1.5). **RESULTS:** Of the 125 participants, 103 (82%) were female. 56 (45%) were white; 52%, 30% and 18% were obese, overweight and normal/underweight, respectively. Half reported very poor asthma control. Mean (SD) sedentary time/day was 406.5 (114.1) minutes/day and did not vary by BMI or ACQ. Mean light activity was 397.4 (95.4) minutes/day and moderate-vigorous activity (MVA) was 38.9 (28.5) minutes/day. Patients with obese or overweight BMI had somewhat lower MVA than those with normal BMI (35.7, 39.9, 46.2 minutes/day; $p=0.09$) and significantly lower daily steps (5670, 7105, 7727; $p=0.004$). Similarly, patients with very poor asthma control had non-significantly lower MVA than those with poor or good control (34.1, 39.4, 49.0 minutes/day; $p=0.08$) and significantly lower daily steps (5690, 6742, 7910; $p=0.003$). **CONCLUSIONS:** Overall, activity levels in these patients with asthma were not lower than the general adult population. However, those with higher BMI and worse asthma control were less active (respectively), suggesting that interventions to increase PA in patients with asthma should consider addressing body weight and asthma control.

464 Board #302 May 29 11:00 AM - 12:30 PM
Less Evening Exercise is Associated with Progressive Visual Field Defect in POAG Patients

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PURPOSE: To investigate the exercise habits of those with primary open angle glaucoma (POAG) and its associations with the progression of glaucomatous visual field (VF) loss. **METHODS:** Daily PA was monitored by an accelerometer (ActiGraph wGT3x-BT), which patients wore for 24-hours on their waist (right) for 1 week. main outcome measures are daily PA, such as calories (kcal), light PA time, moderate PA time, vigorous PA time, moderate to vigorous physical activity (MVPA) and step counts. Progressive VF loss is defined as the same three or more points in pattern deviation change probability maps in at least two consecutive visits detected by Glaucoma Progression Analysis. **RESULTS:** No significant difference was found for daily PA between the 76 non-progressive and 22 progressive patients who wore the device for more than 10 hours per day ($P>0.05$ for all). Better eye VF mean deviation (MD) averaged -3.1 dB in non-progressive group and -4.1 dB in progressive group. 88 (89.8%) participants who had worn an accelerometer for an entire day were analyzed for their 24-hour exercise habits. Patients with POAG preferred to exercise more during 07:00-09:00 am, 15:00-17:00 pm, and 18:00-20:00 pm. Additionally, MVPA time in the non-progressive group is significantly higher than the progressive group at 18:00-20:00 pm (25.0(34.3) min VS 18.9(17.6) min, $P=0.002$). Binary logistic

regression analysis indicated that MVPA (18:00-20:00 pm) and other parameters, such as mean retinal nerve fiber layer (mRNFL), MD, mean arterial pressure (MAP), mean intra-ocular pressure (mIOP), age and gender were significantly correlated with POAG patients' progressive VF damage. Multivariate analysis showed that MVPA (odds ratio, OR (95% confidence intervals, CI) =0.96(0.94, 0.99), $P=0.002$), mRNFL (OR (95%CI) =0.97(0.94, 1.00), $P=0.02$), MAP (OR (95%CI) =0.88(0.83, 0.92), $P<0.001$), age (OR (95%CI) =1.10(1.06, 1.15), $P<0.001$) and gender (OR (95%CI) =0.44(0.22, 0.91), $P=0.001$) were still related to progressive VF loss after adjusting the other risk factors.

CONCLUSIONS: Patients with POAG prefer to exercise more during 07:00-09:00 am, 15:00-17:00 pm and 18:00-20:00 pm. Less evening exercise is associated with glaucomatous progressive VF damage, with an increasing of one minute of MVPA time decreasing the progression of POAG about 4%.

465 Board #303 May 29 11:00 AM - 12:30 PM
Increased Functional Capacity For Adaptive Athletes Through High Intensity Functional Training (HIFT)

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BACKGROUND: Individuals with adaptive needs (e.g., spinal cord injuries, cerebral palsy, amputations) encounter various barriers that limit their physical activity (PA). High intensity functional training (HIFT) programs have been developed to help those with adaptive needs improve their functional capacity. Adaptive HIFT programs allow for the preservation of a workout stimulus with exercise modifications or substitutions made for current physical conditions. However, research is lacking for adaptive HIFT programs.

PURPOSE: To compare ratings for difficulty and confidence of functional movements before and after an adaptive HIFT intervention.

METHODS: Participants included 13 adults (age = 38 ± 11 years, 75% male), and required the use of wheelchairs, limb braces, prosthesis, and crutches. The study consisted of an 8-week adaptive HIFT intervention with 2-3 60-minute supervised sessions per week. Participants completed a survey before and after the intervention that included the Outpatient Physical Therapy Improvement in Movement Assessment Log (OPTIMAL), which measured difficulty and confidence in performing 22 movements necessary to perform various functional activities (e.g., rolling over, squatting), on a 5-point scale (1 high, 5 low). All 13 participants completed the intervention. Due to differential survey completion (i.e., baseline $n = 8$, posttest $n = 5$; only 2 of those completed it at each time point), data were treated as cross-sectional and independent samples t-tests were performed via SPSS 25 to compare ratings for each time point.

RESULTS: Difficulty ratings approached significance for lying flat, $\Delta M = 1.1 [-0.1, 2.3]$, ($N = 8, 5$), $t(7) = 2.3$, $p = .051$, $SE = .4$; squatting, $\Delta M = 1.7 [-1.1, .9]$, ($N = 7, 5$), $t(10) = 2.1$, $p = .06$, $SE = .8$; and walking long distances, $\Delta M = 1.7 [-4.4, 3.7]$, ($N = 7, 5$), $t(10) = 2.2$, $p = .06$, $SE = .8$. Confidence ratings were significant for grasping, $\Delta M = .6 [-0.03, 1.2]$, ($N = 8, 5$), $t(7) = 2.4$, $p = .05$, $SE = .3$. No difficulty or confidence ratings had significantly lower scores at posttest.

CONCLUSION: Adaptive HIFT programs show promise for addressing functional movement limitations for adaptive adults. This would allow for increased PA participation. Future studies should increase sample sizes and compare outcomes from HIFT programs to other types of PA for the adaptive population.

466 Board #304 May 29 11:00 AM - 12:30 PM
The Effects of Endurance Stair Climbing on Individual Health

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(No relevant relationships reported)

Purpose

To assess cardiovascular intensity in athletes participating in an endurance stair climbing event.

Methods

This was an observational pilot study in which participants wore fitness tracking watches during an endurance stair climb of 103 floors. The devices provided continuous heart rate data throughout the climb. Participants completed the Borg Rating of Perceived Exertion upon completion of the event. The sample included 11 stair-climb event participants, including eight novices and three elites (i.e., Tower Running World Association members). The primary outcome was proportion of time spent with heart rate $>50\%$ of estimated maximum (moderate-to-vigorous intensity) and $>70\%$ of estimated maximum (vigorous intensity). Perceived level of exertion (Borg score) was a secondary outcome.

Results

The sample ($N=11$) comprised eight women and three men, with mean age of 34 years ($SD=11.5$) and BMI 23.2 ($SD=2.8$). All participants spent at least 90% of the climb with heart rate $>50\%$ of estimated maximum, and 64% of participants spent at least 50% of the climb with heart rate at $>70\%$ of estimated maximum. Elite participants spent a greater proportion of time in vigorous intensity activity than did novices (68% vs 55%), though this finding was not statistically significant ($p>.05$). Participants did not differ in time taken to reach $>70\%$ of estimated maximum heart rate ($M=6.5$ minutes, $SD=5.7$). On average, participants perceived their level of exertion as "very hard" (Borg score $M=16.7$, $SD=2.4$).

Conclusion

This pilot study provides evidence that endurance stair climbing represents an alternative form of moderate-to-vigorous intensity exercise, as characterized by percent of estimated maximum heart rate and perceived level of exertion. Elite athletes achieved vigorous intensity activity levels for a greater duration than did novices, although a larger scale study is needed to confirm this trend. Next steps include assessing the health benefits of sustained daily stair climbing across the continuum of age and baseline activity level.

467 Board #305 May 29 11:00 AM - 12:30 PM
Ankylosing Spondylitis: How Important is Exercise as Part of Management

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INTRODUCTION: Ankylosing Spondylitis (AS) is an autoimmune disease characterised by chronic inflammation of the sacroiliac joints and axial spine. The body's immune response to chronic inflammation initiates calcification and excessive bone formation causing structural joint damage and spinal fusion subsequently restricting mobility. AS has a 3:1 male-to-female ratio and symptoms typically appear at 15 - 45 years of age. Current treatment involves both pharmacological and non-pharmacological therapy. **PURPOSE:** To identify the role of exercise as part of the treatment plan in AS patient. **METHODS:** Investigate and summarise current knowledge on recommended practice points, frequency, intensity, time and type of exercise as well as progression of an exercise program, in AS patients. **RESULTS:** Current literature indicates the importance of exercise as part of treatment with pharmacological agents is aimed to delay progression of disease, relieve pain, minimise inflammation, maintain function and improve quality of life. Recommended practice points include a professional team with: knowledge of continual patient assessment and monitoring, realisation of complications, understanding complex exercise and pathology interactions, and a practical approach to the exercise setting that will encourage and motivate patients. The main long-term therapeutic goals should be: posture, mobility and respiratory function. Four key elements of the FITTPro Principle (frequency, intensity, time, type and progression) is recommended in exercise prescription. An AS exercise program of 5 days/week, for 30 minutes/day is advised. It generally consists of daily range of motion (ROM), aerobic-, breathing- and strengthening exercises 1-3 times/week. The type of exercises should fit the patient's profile e.g. hydrotherapy is beneficial, but contact sports should be avoided. **CONCLUSIONS:** Individualised continual assessment and exercise prescription with the emphasis on spinal mobility, ROM, muscle strengthening and cardiorespiratory fitness to improve balance, coordination and fitness are an important part of the management plan. Continuous disease modifying treatment including anti-TNF α therapy combined with regular exercise prescription confers additional benefit to pharmacological therapy alone.

A-57 Exercise is Medicine®/Poster - EIM On Campus, Children, Adolescents, EIM and Physicians

Wednesday, May 29, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

468 Board #306 May 29 11:00 AM - 12:30 PM

Exercise Is Medicine On Campus: A Survey Of Opinions And Attitudes

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Exercise is Medicine (EIM) is a global joint initiative between the American Medical Association (AMA) and the American College of Sports Medicine (ACSM). West Chester University (WCU) is recognized by the ACSM as an EIM-On Campus which indicates that WCU is a campus that is actively trying to engage the campus community in physical activity. **PURPOSE:** The purpose of this study was to gauge opinions and attitudes related to EIM Day at WCU—a first-time event launched at the campus. This event was hosted by the College of Health Sciences (CHS) at WCU and included participation from all six departments in the CHS, faculty and staff across campus, alumni, and community stakeholders.

METHODS: Forty participants (11 male, 29 female) ($M_{age} = 27.5$, $SD=12.16$) who visited the event responded to an exit program evaluation survey. **RESULTS:** Descriptive results from Likert scale data (1=not at all - 5=very much) indicated that participants reported high levels of enjoyment related to the event ($M_{enjoyment}=4.6$, $SD=0.78$). They also reported that they found the event largely beneficial for improving their physical activity and nutritional habits ($M_{helpfulPA}=4.4$, $SD=0.97$; $M_{helpfulNutrition}=4.3$, $SD=0.99$). Participants also expressed strong intentions to revisit the event in the future ($M_{futurevisit}=4.7$, $SD=0.75$). Additional Bayesian analysis also suggested that in comparison to their male counterparts ($M=3.75$, $SD=1.28$), female participants ($M=4.67$, $SD=0.51$) found the event significantly ($p < .05$) more helpful for improving their nutritional habits. Of the motives for participation, 87.5% of the participants reported that they participated because they expected the event to be fun. Finally, with regards to participants' recommendations two themes emerged from the qualitative content analysis: (1) additional activities to include in the event and, (2) greater variety of food and beverage options to offer throughout the event. **CONCLUSIONS:** These results suggest that individuals that participated in this first-time event evaluated it highly favorably and found it beneficial for improving important health behaviors. Future research needs to explore the effectiveness of these initiatives and advance recommendations to further increase their impact.

469 Board #307 May 29 11:00 AM - 12:30 PM

Exercise Is Medicine On Campus Program Comparisons: A Descriptive Study

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PURPOSE: The purpose of this study was to describe the client experience and program characteristics of existing Exercise is Medicine® on Campus (EIM-OC) programs. **METHODS:** A 49-question survey was emailed to all campuses with registered EIM-OC teams. Participants were identified via ACSM Exercise is Medicine® on Campus advisor email list. Permission to send the survey was obtained from the EIM-OC Committee Chair and EIM-OC Program Manager. Frequencies were used to describe EIM-OC program characteristics.

RESULTS: Twenty-eight campuses responded to the survey. Approximately 80% of the responding campuses offer outreach activities and special events as part of EIM-OC programs. Other EIM-OC program options included peer-led programming (50%), referral program (38%), individualized programming (36%), and motivational interviewing (17%). Campuses with funded EIM-OC programs indicated that funding came from a Kinesiology-related department, Campus Recreation, Health Promotion/Wellness, Student Health Services, grants, student government associations and/or student clubs. Seven campuses (25%) indicated no funding source. Twelve of the 28 campuses are referring clients (~80% from student health or student counseling services) or directing clients (30% by campus recreation or an EIM-OC administrator) to a fitness setting (campus recreation in 75% of cases). In all cases, referred or directed clients include students, for whom EIM-OC programs are free. Some campuses also include faculty/staff or community members among referred/directed

clients. "Not meeting physical activity guidelines" was a reason for referral in all cases, with many campuses also reporting existing physical or mental conditions and obesity as reasons for referral. Referred or directed EIM-OC clients are offered some form of individualized programming (one-on-one, small or large group training) in 75% of cases, with the remaining 25% offering reduced gym or training fees or free fitness assessments. Twenty-one respondents (88%) indicated that EIM-OC programs provide new opportunities for students.

CONCLUSIONS: The results provide evidence of a variety of structures and activities involved in current EIM-OC programs, with anecdotal evidence of the benefits for student clients and leaders.

470 Board #308 May 29 11:00 AM - 12:30 PM

Implementation of Exercise is Medicine On Campus at the University of North Carolina - Chapel Hill

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PURPOSE: The University of North Carolina at Chapel Hill was recently registered as an Exercise is Medicine (EIM) campus. To enable effective and sustainable implementation of EIM within Campus Health, the purpose of the current study was to anonymously survey students and determine: current exercise behavior, barriers and motives, interest in receiving exercise advice and by whom, and appropriate methods of communication. **METHODS:** 500 surveys were distributed in Campus Health services between January-April 2018. **RESULTS:** The 407 responders were evenly distributed among college status (20% Freshman, 21% Sophomore, 16% Junior, 17% Senior, 23% Graduate Student, 3% Post-Doc). Time was the biggest barrier to exercise (57%). More than half wanted to receive guidance about exercise (48% Agree, 10% Strongly Agree), and agreed they would be more likely to exercise if they were given advice about exercise (46% Agree, 11% Strongly Agree). Students wanted a referral to an exercise professional (41%), and to receive initial advice and communicate through email (56%). **CONCLUSIONS:** Students attending Campus Health are interested in receiving exercise guidance and, following a referral, this advice should be delivered by trained exercise professionals, e.g., the Exercise and Sport Science Department. Findings from this study will be used to implement a full trial in Counseling and Psychological Services.

471 Board #309 May 29 11:00 AM - 12:30 PM

Exercise Is Medicine On Campus In The Curriculum

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All universities should promote physical activity (PA) on campus to make PA a part of campus culture. Kinesiology departments can promote PA for cardiorespiratory health by offering a simple walking class. Studies indicate that even a low-volume walking program can yield cardiovascular benefits. **PURPOSE:** To determine the impact of a seven week walking course on cardiovascular health in college students. **METHODS:** Six college students (1=M; 5=F) enrolled in a walking class offered in Fall 2018. Five students completed the course. The 50 minute class met twice per week for seven weeks and students walked a minimum of 40 minutes each class period. An estimated VO_{2max} was determined for each student during the first class meeting using the Rockport 1-Mile walk test. Following the seven week course, students completed another Rockport 1-Mile walk for VO_{2max} estimation. Pre-test and post-test estimated VO_{2max} results were compared. **RESULTS:** All students showed improvements in estimated VO_{2max} . Mean estimated VO_{2max} for all students pre-intervention was 47.11 ($ml/kg/min \pm 8.44$) with a post-intervention mean of 42.06 ($ml/kg/min \pm 10.13$). Paired t -tests identified significant improvement in estimated VO_{2max} ($\mu=3.89ml/kg/min \pm 1.76$ $p=0.008$). Female mean estimated VO_{2max} improved significantly by 3.23 ($ml/kg/min^{-1}$ $p=.010$). **CONCLUSION:** Introducing PA courses as simple as walking to the campus course curriculum may yield improved cardiovascular health in college students. Kinesiology departments are encouraged to offer PA courses promoting Exercise is Medicine On Campus.

472 Board #310 May 29 11:00 AM - 12:30 PM
Exercise is Medicine on Campus 2018 Expanding EIMOC Programming Across a Branch Campus Network

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PURPOSE: Pennsylvania State University has been promoting Exercise is Medicine on Campus (EIMOC) since 2010 and has expanded the year-round program to include events, student and employee-focused initiatives, numerous on- and off-campus partnerships, and more. A recent focus of the EIMOC program has been expansion to other Penn State campus locations. As a University, Penn State operates 24 campuses throughout the state, with over 84,000 undergraduates enrolled. The wide array of locations, sizes, and educational foci present opportunities and challenges as EIMOC at Penn State attempts to expand beyond its founding campus. **METHODS:** The central EIMOC program conducts year-round activities the main campus, while providing assistance and guidance to commonwealth campuses when appropriate. Several times per year the EIMOC team travels to commonwealth campuses to assist on-site in the development and execution of EIMOC commonwealth programs, in partnership with local EIMOC committees at each campus. Program components are adjusted based on campus location, setting, size, partners, and available funding. Counts are conducted at each event for participation and engagement, lessons learned are reviewed to ensure the successful progression and expansion of future initiatives. Reviews are shared with other campuses to inform program development. **RESULTS:** EIMOC at Penn State has expanded to six commonwealth campuses, with four locations earning official EIMOC recognition. In 2017, Penn State University Park, the largest undergraduate campus earned Gold, Penn State Berks and Harrisburg both earned Silver, and Penn State Hershey School of Medicine earned Bronze. Three other campuses are currently pursuing official EIMOC status. Larger campuses benefited from higher levels of available resources and partnerships, though struggled spreading awareness. Smaller institutions had greater success with awareness and engagement, though had smaller scopes. Additional differences were noticed between rural and urban settings. **CONCLUSIONS:** The current study offered insights on the challenges and successes in leveraging a large university network to expand EIMOC programming across a diverse array of campuses. EIMOC programming has proven successful across a broad range of campus settings and sizes.

473 Board #311 May 29 11:00 AM - 12:30 PM
Exercise And Adiposity In Overweight And Obese Children And Adolescents: A Network Meta-analysis

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Overweight and obesity are major public health problems among children and adolescents. However, the effects of different types of exercise on adiposity are not well established. **PURPOSE:** Use the network meta-analytic approach to determine the effects of different types of exercise (aerobic, strength training, or both) on adiposity in overweight and obese children and adolescents. **METHODS:** Direct and indirect randomized exercise intervention trials ≥ 4 weeks that were published in any language up to June 16, 2018 and assessed body mass index (BMI) in kilogram-meters-squared, fat mass (kg), or percent body fat in overweight and obese children 2-18 years of age were eligible. Studies were retrieved by searching seven electronic databases, cross-referencing, and expert review. Dual selection and data abstraction were conducted. Results were pooled using random-effects, restricted maximum likelihood models. Surface under the cumulative ranking curves (SUCRA) were used to establish a hierarchy of exercise interventions (aerobic, strength, both). A two-tailed alpha value ≤ 0.05 and non-overlapping 95% confidence intervals were considered statistically significant. **RESULTS:** Fifty-seven studies representing 127 groups (73 exercise, 54 control) and up to 2,792 participants (1,667 exercise, 1,125 control) met the criteria for inclusion. Statistically significant reductions in BMI, fat mass, and percent body fat were observed in aerobic vs. control comparisons (BMI, mean, 95% CI, -1.0, -1.4 to -0.6; fat mass, -2.1, -3.3 to -1.0 kg; percent fat, -1.5, -2.2 to -0.9%) and combined aerobic and strength vs. control comparisons (BMI, -0.7, -1.4 to -0.1; fat mass, -2.5, -4.1 to -1.0 kg; percent fat, -2.2, -3.2 to -1.2%). A statistically significant reduction in percent fat was also found for strength vs. control comparisons (-1.3, -2.5 to -0.1%). Based on SUCRA results, combined aerobic and strength training was ranked first for improving both fat mass (kg) and percent body fat while aerobic exercise was ranked first for improving BMI. **CONCLUSIONS:** Combined aerobic and strength training is optimal for improving adiposity-specific outcomes in overweight and obese children and adolescents. Supported by AHA Grant 17GRNT33630158

474 Board #312 May 29 11:00 AM - 12:30 PM
Freshmen Physical Activity Habits And Senior Fitness Levels: Examining A Healthy Transition To College

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The years in post-secondary education are important for building healthy lifestyle habits to transfer into adulthood. Previous research has indicated that physical activity (PA) declines during the years of college, and Exercise is Medicine on Campus (EIMOC) programs are poised to help address this.

PURPOSE: To examine how freshmen exercise patterns and perceptions were related to fitness and physical activity in senior year of college at a large Northeastern university.

METHODS: A volunteer sample of university seniors (n=439) completed a fitness assessment (YMCA bicycle test) and an online survey which addressed their PA participation, freshman exercise perceptions and engagement in on-campus exercise opportunities. Pearson correlations examined the relationship between fitness and PA with freshman variables. T-tests examined differences in fitness and PA by freshman variables.

RESULTS: The sample was predominately male (n=254, 59.3%) and Non-Hispanic White (n=343, 78.4%). Many (n=232, 53%) reported being more active currently than in freshman year. Most (n=178, 52.7%) reported that they were well informed of campus exercise options, 28.5% (n=125) reported doing intramural sports and 10% (n=44) did club sports as freshmen. Current VPA was associated with being better informed of options for exercise on campus as a freshmen ($r=.11$, $p=.04$), campus fitness center membership as a freshmen ($p=.004$), and freshman club sport participation ($p=.004$). VO2max was associated with club sport participation as a freshman ($p<.001$). Challenges with time management (n=305, 85.4%) and lack of motivation (n=226, 63.6%) were frequent barriers to exercise as freshmen. Motivation challenges as a freshman was negatively associated with current VPA ($r=-.21$, $p<.001$) and VO2max ($r=-.19$, $p=.001$). Students indicated that programs partnering with an exercise buddy (n=255, 74.1%) or events around outdoor exercise/outings (n=179, 52%) would have been the most useful to motivate them as freshmen.

CONCLUSIONS: This study examined how exercise patterns and perceptions as a freshman were related to PA participation and fitness as a senior. Findings indicate the importance of developing EIMOC programs and strategies to specifically help freshmen transition to college campuses and engage in healthy behaviors.

475 Board #313 May 29 11:00 AM - 12:30 PM
Physical Play with Children Predicts Better Hematological Health; Hematological Health Predicts Cognitive and Behavioral Development

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More than half of all Ugandan children under the age of 5 are anemic. The consequences of anemia are amplified during this period as it is critical to cognitive and physical development. Adequate physical play may bolster hematological health, and in turn cognitive and behavioral development, but this has not been previously explored. **PURPOSE:** Examine the effect of play on serum hemoglobin (Hb) among children under the age of 5 in Uganda, and to test the effect of Hb on cognitive and behavioral development. **METHODS:** We analyzed the 2016 Demographic Health Surveys of Uganda, Children's Records dataset. Anemia testing was performed on children age 6-59 months whose parents or guardians consented (N=3,944). Hb levels were collected to determine the incidence and severity of anemia. Children with Hb ≥ 11 g/dL were not considered anemic. Multiple linear regression was used to identify the effect of physical play with parents on Hb. Logistic regression analyses were used to test the effect of Hb on the odds that children were developing literacy and appropriate behaviors. **RESULTS:** On average, children were 31.3 ± 15.6 months old and had 10.9 ± 1.61 g/dL of Hb; 54.6% were anemic. Holding constant the mothers' height and weight, the child's age, height, and weight, and the region (controlling for differences in culture, geography, and altitude), if the mother or father played with their children, the children's Hb was elevated by 0.14 g/dL ($p=0.019$); if the mother smoked, the children's Hb decreased by 0.3 g/dL ($p=0.036$). Holding constant the child's age, height, and weight, increased Hb associated with increased odds of behaving appropriately around other children ($\beta=0.38$; $p=0.001$), being capable of performing tasks independently ($\beta=0.13$; $p=0.036$), being able to read and count to 10 ($\beta=0.19$; $p=0.002$), being able to read at least 4 words ($\beta=0.31$; $p<0.001$), and being able to identify at least 10 letters ($\beta=0.32$; $p<0.001$). **CONCLUSIONS:** In a sample of children from Equatorial Africa, physical play with parents predicted elevations in Hb.

In turn, elevated Hb predicted more advanced cognitive and behavioral development. Implementing physical activity in parent-child interactions may have value as a primary prevention for anemia and it may also help advance the child's growth and maturation.

476 Board #314 May 29 11:00 AM - 12:30 PM
Health/Fitness Assessments of Resident Physicians by Exercise Science Interns - Exercise Prescriptions and Follow-Up Measures

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Resident physicians' postgraduate training and fitness status are important predictors of their decision to provide physical activity (PA) counseling to their patients. Providing instruction about these topics within medical education may improve residents' health/fitness outcomes and increase the likelihood of residents providing PA counseling to their patients. **Purpose:** To assess the health/fitness status of resident physicians during a healthy lifestyle rotation. **Methods:** We measured 187 resident physicians' health/fitness status for one required assessment and two optional follow-up assessments that were on average, 9.5 months apart. Residents learned their results, received an exercise prescription, and were supported by an Exercise Science Student Trainer during one PA session. Residents could then exercise independently at an employee only fitness facility, elsewhere, or not at all. **Results:** The mean age of the sample was 28.07 ± 1.99 yrs. All baseline measures indicated residents were in a healthy (good to above average) range for males ($n = 110$) and females ($N = 77$). T-tests were used to evaluate the waist circumference of residents who completed assessments 1 and 2 ($n=55$). Waist circumference increased from 78.7 ± 32.1 cm to 84.3 ± 33.7 cm ($p<.05$). No other measures (BMI, body fat, VO_2max , RHR, SBP, DBP, push-up, plank, and sit and reach) were significantly different. ANOVA was used to evaluate those who completed three assessments ($n=18$). This group experienced an increased BMI (23.9 ± 3.51 kg/m², 24.27 ± 4.11 kg/m², 24.56 ± 3.71 kg/m²; $p<.05$) and body weight (73.14 ± 15.74 kg, 74.05 ± 18.1 kg, 76.90 ± 17.23 kg; $p<.05$). No other measures were significantly different. **Conclusion:** Few residents participated in more than the mandatory assessment. Those who volunteered for follow-up demonstrated increases in weight-related measures and no improvement in health/fitness outcomes. Additional supports for residents to participate in PA, achieve or maintain a healthy weight, and maintain or improve health/fitness outcomes is needed to positively influence these factors and increase the likelihood of resident physicians promoting PA to their patients.

477 Board #315 May 29 11:00 AM - 12:30 PM
Examining the Effects of Exercise Referral Schemes on Changes in Physical Activity Levels.

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Exercise referral within the United Kingdom (UK) offers individuals an opportunity to take part in physical activities in a non-clinical environment, yet gain clinical health benefits. Referral schemes focus on improving health outcomes, including increased physical activity (PA), of medically referred individuals. However, inconsistencies have been found within the literature reviewing impact of exercise referral on improving PA levels. **PURPOSE:** To determine if exercise referral schemes (ERS) influence change in PA levels amongst individuals across the UK. **METHOD:** Data were obtained from 5246 participants (53 ± 15 years; 68% = female) who attended 12 different ERSs. Participants self-reported IPAQ scores pre- and post- scheme completion to determine if exercise referral had any impact on PA levels. Schemes were 12 weeks in length and situated in leisure environments including gyms, leisure centres and community halls, throughout the UK. Exercise prescriptions consisted of both aerobic and resistance training. Two-stage individual patient data meta-analysis was performed separately on the pre-ERS, and on the change scores (post- minus pre-ERS scores), for metabolic equivalent (MET)-minutes per week; analysis was chosen due to data being hierarchical and accounting for clustering at scheme level. **RESULTS:** Analyses were conducted on the continuous data collected through the IPAQ. For pre-ERS MET-minutes the estimate from random effects model was 1183 MET-minutes per week [911 to 1457], $p<.0001$). For ERS change, the estimate from random effects model for was 666 MET-minutes per week [385 to 948], $p<.0001$). Significant heterogeneity was evident among the schemes ($Q_{(11)} = 162.22$, $p<.001$; $I^2 = 97.71\%$). Considering the estimate for pre-ERS MET-minutes (1183 MET-minutes), the estimate for change in MET-minutes could be considered meaningful, as it would result in participants moving from the 'moderate' to 'high' category for PA. **CONCLUSION:**

This change in PA represents greater reductions of risks of specific physical inactivity-related conditions, such as obesity and type 2 diabetes. The results showed meaningful change in MET-minutes, which resulted in participants moving from 'moderate' to 'high' on the IPAQ, suggesting that a scheme length of 12 weeks is sufficient for changing PA levels.

478 Board #316 May 29 11:00 AM - 12:30 PM
Low Usage of Physical Activity Related Diagnostic Codes Among Indiana Medical Providers

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The National Academy of Medicine and "Exercise Is Medicine®" recommend physicians routinely advise patients about physical activity (PA) and, when needed, refer to PA support to improve patient and population health. Uptake of these recommendations has been slow. Knowledge of diagnostic codes for billing may influence provider behavior. The Indiana Health Information Exchange (IHIE) connects more than 100 healthcare entities and 40,000 providers for >18 million patients, with >10 billion clinical data elements. **Purpose:** To document ICD-9 and ICD-10 PA-related billing code use for "Lack of Physical Exercise" and "Physician Exercise Counseling". **Methods:** We searched IHIE for PA-related ICD-9 and ICD-10 codes and comorbidity codes from 01/01/94 through 04/24/18. **Results:** PA-related ICD codes were used for 54,543 patients, but <10% (5,221) were used for adults. Fewer occurrences were in adult patients with common chronic diseases that could be improved through PA (Table 1).

Table 1	Total Patient Count	"Lack of Physical Exercise"		"Exercise Counseling"	
		ICD-9 V69.0	ICD-10 Z72.3	ICD-9 V65.41	ICD-10 Z71.82
All Patients	54,543	993	357	52,317	1,104
Adults Only	5,221	607	329	3,970	382
Comorbidities of 5,221 Adults – ICD Code Use within 1 Year of PA-Related Code					
	Adults	"Lack of Physical Exercise"		"Exercise Counseling"	
Condition		ICD-9 V69.0	ICD-10 Z72.3	ICD-9 V65.41	ICD-10 Z71.82
Type 2 Diabetes	821	160	97	515	60
Hypertension	1,577	299	73	1,217	<10
Insomnia	392	58	38	275	21
Osteoarthritis	611	134	77	380	27
Osteoporosis	116	38	22	53	<10
BMI 25.0-29.9	104	<10	24	54	28
BMI 30.0-34.9	284	<10	19	167	109
BMI 35.0-35.9	352	12	22	177	155
BMI 40-49.9	425	20	19	219	173
BMI > 50	163	12	<10	87	57

Discussion: Low use of PA-related ICD codes may be due to a lack of awareness of existing codes. Physician education regarding PA-related ICD codes may increase physician counseling, code usage and possibly referral to PA resources.

- 479** Board #317 May 29 11:00 AM - 12:30 PM
Making Strides Towards Health: Expanding Physician-led Walking Groups In The Community
 Alexa Namba, Adeola Awodele, Cherie Conley, Sarah McMahon, Jaehan Yi, Amy Zhao, Janet Bettger. *Duke University, Durham, NC.*
 Email: alexa.namba@duke.edu
 (No relevant relationships reported)

While healthy lifestyle modification is often the first line recommendation to treat and prevent chronic disease, physicians inconsistently provide patients with guidance and resources to ensure appropriate physical activity participation. **PURPOSE:** To increase physical activity among patients, this project aimed to expand a physician-led walking program from a single clinic to a community-based partnership for broader reach. **METHODS:** The originally developed Walk with a Doc (WwaD) program was established in a family medicine clinic. Patients were referred to attend the monthly program during clinical encounters. The four phases of the IHI Scale-up Framework were applied to (1) examine the existing program (provider buy-in for walking prescriptions, rate of referral, and patient participation and satisfaction); (2) define a scalable program; (3) test the new context for scale-up (validate feasibility, utility and acceptability); and (4) plan to go to full scale. **RESULTS:** The WwaD program had 82 unique patients participating over 36 months of implementation with 15 providers making referrals to the walking program and 100% participant satisfaction. A landscape assessment of available parks and trails was completed and locations were geospatially mapped to examine distance from outpatient clinics. In partnership with the city's Parks and Recreation department, new walking program sites were identified to leverage "healthy mile" trails in local neighborhoods with existing clinics. Site surveys confirmed clinic patients' and providers' interest, and trail safety and accessibility. The scalable program was defined to include a walking prescription and referral to the program, program reminders for the patient, and use of the city's designated healthy mile trails. Pre-health students were incorporated to improve the ratio of program leads to patients, improve participant satisfaction, and to build student volunteers' understanding of exercise is medicine and interdisciplinary competencies for future health professions careers. **CONCLUSION:** Leveraging the commitment to shared goals for increased physical activity, we developed a scalable walking program with integrated clinical, academic and community resources in a mutually beneficial partnership to improve patients' health and well-being.

- 480** Board #318 May 29 11:00 AM - 12:30 PM
Translating Physical Activity Evidence into Exercise Medicine the Moving Medicine Project, UK
 Kush Joshi¹, Natasha Jones², Hamish Reid², Ralph Smith², Rebecca Robinson³. ¹Homerton University Hospital, London, United Kingdom. ²Oxford University Hospitals, Oxford, United Kingdom. ³Sheffield University Hospitals, Sheffield, United Kingdom. (Sponsor: Kathryn Schmitz, FACSM)
 (No relevant relationships reported)

Moving medicine is a novel interactive information resource in UK healthcare. This initiative from the Faculty of Sport and Exercise Medicine was developed in partnership with Public Health England and Sport England. **PURPOSE** The UK's pandemic levels of physical inactivity are associated with high mortality and morbidity. Despite overwhelming evidence supporting the role of physical activity (PA) in management of non-communicable chronic disease, knowledge, skills, time and healthcare professionals (HCP) confidence limit PA promotion across healthcare environments. This integrative digital resource was developed to empower HCPs to give PA advice. The resource provides an evidence-based approach to facilitate interaction and behaviour change. **METHODS** Using a knowledge into action framework this interactive tool was developed in a 2-step process. 1. Knowledge creation Literature reviews defined the evidence and expert working groups were recruited across 9 NCD streams, undertaking narrative reviews, refining evidence in clinical context. 2. Action cycle Delphi study and behavioural change framework analysis underpinned an iterative development process to create action cycles in a time based framework. **RESULTS** Moving Medicine was launched successfully in October 2018 by the UK Secretary of State for Health, headlining this flagship set of resources that champion physical activity as a powerful tool to change behaviour and improve the trajectory of chronic disease. Formal evaluation will follow the initial launch and delivery phase. **CONCLUSION** High levels of professional engagement and early positive feedback indicate Moving Medicine is an acceptable, adaptable novel tool supporting HCPs to engage patients with meaningful conversations about PA. Formal analysis will add to this knowledge and inform transferability across healthcare environments. Further steps for development are projected to include online modules on prescribing movement, educational resources and an active hospital toolkit. Moving Medicine welcomes international collaboration and is open access and free to use at www.movingmedicine.ac.uk.

- 480b** Board #319 May 29 11:00 AM - 12:30 PM
Tennis Players Enjoy Better General, Physical, Social and Mental Health: A Survey of 10,380 United States Tennis Association Leagues Players Using Norm-Based SF-36 Scores
 Jared C. Tishelman, Daniel Bu, James Gladstone, Alexis Colvin. *Icahn School of Medicine at Mount Sinai, New York, NY.*
 (No relevant relationships reported)

PURPOSE: The purpose of this study is to characterize the general, physical, social and mental health of USTA members using validated SF-36 outcomes domains in reference to the general population.

METHODS: A modified SF-36 version 1.0 was administered to USTA members via online form. The following patient variables were included: Age group (18-29, 30-39, 40-49, 50-59, 60-69, 70-79, 80+), days of tennis per week, self-reported ability, National Tennis Rating Program (NTRP) score, smoking status, BMI and sex. The following SF-36 outcomes domains were included for analysis: Physical Functioning (PF), Role Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Role Emotional (RE), Mental Health (MH). Physical Component Summary (PCS) and Mental Component Summary (MCS) scores were calculated. Norm-Based Scores (NBS) were computed for these domains using an algorithm provided by Optum Health (Eden Prairie, MN); general population mean of 50; standard deviation of 10.

RESULTS: 10,380 USTA leagues members responded and completed the modified SF-36 questionnaire. 63% of respondents were female, the average BMI of the cohort was 24.88±4.17 and 97.7% reported that playing tennis helps them manage their health. For all Norm-based SF-36 domains, USTA athletes scored higher than the general population (mean = 50). Multivariate comparisons revealed higher SF-36 outcomes scores for younger athletes (all SF-36 domains, p<0.001), and more frequent players (all domains, p<0.001). Elite tennis players (NTRP>4) scored higher for the PF domain than those with less advanced tennis skills. Female tennis players reported higher BP, GH, PCS scores and lower BMI (All p<0.002). Elderly tennis players (age > 70) scored worse for PF, RP, GH, VT, SF, RE, and MH domains for the SF-36 (p<0.001). Additionally, patients who reported playing more than 3 days per week scored higher in all categories (all p<0.003).

CONCLUSIONS: USTA members enjoy above average general, physical, social and mental health scores. Patients with a higher level of skill have higher physical functioning. Younger tennis players and athletes who competed more than 3 occasions per week scored higher in all SF-36 domains than those who were older and played less, respectively.

B-07 Thematic Poster - Blood Flow

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-101A

517 Chair: Kyra E. Pyke. *Queen's University, Kingston, ON, Canada.*

(No relevant relationships reported)

518 Board #1 May 29 1:00 PM - 3:00 PM
Imaging Transcranial Doppler: A Novel Approach to Assess Cerebral Blood Flow
Catherine L. Jarrett¹, Katherine L. Shields¹, Ryan M. Broxterman¹, Soung Hun Park¹, Jayson R. Gifford², Russell S. Richardson¹. ¹University of Utah, Salt Lake City, UT. ²Brigham Young University, Provo, UT.
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(No relevant relationships reported)

Cerebral blood flow is commonly assessed in the middle cerebral artery (MCA) as blood velocity, using non-imaging transcranial Doppler ultrasound (TCD). However, to accurately determine blood flow, both blood velocity and vessel diameter are critical components, and there is mounting evidence that the MCA is vasoactive. **PURPOSE:** Therefore, the purpose of this study was to employ imaging TCD (ITCD), utilizing color flow and pulse wave velocity, as a novel approach to measure both MCA blood velocity and diameter to quantify cerebral blood flow. **METHODS:** ITCD was performed at rest in 9 healthy participants (7M/2F; 29±5 yrs) with sublingual nitroglycerin (NTG, 0.8mg) and without (CON). Measurements were taken for 2 minutes prior, and for 5 minutes following NTG or sham delivery (CON). **RESULTS:** There was a 6-fold fall in MCA blood velocity in response to NTG ($\Delta -4.8 \pm 4.2$ cm/s) compared to negligible fluctuations in CON ($\Delta -0.81 \pm 2.5$ cm/s). MCA diameter increased much more in response to NTG ($\Delta 0.17 \pm 0.02$ cm) compared to the basal variation in CON ($\Delta 0.01 \pm 0.04$ cm). Interestingly, the product of this NTG-induced fall in MCA blood velocity and increase in MCA diameter was a significant increase in blood flow following NTG ($\Delta 159 \pm 59$ ml/min) compared to CON ($\Delta 24 \pm 46$ ml/min). **CONCLUSIONS:** These juxtaposed data highlight the importance of measuring both MCA blood velocity and diameter when assessing cerebral blood flow and document ITCD as a novel approach to achieve this goal. Supported by the Veterans Administration Rehabilitation Research and Development Service (E6910-R, E1697-R, E1433-P, E9275-L and E1572-P).

519 Board #2 May 29 1:00 PM - 3:00 PM
Arm Circumference As A Method To Standardize The Practical Blood Flow Restriction Pressure

Scott J. Dankel¹, J Grant Mouser², Takashi Abe¹, Zachary W. Bell¹, Samuel L. Buckner³, Kevin T. Mattocks⁴, Matthew B. Jessee⁵, Jeremy P. Loenneke¹. ¹The University of Mississippi, University, MS. ²Troy University, Troy, AL. ³The University of South Florida, Tampa, FL. ⁴Lindenwood University-Belleville, Belleville, IL. ⁵University of Southern Mississippi, Hattiesburg, MS.

(No relevant relationships reported)

Practical blood flow restriction training using elastic cuffs is gaining popularity. A criticism of this method is that the pressure applied and the amount of blood flow restriction induced is difficult to quantify. **PURPOSE:** To quantify blood flow following the application of an elastic-cuff and compare that to what is observed using a more traditional pressurized nylon-cuff. **Methods:** 35 participants visited the laboratory once for testing. In a randomized order (one condition per arm), an elastic-cuff (5cm wide) was applied to one arm and blood flow was measured following the cuff being pulled to two distinct lengths; 110% (low pressure) and 120% (high pressure) of the individuals resting arm circumference. The other arm followed a similar protocol but used a pressurized nylon-cuff (5cm wide) inflated to 40% (low pressure) and 80% (high pressure) of the individuals resting arterial occlusion pressure. **RESULTS:** There was a main effect of pressure ($p < 0.001$) with blood flow decreasing from resting in a pressure dependent manner as follows: low pressure: -27.3 (95% CI: -39.5, 15.1) mL/min and high pressure: -47.2 (95% CI: -64.5, -29.9) mL/min. The mean difference (95% CI) in blood flow between cuffs at a given pressure was -5.9 (-18.9, 7.0) % for the lower pressure and -4.0 (-13.2, 5.1) % for the higher pressure. When the relative changes for each cuff were separated by sex, there were no differences in the changes from Pre. The relative difference (95% CI) between sexes were as follows: -5.3 (-23.5, 12.9) % for the nylon cuff inflated to a low pressure, -1.6 (-20.1, 16.8) % for nylon cuff inflated to a high pressure, 6.5 (-13.3, 26.3) % for the elastic pulled to a low pressure, and -4.5 (-24.2, 15.1) % for the elastic cuff pulled to

a high pressure. **CONCLUSIONS:** Our results indicate that an elastic cuff pulled to 110% and 120% of resting arm circumference decreases brachial artery blood flow in a pressure dependent manner. These pressure dependent decreases in blood flow were similar to that observed when a pressurized nylon cuff was inflated to 40 and 80% of the individuals resting arterial occlusion pressure. The application of a pressure relative to the initial cuff length, which is largely dependent upon arm circumference, appears to provide one method to standardize the practical blood flow restriction pressure for future research.

520 Board #3 May 29 1:00 PM - 3:00 PM
Exercise Intensity and Middle Cerebral Artery Dynamics in Humans

Emily Witte¹, Yumei Liu¹, Jaimie L. Ward¹, Katie S. Kempf¹, Alicen Whitaker¹, Eric D. Vidoni², Jesse C. Craig³, David C. Poole, FACSM³, Sandra A. Billinger¹. ¹University of Kansas Medical Center, Kansas City, KS. ²University of Kansas Alzheimer's Disease Center, Fairway, KS. ³Kansas State University, Manhattan, KS.

(No relevant relationships reported)

Understanding the middle cerebral artery dynamic response during different exercise intensities is vital for understanding brain health and designing and evaluating exercise strategies for maximizing therapeutic potential. However, whether there is an interaction between exercise intensity and cerebrovascular kinetics is unknown. **PURPOSE:** To characterize mean middle cerebral artery blood flow velocity (MCAv) kinetics associated with two exercise work rates: low and moderate. We tested the hypotheses that increasing work rate would increase the MCAv amplitude and that age and estimated maximal oxygen uptake ($\dot{V}O_{2max}$) would be related to the MCAv amplitude. **METHODS:** Baseline values were collected for 90-seconds followed by a 6-minute exercise bout on a recumbent stepper. Heart rate, end tidal CO_2 ($P_{ET}CO_2$), beat-to-beat blood pressure, and MCAv were recorded at rest and during exercise. The MCAv kinetics response for participants from baseline (BL) was described by the response amplitude (Amp), time delay (TD), and time constant (τ). **RESULTS:** Sixty-four adults completed the low and moderate intensity exercise transitions. MCAv Amp increased from rest as a function of work rate, low and moderate intensity, respectively, (11.8 and 14.7 cm/s; $p < 0.001$) while no difference between work rates were observed in either TD (43.5 and 45.8 s; $p = 0.65$) or τ (35.2 and 31.4 s; $p = 0.47$). Age showed a moderate, negative association with MCAv Amp ($r = -0.40$ and $r = -0.42$; $p < 0.01$). Higher estimated $\dot{V}O_{2max}$ demonstrated a moderate, positive correlation with MCAv Amp ($r = 0.41$ and $r = 0.50$; $p < 0.01$). **CONCLUSION:** Moderate intensity exercise induced a greater MCAv response amplitude compared to low intensity exercise. The amplitude of the initial MCAv response for both exercise intensities increased systematically with work rate whereas the TD and τ kinetics parameters were invariant. Therefore, the possibility exists that the cerebrovascular system may have protective mechanisms in place to avoid the more rapid responses as seen in skeletal muscle, however more work is needed to address this hypothesis. Finally, although the MCAv Amp declines with age, maintaining higher cardiorespiratory fitness may benefit the cerebrovascular response to exercise.

521 Board #4 May 29 1:00 PM - 3:00 PM
The Influence of a High Sodium Meal on Cerebrovascular Reactivity

Kamila U. Migdal¹, Austin T. Robinson¹, Joseph C. Watso¹, Matthew C. Babcock¹, Jorge M. Serrador², William B. Farquhar, FACSM¹. ¹University of Delaware, Newark, DE. ²Rutgers University, Newark, NJ.

(No relevant relationships reported)

Single high sodium (Na^+) meals transiently reduce peripheral blood vessel function in humans. Rodent models demonstrate that high dietary Na^+ intake reduces middle cerebral artery (MCA) function. Cerebrovascular reactivity (CVR) to carbon dioxide (CO_2) is a validated method for assessing the cerebrovasculature in humans. However, the effects of a single high dietary Na^+ meal on CVR in humans is unknown. **PURPOSE:** We tested the hypothesis that a single high- vs low- Na^+ meal impairs CVR in young adults. **METHODS:** Nineteen healthy, normotensive adults (9M/10F; age: 26 ± 4 yrs; BMI: 23.6 ± 5.1 kg/m²; BP: $105 \pm 9/58 \pm 6$ mmHg, mean \pm SD) participated in this crossover design study. We provided participants with high- (HS: 1,495 mg) and low- (LS: 138 mg) Na^+ meals in randomized order. Visits were separated by one week for males. We tested females in the early follicular phase of their menstrual cycle. Transcranial doppler of the right MCA was assessed while participants lay supine. Serum Na^+ and CVR (% Δ MCA velocity/ ΔCO_2) to high CO_2 (hypercapnia) and low CO_2 (hypocapnia) were measured prior to-, 30 minutes post- and 60 minutes post-meal. Data were analyzed using two-way repeated measures ANOVA (meal x time). Tukey post hoc comparisons were used when appropriate. **RESULTS:** Serum Na^+ was elevated on the high- Na^+ meal at 30- (HS=141.2 \pm 0.3 vs LS=140.0 \pm 0.5 mmol/L, $p < 0.01$) and 60-minutes post meal (HS=141.7 \pm 0.8 vs LS=140.2 \pm 0.6 mmol/L, $p < 0.001$). Hypercapnia increased MCA velocity from baseline at 30- (HS=29 \pm 1 vs

LS=28±1%) and 60- (HS=27±1 vs LS=29±1%) minutes post meal without an effect of the meal ($p>0.05$). Hypocapnia decreased MCA velocity from baseline at 30- (HS=43±4 vs LS=45±4%) and 60- (HS=47±3 and LS=45±4%) minutes post meal without an effect of the meal ($p>0.05$). Despite elevated serum Na^+ , the HS meal did not alter CVR to hypercapnia (30min: HS= $\Delta 0.03 \pm 0.21$ vs LS= $\Delta 0.19 \pm 0.22$ %/mmHg; 60min: HS= $\Delta 0.08 \pm 0.20$ vs LS= $\Delta 0.16 \pm 0.21$ %/mmHg, $p>0.05$). Additionally, CVR to hypocapnia was not different between the two meals (30min: HS= $\Delta 0.15 \pm 0.08$ vs LS= $\Delta 0.08 \pm 0.12$ %/mmHg; 60min: HS= $\Delta 0.17 \pm 0.07$ vs LS= $\Delta 0.001 \pm 0.09$ %/mmHg, $p>0.05$). **CONCLUSION:** These preliminary data suggest that a high sodium meal does not acutely alter cerebrovascular reactivity in healthy young adults. Supported by: ACSM 17-00577 (KUM) and NIH Grant R01HL128288 (WBF)

522 Board #5 May 29 1:00 PM - 3:00 PM
The Effects of Prolonged Sitting on Cerebral Perfusion and Executive Function

Jade Blackwell¹, Quentin Willey¹, Bill Evans², Katie Burnet¹, Erik Hanson¹, Daniel Credeur³, Lee Stoner, FACSM¹. ¹University of North Carolina, Chapel Hill, NC. ²University of Maryland, College Park, MD. ³University of Southern Mississippi, Hattiesburg, MS. (Sponsor: Lee Stoner, FACSM) (No relevant relationships reported)

Purpose: Little is known about the effects of prolonged sitting on cerebrovascular function. We hypothesized intermittent calf raises (every 10min) would: (i) prevent venous pooling in the lower extremities; (ii) maintain cerebral perfusion; (iii) maintain executive function. **Methods:** 20 healthy, yet sedentary subjects (19-35 years old) were recruited to participate in two 3 hr sitting conditions: control (CON) and experimental heel-raise (HEEL) study. Cerebral perfusion (total haemoglobin, tHb) and tissue oxygenation (tissue saturation index, TSI) were measured using near-infrared spectroscopy (NIRS) and the Stroop-color test evaluated executive function. Measurements were made at 10, 90 and 170min. **Results:** There were non-significant time effects for cerebral tHb ($p=0.287$) and TSI ($p=0.923$); however, calf raises decreased tHb ($p<0.001$, $d=0.633$) but had no effect on TSI ($p=0.761$). There was a non-significant time ($p=0.641$) and condition ($p=0.083$) effect for the Stroop-color test. **Conclusion:** Intermittent calf raises prevent venous pooling in the lower extremities in healthy, yet sedentary young subjects, but do not improve cerebral perfusion or executive function.

523 Board #6 May 29 1:00 PM - 3:00 PM
Using Continuous And Interval Exercise To Manipulate Shear Rate Patterns In The Common Femoral Artery

Abigail L. Cook, Gemma K. Lyall, Karen M. Birch, FACSM. University of Leeds, Leeds, United Kingdom. (Sponsor: Karen M. Birch, FACSM) Email: bsaco@leeds.ac.uk (No relevant relationships reported)

Vascular shear rate (SR) assessed via ultrasound represents frictional force of blood flowing over the endothelium. Low and oscillatory shear confers a pro-inflammatory phenotype, whereas greater shear has an anti-inflammatory phenotype decreasing CVD risk. Exercise increases SR, however the impact of continuous (CON) and interval (INT) exercise upon the balance of antegrade (ANT) and retrograde (RET) SR and thus the oscillatory shear index (OSI) is unknown. **PURPOSE:** To examine the impact of acute CON and INT (no active recovery) exercise on SR patterns and OSI in the common femoral artery (CFA) during exercise. **METHODS:** 10 healthy individuals (25±3 years, n=5 male) underwent two work-matched exercise sessions (CON and INT) on a supine cycle ergometer at 125% lactate threshold. In each protocol repetitive ultrasound scans were taken of the CFA during a brief cessation in exercise to determine in-exercise shears. Flow mediated dilatation (FMD) was measured before and after exercise to assess acute changes in endothelial function. **RESULTS:** FMD did not differ after exercise in either protocol (CON: 9.9±8.1% vs 8.4±6.2%; INT: 9.1±5.9% vs 6.6±3.4%; $P>0.05$). ANT and RET SR reached a plateau in each protocol. Total ANT SR was lower in CON than INT (CON: 861540±291534 vs INT: 1955615±674594 s^{-1} ; $P<0.05$), however total RET SR did not differ between protocols (CON: 76625±89390 vs INT: 78126±78697 s^{-1} ; $P>0.05$). Peak and mean SR were similar in CON and INT, respectively (peak ANT: 1258±403 vs 1480±510 s^{-1} ; RET: 107±123 vs 108±75 s^{-1} ; $P>0.05$; mean ANT: 1171±372 vs 1358±469 s^{-1} ; RET: 61±81 vs 54±55 s^{-1} ; $P>0.05$). Mean and peak OSI were also similar in both types of exercise (peak CON: 0.07±0.08 vs INT: 0.08±0.06 AU; mean CON: 0.05±0.06 vs INT: 0.04±0.04 AU; $P>0.05$). No time was spent in pure oscillatory shear (>0.5 AU). **CONCLUSION:** During exercise matched for intensity and the duration of muscular work, using an INT approach ensured a similar OSI but a greater total ANT SR compared to CON. This would suggest that in the exercising limb INT exercise does not confer a negative oscillatory profile. **GRANT FUNDING:** Medical Research Council

524 Board #7 May 29 1:00 PM - 3:00 PM

Impact of a Brief Period of Uninterrupted Sitting on Cerebrovascular Hemodynamics

Raymond Jones¹, Dominique McArthur¹, Stephanie M. McCoy¹, Lee Stoner, FACSM², Daniel P. Credeur¹. ¹University of Southern Mississippi, Hattiesburg, MS. ²University of North Carolina, Chapel Hill, NC. (Sponsor: Lee Stoner, FACSM) Email: raymondjones@usm.edu (No relevant relationships reported)

Prolonged periods of uninterrupted sitting (1-6 hours) have been shown to reduce lower limb blood flow, impair vascular endothelial function of leg arteries, and increase central arterial stiffness. It is unclear whether sitting can have a similar negative impact on cerebrovascular hemodynamics. **PURPOSE:** To determine the impact of a brief period (1 hour) of uninterrupted sitting on total brain blood flow (BBF). **METHODS:** Eleven participants (25±1 years, BMI=26±1 kg/m², Female=5) completed a 1-hour bout of sitting. Assessments of central (heart rate and mean arterial pressure) and cerebrovascular hemodynamics (carotid artery blood flow, assessed via Doppler-ultrasound) were performed pre-post 1-hour of sitting (supine), as well as during the sitting intervention (10- and 60-minutes). In a subset (N=7), blood flow through the internal carotid (ICA) and vertebral arteries (VA) was examined to estimate total BBF [(ICA+VA)*2]. **RESULTS:** When measured supine, HR and MAP were similar pre-post sitting. However, there was a significant increase in HR when measured while seated (i.e., 10-mins=67±3 vs. 60-mins=70±4 bpm; $p=0.02$). CCA blood flow was comparable pre-post sitting ($p=0.25$), but decreased 10-60 minutes while seated (10-mins=1049±64 vs. 60-mins=921±63 mL/min; $p=0.006$). Conversely, estimated total BBF significantly decreased pre-post sitting (pre=1039±135 vs. post=843±82 mL/min; $p=0.01$), but was comparable between the 10- and 60-minute time points (10-mins=799±148 vs. 60-mins=802±125 mL/min; $p=0.95$). **CONCLUSIONS:** These preliminary findings suggests that cerebrovascular hemodynamics are significantly affected by a 1-hour bout of uninterrupted sitting, largely due to a reduction in estimated total BBF.

525 Board #8 May 29 1:00 PM - 3:00 PM
An Examination of Group and Individual Response Rates to Ischemic Preconditioning for Sport Performance

Joshua Slys, Heather Petrick, Jamie Burr, FACSM. University of Guelph, Guelph, ON, Canada. (Sponsor: Jamie Burr, FACSM) Email: jslys@uoguelph.ca (No relevant relationships reported)

PURPOSE: Ischemic Preconditioning (IPC) has been shown to improve exercise performance; yet large variability in response exists between individuals and the mean changes reported between studies. It has been suggested that there are responders and non-responders to IPC and this is a common explanation for the observed variability. At present, existing studies that demonstrate individual responses to IPC lack an appropriate assessment of the within-subject variability of the exercise task, thereby preventing proper evaluation of response versus non-response to the stimulus. Thus, the purpose of this study was to use repeated control trials to measure within-subject variability to assess the existence of true responders to IPC. **METHODS:** In a randomized, crossover design, twelve recreational cyclists (7m/5f, 30yrs, 72kg, 175cm, 55ml·min⁻¹·kg⁻¹) completed six, 5km cycling time trials, each separated by one week. Three separate trials were performed with and without IPC to characterize the expected individual variability in performance with and without treatment. For each IPC trial, IPC was completed 15 minutes prior to exercise and consisted of 3x5-min cycles of bilateral occlusion and reperfusion to the upper thighs. **RESULTS:** Comparing baseline control to IPC, mean time to completion did not reach significance (5±8s or 1.0±1.8%, $p=0.08$), despite a 1% change commonly being recognized as the benchmark for a meaningful alteration in performance. Examination of individual participant data revealed 8 of 12 (68%) participants improved mean 5km TT performance following IPC (2.1±1.3%). If the individual's mean IPC response is considered only as an improvement that exceeded one's own percent coefficient of variation from the repeated controls (0.4±0.8%) then 7 (58%) and 5 (42%) would be classed as legitimate responders and non-responders. When the individual response or non-response to IPC was examined over the three repeated IPC trials, 81% and 87% of trials confirmed the effect, respectively. **CONCLUSIONS:** We present evidence that individual performance is affected at a magnitude that exceeds normal variability. This suggests the existence of participants who consistently respond to IPC exposure at a magnitude that exceeds chance.

B-08 Thematic Poster - Cooling Interventions, Physiological Responses, and Performance in the Heat

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-101B

526 Chair: Scott Montain. *USARIEM, Natick, MA.*
(No relevant relationships reported)

527 Board #1 May 29 1:00 PM - 3:00 PM Extra- And Intra- Renal Vascular Responses To Sympathetic Activation Are Not Modified Following Cooling Recovery

Christopher L. Chapman, Julia M. Benati, Nicole T. Vargas, Blair D. Johnson, Penelope C. Lema, Zachary J. Schlader, FACSM. *University at Buffalo, Buffalo, NY.* (Sponsor: Zachary J Schlader, FACSM)
(No relevant relationships reported)

Elevated renal vascular resistance (RVR) during heat stress may provoke localized ischemia, especially when exposed to multiple sympathetic stressors. Whole-body cooling reduces risks associated with heat stress. However, this cooling raises RVR and could therefore exacerbate increases in RVR caused by prior heat stress, particularly during sympathetic activation. **PURPOSE:** To test hypotheses that increases in both extra- and intra- RVR to the cold pressor test (a sympathoexcitatory stimulus, CPT) are exacerbated by whole-body cooling following heat stress. **METHODS:** Nineteen healthy adults (22 ± 2 y) underwent passive heat stress sufficient to raise core temperature 1.2°C above normothermic baseline (NT), after which they underwent passive cooling recovery (CR) to within 0.2°C of NT. Participants completed a 2 min CPT at NT and at the end of CR. Changes in body weight provided an indication of dehydration. Heart rate (HR), mean arterial pressure (MAP), and renal blood velocity (RBV) were measured pre-CPT (Pre) and at the end of the CPT (End). RBV was measured using the coronal approach with Doppler ultrasound at the distal segment of the right renal artery (Extra-, $n=11$) or in the same segmental artery within participants in the right kidney (Intra-, $n=8$). RVR was calculated as MAP/RBV . Data are presented as mean \pm SD. **RESULTS:** The change in body weight was $-1.2 \pm 0.5\%$. In Extra- at Pre, MAP was elevated in CR compared to NT (95 ± 9 vs. 85 ± 7 mmHg, $P<0.01$) with no differences in HR (58 ± 7 vs. 56 ± 9 bpm, $P=0.24$). MAP and HR in Intra- at Pre did not differ from Extra- ($P\geq 0.72$). In Extra- at Pre, RBV (33 ± 4 vs. 36 ± 5 cm/s, $P=0.01$) and RVR (0.35 ± 0.06 vs. 0.43 ± 0.08 mmHg/cm/s, $P<0.01$) were lower in CR compared to NT. RBV was lower and RVR was higher in Intra- compared to Extra- ($P\leq 0.02$) at Pre. At End, increases in HR (12 ± 9 vs. 14 ± 7 bpm, $P=0.50$) and MAP (24 ± 16 vs. 24 ± 16 mmHg, $P>0.99$) were not different between CR and NT in Extra-. Changes in RBV (-3 ± 5 vs. -2 ± 7 cm/s, $P=0.59$) and increases in RVR (1.24 ± 0.97 vs. 0.95 ± 0.99 mmHg/cm/s, $P=0.29$) did not differ between CR and NT in Extra- at End. There were no differences in the HR, MAP, RBV, or RVR response to CPT in Intra- compared to Extra- ($P\geq 0.10$). **CONCLUSION:** Whole-body cooling following passive heat stress does not affect the extra- or intra- renal vascular responses to sympathetic activation.

528 Board #2 May 29 1:00 PM - 3:00 PM Cooling Treatment Induces Changes in Aquaporins Expression as a Protective Mechanism for Exertional Heat Stroke

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Abstract: Cooling treatment is important to ensure the survival of patients with Exertional Heat Stroke (EHS); however, the protective mechanism of aquaporins in the cooling treatment of EHS is not very clear. Cooling treatment induces changes in renal aquaporins and regulates homeostasis of water metabolism, which mechanism involves aquaporin gene expression. **PURPOSE:** To determine the role of AQP2 mRNA expression and AQP2 protein expression in kidney in the homeostasis of water metabolism when EHS rats were treated with cooling. **METHODS:** In this study, there

were 4 groups of male SD rats, including normal control group (NC, $n=8$), EHS onset group (EHSO, $n=9$), EHS rest group (EHSR, $n=9$) and EHS cooling group (EHSC, $n=8$). We established the rat model of EHS by exercising to exhaustion in the environment of 36°C temperature and 75% humidity until rectal temperature reaching about 42°C . The cooling treatment for EHS was to immerse in cold water for 5 minutes at 19°C . Blood and kidney were taken. Hct in serum was measured by automatic blood cell analyzer. PCR and WB were used to detect AQP2 mRNA expression and AQP2 protein expression respectively. Data were analyzed with Mann-Whitney U in nonparametric test. **RESULTS:** When EHS occurs, Hct increased significantly (EHSO: 0.43 ± 0.29 vs. $0.40 \pm 0.04/\text{L}$, $p<0.05$). To fit for water metabolism, AQP2 mRNA expression and AQP2 protein expression were up-regulated significantly (EHSO vs. NC) (mRNA: 3.45 ± 0.95 vs. 1.19 ± 0.37 , $p<0.01$; Protein: 2.76 ± 1.01 vs. $1.00 \pm 0.00/\text{L}$, $p<0.01$). After cold water immersion, No significant change of Hct was found, AQP2 mRNA expression and AQP2 protein expression were significantly down-regulated (EHSC vs. EHSO) (mRNA: 1.66 ± 0.33 vs. 3.45 ± 0.95 , $p<0.01$; Protein: 1.52 ± 0.85 vs. $2.76 \pm 1.01/\text{L}$, $p<0.05$). **CONCLUSIONS:** Hct, AQP2 mRNA expression and AQP2 protein expression are pathophysiological biomarkers of EHS. Cooling treatment restrain water reabsorption by down-regulating the expression of AQP2 mRNA and AQP2 protein in kidney.

529 Board #3 May 29 1:00 PM - 3:00 PM The Central Mechanism Underlying Arginine Vasopressin Changes During Cooling Therapy For Exertional Heat Stroke Rats

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Abstract:

Cooling therapy is very effective for improving the survival of patients with Exertional Heat Stroke (EHS); however, the central activation mechanism of Arginine Vasopressin in cooling therapy for EHS is not very clear. The central mechanism of cooling therapy induces changes of AVP to adjust water metabolism, which involves that the synthesis and release of AVP in hypothalamus. **PURPOSE:** To determine the central activation of AVP mRNA expression and AVP protein expression in hypothalamus in improving water metabolism when EHS rats were treated with cooling. **METHODS:** Male Sprague Dawley rats were randomly divided into normal control group (NC $n=8$) and EHS group. EHS group was further divided into the onset group (EHSO $n=9$), the rest group (EHSR $n=9$) and the cooling group (EHSC $n=8$). The rat model of EHS was induced by exercising to exhaustion and raising rectal temperature to about 42°C in the environment of 36°C temperature and 75% humidity. Cold water immersion for 5 min at 19°C was used as cooling treatment. Blood and hypothalamus were taken for testing. AVP in serum was measured by ELISA method. AVP mRNA expression and AVP protein expression were detected by PCR and WB respectively. We analyzed data with Mann-Whitney U of nonparametric test. **RESULTS:** Onset of EHS, to regulate water metabolism, AVP, AVP mRNA expression and AVP protein expression of EHSO group rats were upregulated significantly than that of NC group (AVP: 66.02 ± 24.55 vs. 33.52 ± 11.13 , $p<0.01$; mRNA: 5.06 ± 4.10 vs. 1.21 ± 0.49 , $p<0.01$; Protein: 2.90 ± 1.26 vs. $1.00 \pm 0.00/\text{L}$, $p<0.01$). After cold water immersion, AVP mRNA expression and AVP protein expression were significantly downregulated, AVP changed little (EHSC vs. EHSO) (mRNA: 1.22 ± 0.50 vs. 5.06 ± 4.10 , $p<0.01$; Protein: 1.48 ± 0.89 vs. $2.90 \pm 1.26/\text{L}$, $p<0.05$). **CONCLUSIONS:** AVP, AVP mRNA expression and AVP protein expression can be used as pathophysiological biomarkers of EHS. Cold water immersion inhibits anti-dehydration reaction by downregulating the expression of AVP mRNA and AVP protein in hypothalamus.

530 Board #4 May 29 1:00 PM - 3:00 PM Continuous Forearm Cooling Attenuates Increase in Core Body Temperature of Elite Cyclists under Heat Stress

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(No relevant relationships reported)

Physical activity results in the generation of heat which is dissipated through thermoregulatory processes, such as the production of sweat. Environmental conditions

can inhibit thermoregulation resulting in heat accumulation with eventual impairment in performance. **PURPOSE:** To determine if continuous inner forearm cooling helps to maintain body core temperature and athletic performance during cycling in a hot and humid environment. **METHODS:** Preliminary results report on data collected from three competitive triathletes [two male, one female; age: 31 ± 2 years; mean \pm standard deviation]. Each performed two cycling sessions at $70 \pm 4\%$ of their functional threshold power for up to 45 minutes in an environmentally controlled chamber (temperature: 30°C , humidity: 70%). One trial included continuous inner forearm cooling (FC), while the other was a control trial (NFC). Heart rate (HR) was monitored throughout the test and body core temperature (T_{core}) was measured using an ingestible radio capsule. Ratings of perceived exertion and thermal comfort were assessed every 10 minutes throughout exercise. **RESULTS:** Preliminary data suggest that forearm cooling attenuated the increase in T_{core} during exercise (FC: $2.32 \pm 0.36^\circ\text{C}\cdot\text{hr}^{-1}$ vs. NFC: $2.85 \pm 0.33^\circ\text{C}\cdot\text{hr}^{-1}$), as 89.6 ± 11.7 kJ of heat were removed from the body during the cooling trials. Furthermore, two of the three participants were unable to complete the non-cooling trial due to reaching the temperature threshold for test termination (39.3°C). Similarly, HR appeared to be lower in the FC condition compared to the NFC condition. Participants' ratings of perceived exertion were similar between conditions; however, participants' thermal comfort was improved with inner forearm cooling. **CONCLUSION:** Preliminary data analysis suggests that during cycling in the heat, continuous cooling of the forearms may improve athlete comfort by attenuating the exercise induced increase in core body temperature.

531 Board #5 May 29 1:00 PM - 3:00 PM

Influence of Face and Head Cooling on Thermoregulation and Perception During Simulated American Football

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(No relevant relationships reported)

The skin of the human face and head is uniquely sensitive to cold stimuli, influencing whole body thermal perception more than most other skin surfaces. This sensitivity might be particularly relevant for American football, where padding and equipment cover much of the body but athletes regularly experience large thermal stress.

PURPOSE: To assess how face and head cooling impact thermoregulation and perception during simulated American football. **METHODS:** Ten male American football or rugby athletes (age = 27 ± 5 y, height = 184.1 ± 5.9 cm, mass = 96.7 ± 18.2 kg; mean \pm SD) completed two 165 min intermittent exercise protocols. Each protocol was divided into four quarters (Q1 - Q4) and consisted of maximal sprints and plyometric push-ups separated by breaks regularly occurring during an American football game (e.g. breaks between quarters, time outs, and offense-defense transitions). Sessions occurred in 36°C and 50% RH and participants wore full American football uniforms throughout. During one session (COOL), each participant removed his helmet and donned a cooling hood during breaks longer than two minutes; the cooling hood covered the cheeks, forehead, head, and neck and was activated by soaking in an ice slurry mixture. During the other session (CON), each participant only removed his helmet during breaks longer than two minutes. Thermoregulatory and perceptual variables were measured throughout. **RESULTS:** No significant differences existed between COOL and CON for gastrointestinal temperature (COOL = $38.0 \pm 0.5^\circ\text{C}$, CON = $38.1 \pm 0.5^\circ\text{C}$), mean weighted skin temperature (COOL = $35.5 \pm 0.7^\circ\text{C}$, CON = $35.6 \pm 0.7^\circ\text{C}$), or heart rate (COOL = 124 ± 26 bpm, CON = 125 ± 26 bpm). COOL significantly improved whole body thermal sensation compared to CON (COOL: Q1 = 4 [4-5], Q2 = 5 [4-5], Q3 = 5 [4-5], Q4 = 5 [4-5]; CON: Q1 = 6 [6-6], Q2 = 6 [5-6], Q3 = 6 [5-6], Q4 = 7 [6-7]; median [interquartile range]). COOL similarly benefitted thermal comfort. **CONCLUSIONS:** These data confirm the sensitivity of the face and head to cooling stimuli and reinforce their influence over whole body thermal sensation and comfort during exercise in the heat. Moreover, these data indicate a cooling hood covering the cheeks, forehead, head, and neck can significantly improve thermal perception during exercise in the heat without influencing classic thermoregulatory measures.

532 Board #6 May 29 1:00 PM - 3:00 PM

Precooling's Effects on American Football Skills

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(No relevant relationships reported)

Precooling (i.e., cooling before exercise, PC) with cold-water immersion (CWI) may help reduce the risk of exertional heatstroke (EHS) in American football athletes. However, implementation of PC would likely be low if it impaired American football performance. **PURPOSE:** We investigated PC effect on eight American football skills. **METHODS:** Twelve physically-active men (24 ± 2 y, mass = 85.5 ± 6.3 kg, height = 181.8 ± 8.1 cm) completed this randomized, crossover, counterbalanced study.

Participants practiced each skill until proficient and then completed two testing days outdoors (wet bulb globe temperature = $19.3 \pm 4.1^\circ\text{C}$). On testing days, participants were precooling for 15 minutes using CWI ($10.1 \pm 0.3^\circ\text{C}$) or not. They donned an American football uniform and completed multiple bouts of 40-yard dash, vertical jump, broad jump, agility test, dynamic (i.e., catching while running) and stationary catching, throwing distance, and throwing accuracy. Rectal temperature (T_{rec}) was measured before, during, and after precooling and every 5 minutes during skill testing. MANOVA and dependent t-tests identified differences between conditions for football skill data. Repeated measures ANOVA and Tukey-Kramer post-hoc tests identified differences in T_{rec} between conditions over time. **RESULTS:** Data are means and standard deviations. Cohen's effect sizes (ES) were calculated when significant differences occurred. PC did not affect vertical jump, broad jump, agility, dynamic or stationary catching, or throwing distance ($P \geq 0.13$). PC impaired 40-yard dash time (PC = 5.72 ± 0.53 s, Control = 5.31 ± 0.34 s; $P = 0.03$, ES = 1.2) and throwing accuracy (PC = 0.9 ± 0.2 points, Control = 1.3 ± 0.3 points; $P = 0.001$, ES = 1.4). On average, T_{rec} was $0.58 \pm 0.35^\circ\text{C}$ lower during skills testing following PC and statistically differed from control from minute 10 to the end of testing (~ 35 minutes; $P < 0.05$, ES ≥ 1.2). **CONCLUSION:** PC may be a useful strategy to prevent EHS in American football players since it lowered T_{rec} without affecting most American football skills. By lowering T_{rec} , PC would prolong the time it would take for an athlete's body core temperature to become dangerous (i.e., $> 40.5^\circ\text{C}$). If PC is implemented, coaches should alter practice so throwing accuracy and speed drills occur after an athlete's body core temperature returns to normal.

533 Board #7 May 29 1:00 PM - 3:00 PM

An Ice Vest Limits the Rise in Core Temperature During a Rugby Sevens Warm-up

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(No relevant relationships reported)

Purpose: Determine how a cooling vest worn during a warm-up could influence selected performance [counter movement jump (CMJ)], physical (GPS metrics) and psycho-physiological (body temperature and perceptual) variables. **Methods:** In a randomized crossover design, twelve elite male World Rugby Sevens Series athletes completed an outdoor (WBGT: $23\text{--}27^\circ\text{C}$) match-specific externally-valid 30 min warm-up wearing a phase change cooling vest (VEST; also worn for 70 min prior-to warm-up) and without (CONTROL), on separate occasions 7 days apart. CMJ was assessed before and after the warm-up, with GPS indices and heart rate monitored during the warm-ups, whilst core temperature (T_{c} ; ingestible telemetric pill; $n = 6$) was recorded throughout the experimental period. Measures of thermal sensation (TS) and comfort (TC) were obtained pre- and post-warm-ups, with rating of perceived exertion (RPE) taken post-warm-ups. **Results:** Athletes in VEST had a lower ΔT_{c} from pre-warm-up to post-warm-up [effect size (ES) $\pm 90\%$ confidence limit; $-1.54; \pm 0.62$] and T_{c} peak ($\sim 0.7^\circ\text{C}$ lower on average) at the end of the warm-up ($-1.59; \pm 0.64$) compared to CONTROL. Athletes demonstrated a decrease in ΔTS ($-1.59; \pm 0.72$) and ΔTC ($-1.63; \pm 0.73$) in VEST compared to CONTROL, pre- to post-warm-up. Furthermore, athletes in VEST had a lower post-warm-up RPE compared to CONTROL ($-1.01; \pm 0.46$). Changes in CMJ and GPS indices were trivial between conditions (ES < 0.2). **Conclusions:** Wearing the vest prior-to and during a warm-up can elicit favorable alterations in physiological (T_{c}) and perceptual (TS, TC and RPE) warm-up responses, without compromising the utilized warm-up characteristics or physical performance measures. Supported by Aspire Zone Foundation (AZF; Doha, Qatar) funding.

B-09 Thematic Poster - Ergogenic Aids

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-102A

534 Chair: Craig Sale, FACSM. Nottingham Trent University, Nottingham, United Kingdom.

(No relevant relationships reported)

**535 Board #1 May 29 1:00 PM - 3:00 PM
β-Alanine Supplementation Reduces Anxiety and Increases Neurotrophin Expression in both Young and Older Rats**

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PURPOSE: The effect of 30 days of β-alanine (BA) supplementation (100 mg·kg⁻¹) on behavioral response, expression of brain-derived neurotrophic factor (BDNF), neuropeptide Y (NPY) and markers of inflammation was examined in both young (4 months) and older (14 months) rats.

METHODS: Animals were assigned to either a control group in which young (YC) or older (OC) rats were fed regular food and water or a β-alanine group, in which rats were fed regular food and provided β-alanine in their water (YBA or OBA, respectively). Behavior measures were conducted following the 30-day supplementation period, which included spatial learning, memory and an anxiety index. Hippocampal expressions of BDNF, NPY, glial fibrillary acidic protein, NF-κB p50 and p65 subunits, TNFα and cyclooxygenase-2 were also analyzed.

RESULTS: Learning ability was reduced (p=0.001) and anxiety index higher (p=0.001) in older compared to young rats. Similarly, BDNF and NPY expressions were reduced, and all inflammatory markers were elevated (p's<0.05) in the older animals. β-alanine increased BDNF expressions in the CA1 (p=0.003) and CA3 (p<0.001) subregions of the hippocampus. BDNF expression for YBA was also significantly greater than YC in CA3. Learning for young animals fed β-alanine was significantly better than all other groups. Significant reductions in anxiety were noted in both older and younger rats fed β-alanine compared to age-matched controls.

CONCLUSIONS: Results indicated that β-alanine ingestion in both young and older rats was effective in attenuating anxiety and augmenting BDNF expression in the hippocampus.

**536 Board #2 May 29 1:00 PM - 3:00 PM
The Effects of Two Multi-Ingredient Pre-Workout Supplements on Endurance Capacity and Anaerobic Cycling Performance**

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Reported Relationships: M.E. Beckner: Industry contracted research; Isagenix International LLC..

Multi-ingredient pre-workout supplements (MIPS) have become an increasingly popular ergogenic aid among fitness enthusiasts. Previous research has primarily focused on the effectiveness of individual ingredients, rather than the combination. **PURPOSE:** To examine the effectiveness of two MIPS, one with beta-alanine and caffeine (BAC) and one without (NBAC), vs. placebo (PLA) on anaerobic performance and endurance capacity. **METHODS:** Twenty-eight exercise-trained individuals (15 men, 13 women, 24.3 ± 4.9 years, 173.6 ± 9.2 cm, 74.7 ± 15.5 kg) participated in a randomized, counterbalanced, double-blind, placebo controlled cross-over study to assess anaerobic power and capacity via Wingate (WAnT_{AP} and WAnT_{AC}), and aerobic endurance via cycle VO_{2peak}. On three separate occasions (7 days between trials) subjects completed vertical jump (VJ), 30-second Wingate test and VO_{2peak} test 30 minutes after ingestion of BAC, NBAC, or PLA. WAnT_{AP} and WAnT_{AC} were calculated as the peak and average power relative to body mass, respectively. Following a 10 minute walking recovery, subjects completed the cycle VO_{2peak} test. Blood lactate was collected within 5 minutes post WAnT (BLA_{WAnT}) and VO_{2peak} (BLA_{VO2}). Following tests for normality, outcome variables were compared between supplements using one-way repeated measures ANOVA or Friedman test (alpha=0.05) and Bonferroni adjusted pairwise comparisons as appropriate. **RESULTS:** There was a significant

effect of treatment on WAnT_{AP} (p=0.016). WAnT_{AP} was higher in BAC (10.9 ± 1.4 W/kg) and NBAC (10.8 ± 1.2 W/kg) compared to PLA (10.5 ± 1.2 W/kg) (p = 0.018 and p = 0.014, respectively). WAnT_{AC} was significantly different across supplements (p=.043), but post hoc pairwise comparisons were not significant. BLA_{WAnT} was higher with BAC (17.7 ± 3.5 mmol) and NBAC (17.4 ± 3.2 mmol) compared to PLA (15.3 ± 3.3 mmol) (p = 0.028 and p = 0.033, respectively). BLA_{VO2} was higher with BAC (12.7 ± 5.9 mmol) compared to NBAC (9.9 ± 2.4 mmol, p < 0.001) and PLA (9.7 ± 2.8 mmol, p < 0.001). No significant differences were observed in VO_{2peak} or VJ. **CONCLUSION:** MIPS demonstrate the potential to augment production of anaerobic power during a Wingate cycle test, accompanied by higher blood lactate accumulation. Improvements may be less apparent in vertical jump type movements or prolonged endurance exercise.

**537 Board #3 May 29 1:00 PM - 3:00 PM
Acute Capsaicin Supplementation Improves 400 and 3000 Meters Running Time-trial Performance in a Distance-dependent Way**

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Ergogenic effect of capsaicin has been shown in middle-distance time trial (1500 meters) but not in repeated maximal sprints indicating the need of explore exercises with different metabolic demands. **PURPOSE:** The purpose of this study was to investigate the acute effect of capsaicin supplementation on short (400 m) and middle distance (3000 m) running time-trial performance, maximum heart rate and rate of perceived exertion in physically active adults. **METHODS:** Twelve physically active men (age= 28.6±5.4 y) completed four randomized, double-blind trials: Capsaicin condition (12 mg) or a placebo condition. Forty-five minutes after supplement consumption, the participants performed a randomized 400- or 3000-meters running time trial. Time (in seconds) was recorded. Heart rate was analyzed at rest and immediately post-exercise, and the rate of perceived exertion (RPE) was collected immediately after exercise. The effect of capsaicin on time-trial performance, maximum heart rate and rate of perceived exertion during short (400 m) and middle distance (3000 m) running were analyzed via a Paired t test. In addition, the effect size (ES, 90% confidence interval [CI]) and magnitude-based inference statistics in the selected variables were calculated. **RESULTS:** For 400 m time-trial (Capsaicin= 66.4 ± 4.2 sec vs Placebo= 67.1 ± 4.8 sec, t= 2.250, p= 0.046) and 3000 m time-trial (Capsaicin= 876.2 ± 76.1 sec vs Placebo= 905.1 ± 73.3 sec, t= 2.848, p= 0.016) the time in seconds was significantly lesser in the capsaicin compared to placebo. Capsaicin showed a likely small improvement of performance in the 3000 m (d= 0.40, IC 90%= -0.60 to -0.14) and likely trivial in the 400 m (d= 0.13, IC 90%= -0.24 to -0.03). There was no statistically significant difference for the maximum heart rate (400m: p=0.114; 3000m: p= 0.319) and RPE (400m: p=0.615; 3000m: p= 0.438). **CONCLUSION:** In summary, acute capsaicin supplementation improved 400 m and 3000 m running time-trial performance in a distance-dependent way without modifying RPE and maximum heart rate in physically active adults. Furthermore, the present study showed a meaningful improvement in the performance during 3000 m running time-trial.

**538 Board #4 May 29 1:00 PM - 3:00 PM
Acute Supplementation with Caffeine Improves Strength and Increases Metabolic Stress After a Maximal Strength Test**

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BACKGROUND: Caffeine has dose-dependent benefits on endurance, but the effect of different doses of caffeine on strength are inconclusive. **PURPOSE:** We aimed to analyze the acute effect of different doses of caffeine on strength and metabolic stress in recreationally trained men. **METHODS:** The effect of different doses of caffeine on strength, creatine phosphokinase (CPK), lactate dehydrogenase (LDH), and uric acid (AU) were assessed in 17 recreationally active young adults (19.2 ± 2.5 yrs of age), who performed three tests, separated by 14 days between trials. Day one involved collection of baseline data and brief explanation of the strength test protocol.

The protocol used to analyze the effect of different doses of caffeine on strength was examined by three different exercises (bench press (BP); deadlift (DL); and squats (SQ) following a 10 RM test protocol. Blood samples were collected immediately upon arrival to the laboratory, followed by consumption of a standardized isocaloric shake along with capsules containing different doses of caffeine: 6mg • kg⁻¹ (CF1), 8mg • kg⁻¹ (CF2), or placebo (CG). Another blood sample was collected 45 minutes after caffeine/placebo consumption and immediately after the execution of each exercise. The supplementation followed a double-blind, randomized model. **RESULTS:** The strength on BP, DL and SQ statistically improved between CG and CF2 (BP 98.5 ± 3.2 to 106.7 ± 2.7; DL 123.2 ± 6.5 to 138.3 ± 9.1; SQ 116.4 ± 7.9 to 135.1 ± 5.7 p=0.01); no other statistical differences were observed for strength outcomes. CPK statistically improved in CF2 in comparison to CF1 and CG one hour after strength tests (198.1 ± 10.1 U/L to 171.8 ± 7.4 U/L and 198.1 ± 10.1 U/L to 169.4 ± 11.2 U/L with p=0.001). The LDH levels were significantly higher in CF2 after the third exercise compared to CG and CF1 (229.1 ± 8.3 U/L to 179.3 ± 11.4 U/L and 229.1 ± 8.3 U/L to 220.2 ± 13.2 U/L with p=0.001). AU levels were significant higher in CF2 at 60 minutes posttest compared to GC (7.1 ± 0.8 mg/dL to 5.5 ± 0.6 mg/dL with p=0.01). **CONCLUSION:** An 8 mg • kg⁻¹ dosage of caffeine seems to be more effective than 6 mg • kg⁻¹ and placebo for improving strength levels on BP, DL and SQ. In addition, higher doses of caffeine increased LDH and uric acid concentrations compared to other treatments, which may imply a higher oxidative stress condition.

539 Board #5 May 29 1:00 PM - 3:00 PM
Omega-3 Supplementation Does Not Impair Torque and Power Improvements Following 8 Weeks Eccentric Quadriceps Training

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 (No relevant relationships reported)

Individuals who are unaccustomed to resistance exercise experience greater levels of exercise-induced muscle soreness, this can deter individuals from completing an exercise programme and improving strength and power. To alleviate the symptoms, they may consume Non-steroidal anti-inflammatory drugs (NSAIDs). Evidence suggests NSAIDs blunt muscle protein synthesis (Trappe *et al.*, 2002) and attenuate strength and muscle hypertrophic adaptations from resistance training (Lilja *et al.*, 2018), negating the effects of the exercise. Omega-3 supplementation has been suggested as an alternative to NSAIDs but the impact of Omega-3 on resistance training is inconclusive. **PURPOSE:** To determine the effects of omega-3 supplementation on eccentric training-induced increases in torque and power. **METHODS:** Nine physically active but non-resistance trained males (29 ± 9 years) were pair matched for isometric and eccentric quadriceps strength and randomly assigned, in a double-blind manner, to either omega-3 (5.1g/d) or olive oil (6.0g/d) supplementation for 3 weeks prior to and for 8 weeks during eccentric training. Performance measures of peak torque (isometric, concentric, eccentric) and jump height were conducted before and after 8 weeks of training. Supervised training consisted of maximal eccentric quadriceps contractions on an isokinetic dynamometer at 60°s⁻¹ through 80° range of motion. Two training sessions were conducted per week, with a minimum of 48 hours recovery between sessions. Number of repetitions and sets were increased over the 8 weeks. **RESULTS:** Following 8 weeks of eccentric training, peak eccentric torque significantly increased by 40 ± 56 Nm in omega-3 group and 51 ± 52 Nm in olive oil group, with no differences between groups (p > 0.05). Both groups also significantly increased their maximal isometric torque (p = 0.02); omega-3 group increased by 21 ± 10 Nm and olive oil group increased by 23 ± 30 Nm, with no differences between groups (p > 0.05). There was no main effect of training on peak concentric torque (p > 0.05). Jump height increased by 1.0 ± 1.9 cm in the omega-3 group and decreased by 0.03 ± 1.33 cm in the olive oil group, with no difference between groups (p > 0.05). **CONCLUSIONS:** Omega-3 supplementation does not impair or augment eccentric training-induced increases in torque or power in young males.

540 Board #6 May 29 1:00 PM - 3:00 PM
The Effect of Beetroot Supplementation on High Intensity Functional Training Performance
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 (No relevant relationships reported)

Nitrate supplementation has been shown to improve athletic performance for short-duration, vigorous activity, as well as long-duration, aerobic activity. As an antioxidant, nitrates have the ability to reduce oxidative stress on exercising muscles, which is thought to help maintain energy metabolism, therefore, decreasing fatigue. **PURPOSE:** The purpose of this research was to explore the effects of beetroot nitrate supplementation on performance during a baseline CrossFit® workout. **METHODS:**

Twenty current CrossFit® participants (25±6.5 years, 175.17±8.1cm, 84.94±12.09kg), who attended CrossFit® classes at least 3 days per week for the past 3 months, performed a benchmark performance test, "Nancy" (5 rounds of 15 overhead squats with a 95lb (for males)/65lb (for females) barbell followed by a 400m run). In a randomized order, 72 hrs apart, participants were tested under a control session and once after consuming 2.4oz beetroot nitrate supplement, Beet It®, 2 hours prior to beginning the assigned workout. For both workouts, time to completion, pre- and post-exercise blood lactate levels, RPE, and pre-, during, and post-exercising heart rates were measured. **RESULTS:** No significant difference (p<0.05) between the control (15.50±3.21 min) and supplement (15.88±3.43 min) performance on time to completion. Post-exercise blood lactate (11.14±2.84 mm/dL) was not significantly different (p<0.05) than the control (12.00±2.53 mm/dL). Additionally, mean RPE for BR supplement (14.78±2.50) was not significantly different (p < 0.05) than the control (14.92±2.12). **CONCLUSIONS:** The findings show no improvement in performance following nitrate supplementation. These findings may have been caused by the duration and intensity of the benchmark workout which included both anaerobic and aerobic components, unlike previous research that found relationships between beetroot nitrates and performance of aerobic and anaerobic exercises alone.

541 Board #7 May 29 1:00 PM - 3:00 PM
Potato Ingestion as an Effective Race Fuel to Improve Cycling Performance in Trained Cyclists

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 (No relevant relationships reported)

Carbohydrate (CHO) ingestion is an established strategy to improve endurance performance. Race fuels should not only sustain performance, but also be readily digested and absorbed and replenish electrolytes. Potatoes are a cost-effective option that fulfills these criteria; however, their impact on endurance performance remains unexamined. **PURPOSE:** Compare the effects of potato purée (POT) ingestion during endurance cycling on subsequent performance versus commercial CHO gel (GEL) or a control (water, CTL). **METHODS:** Ten trained cyclists (28.2±5.6y; 70.1±7.4kg; 1.7±0.1m; 62.7±9.3mL/kg/min) consumed a standardized breakfast then performed a 2h cycling challenge (60-85%VO_{2max}) followed by a time trial (6kJ/kg body mass) while consuming POT, GEL, or CTL in a randomized-crossover design. POT, GEL and CTL were administered with U-[¹³C]₆glucose for an indirect estimate of gastric emptying rate. Repeated blood samples were collected. **RESULTS:** Time trial performance significantly improved (p<0.01) with POT (32.2±1.9min) and GEL (32.4±1.9min) versus CTL (38.6±1.9min); no difference between POT and GEL was observed (p=1.00). Post challenge blood glucose concentrations were lower (p<0.01) with CTL (77.9±4.2mg/dL) versus POT (95.5±4.4mg/dL) and GEL (95.6±4.4mg/dL). Similar results (p<0.001) were observed post time trial for blood glucose concentrations (CTL, 68.5±4.2 mg/dL; GEL, 97.5±4.2mg/dL; POT, 92.0±4.2mg/dL). No difference (p=0.88) in blood glucose concentrations were observed between GEL or POT conditions at both time points. Post challenge, blood lactate concentrations were higher (p=0.005) with GEL (5.1±0.4mmol/L) versus POT (3.4±0.4mmol/L). Blood U-[¹³C]₆glucose enrichments were not different between GEL or POT (p>0.05). **CONCLUSION:** Potatoes serve as a viable alternative to commercial gels by sustaining performance and blood glucose concentrations during endurance cycling events in trained cyclists.

542 Board #8 May 29 1:00 PM - 3:00 PM
Post-exercise And Pre-sleep Protein-polyphenol Supplementation Improves Recovery Following Muscle-damaging Eccentric Exercise: Preliminary Findings.

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 (No relevant relationships reported)

Purpose Eccentric contraction (EC) induced muscle damage is characterised by weakened force production, increased soreness and elevated plasma creatine kinase (CK). Recovery rate is likely to be dependent on muscle remodelling, which may be influenced by dietary protein and polyphenol availability. We investigated if consuming protein-polyphenol drinks post-exercise and before bed improved recovery of knee extensor function and reduced soreness following a bout of EC.

Methods In a randomised, parallel groups, placebo controlled double blind design, 18 healthy males and females (22 ± 1 y; BMI: 24.0 ± 0.9 kg·m⁻² (\pm SEM)) consumed a controlled isocaloric diet (1.2 g·kg⁻¹ protein) for 7 days before and after a single bout of 300 maximal unilateral quadriceps EC, in combination with either post-exercise (20 g whey, casein and pea protein blend and 650 mg pomegranate extract) and pre-bed (20 g casein protein and 480 mg tart cherry extract) drinks (Beachbody LLC) (PRO; $n = 9$; 4 females), or isocaloric maltodextrin placebos (PLA; $n = 9$; 3 females). Total isokinetic work over 30 maximal knee extensions (TW), peak isometric torque (PT) and muscle soreness (visual analogue scale (VAS) and pressure pain threshold (PPT)) were measured relative to the contralateral control limb (%con) before and every 24 h for 7 d following EC, as was CK. Data were analysed using two-way ANOVAs.

Results EC caused a maximum decline in TW in PLA after 48 h to 68 ± 6 %con ($P < 0.001$) which remained below baseline until 120 h ($P < 0.05$). Conversely, TW in PRO was reduced at 24 h only (to 89 ± 5 %con; $P < 0.05$) and was restored thereafter. PT decreased following EC ($P < 0.001$) and was significantly lower in PLA compared with PRO at 48 h (69 ± 5 vs 107 ± 13 %con, respectively) and 96 h (76 ± 7 vs 110 ± 14 %con, respectively). Muscle soreness in both groups peaked within 72 h of EC ($P < 0.05$), but *vastus medialis* PPT was attenuated at 72 h in PRO compared to PLA (102 ± 3 vs 88 ± 3 %con, respectively; $P < 0.05$). Plasma CK rose > 30-fold from 96 to 120 h ($P < 0.01$), and was similar between groups ($P > 0.05$).

Conclusion Consumption of commercially available post-exercise and before bed protein-polyphenol beverages accelerated recovery of skeletal muscle function following EC-induced muscle damage, potentially due to improved protein turnover and remodelling.

Supported by a Beachbody LLC (USA) grant.

B-10 Thematic Poster - Hormones and Obesity

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-102B

543 Chair: Jody L. Clasey, FACSM. *University of Kentucky, Lexington, KY.*

(No relevant relationships reported)

544 Board #1 May 29 1:00 PM - 3:00 PM
Post Meal Hypoglycemia With and Without Exercise in Non-Obese and Obese Individuals.

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(No relevant relationships reported)

PURPOSE: Hypoglycemia (<70 mg/dL) during exercise has been observed in some individuals when exercise is preceded by carbohydrate ingestion. Counterregulatory responses normally maintain plasma glucose concentrations to prevent hypoglycemic events in healthy adults. The degree to which hypoglycemia is observed across health statuses in response to an evening meal plus moderate intensity exercise is unknown. The purpose of this study was to examine glucose variability when a dinner meal was followed by moderate exercise in lean and obese individuals, and to establish if transient hypoglycemia occurs during exercise at a time of day when glucose tolerance is poorer. **METHODS:** Obese (OB) and non-OB adults completed 2 study conditions: dinner meal only (NOEX) and meal + exercise (EX) 2 h post meal. Blood samples were collected prior to the meal and for 5 h post meal for blood glucose (BG). The meal contained 10 kcal/kg (40% CHO, 35% FAT, 25% PRO). EX was 45 minutes of 55% of VO₂ peak. RM ANOVA was utilized for analyses. **RESULTS:** 21 adults (5 Male, 16 Female) completed both conditions. Groups consisted of 8 Non-OB and 13 OB. Peak BG conc. was similar between groups and conditions (Non-OB: NOEX 168.6 ± 9.8 , EX 153.9 ± 10.2 mg/dL; OB: NOEX 158.3 ± 7.7 , EX 166.2 ± 8.0 mg/dL). BG nadir was different by group ($p = 0.015$) and condition ($p < 0.001$) (Non-OB: NOEX 58.0 ± 3.7 , EX 44.3 ± 3.0 mg/dL; OB: NOEX 67.1 ± 2.9 , EX 55.9 ± 2.3 mg/dL). Delta (peak-nadir) was similar between groups and conditions (Non-OB: NOEX 110.6 ± 10.6 , EX 109.5 ± 9.1 mg/dL; OB: NOEX 92.4 ± 8.3 , EX 110.3 ± 7.1 mg/dL). Seven Non-OB and 8 OB experienced hypoglycemia during NOEX, while 8 Non-OB and 12 OB experienced hypoglycemia with EX. Non-OB subjects experienced hypoglycemia during NOEX from time 165-225 min. EX shifted this hypoglycemic period earlier by 30 min. OB experienced hypoglycemia during EX from time 150-165 min post meal consumption, overlapping with the exercise session. **CONCLUSIONS:** Very low BG levels are seen following a modest carbohydrate dinner meal in healthy and obese participants, suggesting a previously unappreciated response to exercise. All subjects

remained asymptomatic throughout hypoglycemic periods, alluding that many adults may unknowingly experience low BG values even when exercise begins 2 h post meal. **SUPPORT:** NIH RO1DK101-43-01A1 <!--EndFragment-->

545 Board #2 May 29 1:00 PM - 3:00 PM
Population And Sex Differences In The Associations Between Igf-1, Protein Consumption, And Lean Mass

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(No relevant relationships reported)

Purpose: Protein intake and IGF1 concentrations are two factors that have been implicated as having a positive effect on lean mass (LM); however, the relationship of both protein intake and circulating IGF1 on LM is not well understood. The purpose of this study was to determine the contributions of IGF1 and protein intake on LM and to determine if these associations are similar in Hutterites (H) (self-sufficient, farming, Anabaptist group) and non-Hutterites (NH), as well as in males and females.

Methods: 307 adults (118 H and 54 NH females, 75 H and 60 NH males) aged 20-66 years had body composition measured using DXA, serum (fasted) IGF1 concentrations and protein intake (by FFQ). Correlations were used for bivariate analyses and multivariate modeling was used to determine whether relationships between LM and IGF1 and LM and protein intake were similar in both sexes and populations (sex-by-IGF1, and sex-by-protein, population-by-IGF1, population-by-protein interactions) controlling for age, height, and fat mass.

Results: IGF1 correlated with protein intake in NH ($r = 0.27$, $p = 0.004$), but not in H ($r = -0.01$, $p = 0.9$); there was no correlation between circulating IGF1 and protein consumption in females ($r = 0.12$, $p = 0.1$) or males ($r = 0.01$, $p = 0.1$). LM was not correlated with IGF1 in NH ($r = 0.09$, $p = 0.3$) or H ($p = -0.11$, $p = 0.1$); LM was correlated with IGF1 in males ($r = 0.21$, $p = 0.02$) but not females ($r = 0.02$, $p = 0.8$). LM was positively correlated with protein intake in NH ($r = 0.44$, $p < 0.01$) and H ($r = 0.44$, $p < 0.01$), and in males ($r = 0.33$, $p < 0.01$) but not females ($r = 0.02$, $p = 0.8$). Greater LM was not associated with age ($\beta = -0.04$, $p = 0.09$), but was associated with greater fat mass ($\beta = -0.51$, $p < 0.001$), being taller ($\beta = 0.49$, $p < 0.001$), being male ($\beta = 15.4$, $p < 0.001$), and consuming more protein ($\beta = 0.02$, $p = 0.02$). None of the interactions were significant indicating that the relationships between LM and IGF1 and protein intake are similar for both populations and sexes.

Conclusions: Results from this study indicate that protein intake is an important factor in maintaining LM and is independent of IGF1 concentrations. These data support previous studies indicating that manipulating IGF1 concentrations to improve LM may be ineffective and that individuals attempting to gain LM should focus on ensuring that adequate protein is being consumed.

546 Board #3 May 29 1:00 PM - 3:00 PM
Changes in Metabolic Hormones and Their Associations With Cancer-Related Fatigue in Cancer Survivors

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(No relevant relationships reported)

Cancer-related fatigue (CRF) is the most common toxicity experienced by patients with cancer, particularly in patients with metabolic syndrome. Metabolic syndrome is associated with dysregulated metabolic hormones such as decreased ghrelin and increased insulin levels. Whether changes in serum metabolic hormones are associated with changes in CRF is unknown.

PURPOSE: To assess changes in serum metabolic hormones and their associations with CRF in cancer survivors after 4 weeks of behavioral interventions.

METHODS: We selected 36 cancer survivors (age 56.4 ± 1.87 years) based on changes in CRF, regardless of intervention assignments, from an ongoing randomized controlled trial. Twenty-four survivors reported having no change/improved CRF (IMPV) and 12 survivors reported having worsened CRF (DECL). CRF and serum metabolic hormones (ghrelin, insulin, glucagon, leptin, PP) were assessed by Multidimensional Fatigue Symptom Inventory (MFSI) and a Luminex Multiplex Immunoassay, respectively, at pre- and post- intervention. T-tests and ANCOVAs were used to evaluate within- and between-group differences, respectively. Spearman's rank correlation was used to examine the associations of metabolic hormones with MFSI.

RESULTS: Changes in ghrelin were significantly different between groups ($p = 0.02$): serum ghrelin level was increased in the IMPV group (11.8 ± 2.19 pg/mL) but it was

decreased in the DECL group (-8.0 ± 5.93 pg/mL) from pre- to post-intervention. Changes in MFSI were negatively correlated with changes in serum ghrelin levels ($r = -0.32$, $p = 0.06$), indicating that increased serum ghrelin level is associated with improvements in CRF. No within- or between-group differences in other tested metabolic hormones nor their associations of CRF were found.

CONCLUSIONS: These exploratory findings suggest a potential association between increases in serum ghrelin and improvements in CRF among cancer survivors. Studies with larger sample sizes are needed to further establish the associations of metabolic hormones and CRF.

Supported by NCI UGCA 189961, R25 CA102618.

547 Board #4 May 29 1:00 PM - 3:00 PM
Improved Immune Profile Accompanying Increased Fitness Following an Exercise Intervention Among Overweight Older Women

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(No relevant relationships reported)

Aging is associated with a decrease in naïve T cells and an increase in late differentiated T cells, an immune profile associated with increased inflammation and decreased protection against illness. Physical fitness appears to delay the appearance of the aging immune profile, but this has only been examined cross-sectionally.

PURPOSE: To assess longitudinally whether increasing fitness can increase naïve T cells and decrease late differentiated T cells in older overweight women. **METHODS:** 16 women (63±5 years) completed 36 exercise training sessions over 14 weeks.

Training occurred 3 days a week and consisted of supervised strength training and walking. 9 women (66±5 years) participating in a health education class meeting 24 times over the same period served as controls. Blood was sampled before and after the interventions and analyzed by flow cytometry. Changes in fitness and lymphocyte subpopulations were assessed by maximum likelihood linear mixed models.

RESULTS: The training group decreased gynoid fat (pre: $51 \pm 0.8\%$, post: $49.2 \pm 0.8\%$; $p < 0.05$) and increased strength (8RM leg press pre: 145.6 ± 11 lbs, post: 200 ± 12 lbs, $p < 0.001$; 8 RM chest press pre: 60 ± 3 lbs, post: 84.4 ± 3.7 lbs, $p < 0.001$); there was a trend for increased $\text{VO}_{2\text{max}}$ (pre: $21.6 \pm .97$ ml/kg/min, post: 24.1 ± 1.3 ml/kg/min; $p = 0.62$). No differences in body composition or performance were observed in controls (all $p > 0.05$). The training group increased the proportion of naïve (CD45RA+CD62L+) CD8 T cells (pre: $23.9 \pm 2.9\%$, post: $27.8 \pm 3.2\%$, $p < 0.05$) and T memory stem cells (pre: $3.3 \pm 0.7\%$, post: $4.4 \pm 0.7\%$, $p < 0.05$). No changes were observed in high differentiated T cell subsets, or in any immune phenotype of controls (all $p > 0.05$).

CONCLUSIONS: Improvements in fitness following a supervised 14 week resistance and aerobic exercise intervention amongst overweight older women is accompanied by an increase in naïve and memory stem CD8 T cells. This suggests the immune system is modifiable with fitness, even at older age.

548 Board #5 May 29 1:00 PM - 3:00 PM
Obesity, Physical Activity, And Sedentary Behavior, Not Diet, Predict Low Testosterone Status in Men

Trevor J. Dufner¹, John S. Fitzgerald¹, James N. Roemmich, FACSM², Patrick B. Wilson³. ¹University of North Dakota, Grand Forks, ND. ²Grand Forks Human Nutrition Research Center, USDA, Grand Forks, ND. ³Old Dominion University, Norfolk, VA. (Sponsor: James N Roemmich, FACSM)

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(No relevant relationships reported)

Hypogonadism (serum testosterone concentration < 300 ng·dL⁻¹) has been associated with poor health in men. The current treatment for hypogonadism—testosterone replacement therapy—is expensive, may produce adverse effects and its long-term safety is unknown.

Purpose: To identify nutritional and physical activity predictors of low serum testosterone status in men using the National Health and Nutrition Examination Survey (NHANES), a nationally representative sample of the United States.

Methods: A secondary analysis of cross-sectional data from 2011-2012 NHANES was carried out to examine the associations between weight status, dietary intakes, physical activity and serum testosterone concentrations; 1,933 adult men were included in the study after exclusion for missing or unreliable data. Nutrient intakes from foods and supplements were assessed using 24-hour recall via the 5-step Automated Multiple Pass Method. Participants self-reported typical weekly physical activity and daily sitting time. Body mass index (BMI), age, race, relationship status, education, and smoking behavior and serum testosterone concentration were assessed during

mobile exam center visits. Logistic regression was used to identify predictors of low testosterone status (lowest quartile; 204 ± 4 ng·dL⁻¹). Sampling weights were utilized in the analyses to account for the complex sampling design.

Results: Overweight and obese men had greater odds (2.10, 95% CI 1.17-3.78; 5.23, 95% CI 3.12-8.76) of low testosterone. Men reporting any vigorous physical activity, either recreational or work-related, had lower odds (0.42, 95% CI 0.28-0.64; 0.56, 95% CI 0.33-0.98) of low testosterone, whereas sitting time was associated with greater odds (1.05, 95% CI 1.02-1.08). None of the dietary variables were statistically significant predictors of low testosterone status in the logistic regression model (all $p > 0.153$).

Conclusion: BMI, vigorous physical activity and sitting time were independently associated with low testosterone status and appear to be candidates for lifestyle interventions. Future research should examine the effectiveness of weight loss interventions employing dietary, sedentary behavior, and physical activity modification to increase testosterone in overweight/obese men with low testosterone status.

549 Board #6 May 29 1:00 PM - 3:00 PM
Energy Availability is Predictive of LH Pulse Frequency Across a 3-month Diet and Exercise Trial

Kristen J. Koltun, Mary Jane De Souza, FACSM, Nancy I. Williams, FACSM. Penn State University, University Park, PA.

(No relevant relationships reported)

Exercising women are at risk for low energy availability (EA). Restricting EA to 20 kcal/kgLBM/d for 5 days reduces LH pulse frequency, but it's unclear how low EA over a longer duration affects LH. Slowed LH pulse frequency reflects reproductive axis suppression and is linked to menstrual disturbances. We showed that daily EA over a 3 month diet and exercise intervention predicted the frequency of menstrual disturbances, but the relation between low EA and upstream LH pulse dynamics is unclear. **PURPOSE:** To determine if reductions in EA due to diet and exercise over a prolonged period are related to LH pulse frequency in premenopausal, previously sedentary women. **METHODS:** This was a randomized controlled trial consisting of a 3 month controlled diet and supervised exercise program (5d/wk) leading to moderate weight loss. EA was calculated by measured energy intake (kcal) and recorded exercise energy expenditure (kcal) normalized to fat free mass (kgFFM). EA was measured daily and averaged during baseline and each of 3 intervention menstrual cycles. Blood samples were obtained via intravenous catheter every 10 min for 24hr in the early follicular phase prior to the intervention ($n=16$) and after 3 months of diet and exercise ($n=14$). Samples were assayed for LH via Immulite. LH pulse dynamics were assessed by Cluster. Paired t-tests compared Pre-Post differences. A linear mixed model was used to determine if EA predicts LH pulse frequency in the same or subsequent menstrual cycle.

RESULTS: Subjects were 20 ± 1 yrs old, 165 ± 1 cm tall, and weighed 58.4 ± 1.1 kg. Average weight loss was 3.1 ± 0.6 kg ($p < 0.001$). LH pulse frequency was 0.81 ± 0.06 pulses/hr prior to the intervention and 0.63 ± 0.08 pulses/hr after ($p = 0.047$). Average EA in the Pre cycle was 38.6 ± 1.8 kcal/kgFFM/d and 27.9 ± 2.1 kcal/kgFFM/d during Post ($p < 0.001$). EA measured within a menstrual cycle was a significant positive predictor ($p = 0.011$) of LH pulse frequency in the same or subsequent cycle. Specifically, for every 1 kcal/kgFFM/d increase in EA, LH pulse frequency increases by 0.014 pulses/hr. **CONCLUSIONS:** EA is a positive predictor of LH pulse frequency within the same or subsequent menstrual cycle. To prevent suppression of the reproductive axis, EA should be maintained at optimal levels, as a reduction in EA from 38 to 28 kcal/kgFFM/d suppresses LH pulse frequency by 19%.

B-11 Free Communication/Slide - Resistance Training

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-202C

550 **Chair:** Kevin R. Ford, FACSM. *High Point University, High Point, NC.*
(No relevant relationships reported)

551 **May 29 1:00 PM - 1:15 PM**
Ground Reaction Force Characteristics In Power Cleans With And Without The Double Knee Bend Technique

Alexander M. Carnall, Jake A. Melaro, Douglas W. Powell, FACSM. *University of Memphis, Memphis, TN.* (Sponsor: Douglas W Powell, FACSM)
(No relevant relationships reported)

INTRODUCTION: Muscular power (i.e. muscular force x shortening velocity) is arguably the most important physical quality an athlete can possess. Many athletes use power cleans to improve muscular power but are not taught to use a double knee bend (DKB). The DKB is used by competitive weightlifters to increase muscular power produced in the second pull of the power clean exercise. Thus, athletes using power cleans to improve muscular power without using the DKB may not experience optimal benefit from the exercise. **PURPOSE:** To determine differences in ground reaction force characteristics between a power clean from the floor both with, and without, the use of a DKB in athletes with weightlifting experience. **METHODS:** Six participants with weightlifting experience each performed three power cleans with and without a DKB at 80% of their self-reported one-repetition maximum. Ground reaction forces (GRFs) were captured using two force platforms (1200Hz). Commercially available biomechanical analysis software was used to calculate concentric impulse (IMP_{CON}), peak vertical ground reaction force ($VGRF_{PEAK}$), and rate of force development (RFD) in the second pull for each trial. Paired samples t-tests were used to compare dependent variables in each condition: DKB and NO DKB. Cohen's d estimates of effects size were used to determine meaningful differences. **RESULTS:** RFD was greater in the second pull of the power clean when a DKB was used ($p < .001$, $d = 2.25$; DKB: 6922 ± 1664 ; NO DKB: 4710 ± 277 N/s). IMP_{CON} was lower in the DKB condition ($p < .001$, $d = 1.09$; DKB: 146 ± 28.8 N*s; NO DKB: 174 ± 36.6 N*s), and no differences were observed in $VGRF_{PEAK}$ ($p = 0.375$, $d = 0.15$; DKB: 1607 ± 221 N; NO DKB: 1582 ± 169 N). **CONCLUSIONS:** Although no differences were observed in $VGRF_{PEAK}$ and IMP_{CON} was reduced, RFD was significantly greater in the second pull with the DKB. These data suggest that DKB may enhance the training stimulus by enabling the athlete to produce comparable peak forces in shorter time periods by increasing muscular shortening velocity. This may be due to a positional optimization of muscular length-tension properties in the hip, knee, and ankle extensor musculature uniquely offered by utilizing a DKB technique.

552 **May 29 1:15 PM - 1:30 PM**
Modulation Of Corticospinal Excitability and Short Intracortical Inhibition During Different Levels Of Voluntary Contraction In Untrained And Chronically Resistance Trained Individuals.

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(No relevant relationships reported)

PURPOSE: To investigate central nervous system (CNS) excitability modulation in chronic resistance trained and untrained participants by assessing 1) short intracortical inhibition (SICI) and 2) motor evoked potential (MEP) of the biceps brachii, during different voluntary contraction intensities.

METHODS: 12 participants, 6 untrained (30 ± 1.4 years) and 6 chronic resistance trained (29.6 ± 7.5 years), completed one experimental session during which three blocks of contractions were performed. Each block included 10 brief (7s) elbow flexors isometric contractions at the intensity of 15, 25 or 40 % of maximum voluntary contraction (MVC). Prior to the contractions: 1) elbow flexors MVC, 2) maximal compound muscle action potential (Mmax) in the biceps brachii during a 5% MVC elbow flexion contraction and 3) active motor threshold at the three different contraction intensities were recorded. A total of 60 MEPs, evoked by transcranial magnetic stimulation (TMS), were assessed from biceps brachii muscle of the dominant arm during the three different contraction intensities.

RESULTS: 1) MVC force of the chronic resistance trained group was 33 % higher ($p \leq -0.001$) than the untrained group. 2) The chronic resistance trained group had lower AMTs at all contraction intensities ($p \leq -0.03$, $p \leq -0.01$, $p \leq -0.08$ for the 15 %, 25 % and 40 % of MVC, respectively) compared to the untrained group. 3) MEP amplitude (normalized to Mmax) did not differ between the two groups. 4) During 25 % of MVC, the untrained group exhibited decreased SICI in comparison to the chronic resistance trained group (SICI: $78 \pm 13\%$ vs. $97 \pm 9\%$ of test pulse; $p \leq -0.01$, respectively). During 40 % of MVC, the untrained group also exhibited decreased SICI in comparison to the chronic resistance trained group (SICI: $86 \pm 14\%$ vs. $102 \pm 11\%$ of the test pulse; $p \leq -0.03$, respectively). SICI did not differ between groups at 15 % MVC ($p \leq -0.30$).

CONCLUSION: Based on the results, chronic resistance training significantly reduces SICI at stronger contraction intensities compared to no training. The significant reduction in inhibitory outputs suggest the presence of an adaptive process of facilitatory network activation, which can cancel out the SICI, to increase corticomotor drive to the exercised muscle following a long period of resistance training.

553 **May 29 1:30 PM - 1:45 PM**
Patellofemoral Joint Loading While Squatting To Different Depths Using High and Low Bar Positions

William Goodman, Christopher Casillas, James Becker. *Montana State University, Bozeman, MT.*
(No relevant relationships reported)

In high bar (HB) squats, the bar is placed just inferior to C7 while in low bar (LB) squats the bar is placed across the inferior scapular spine. These different positions change the moment arm of the weight relative to the knee joint, and thus potentially alter knee extensor moments and patellofemoral (PF) joint loading. **PURPOSE:** Examine how knee extensor moments (pKEM) and PF joint reaction forces (PFJRF) and stresses (PFJS) change when squatting to above parallel (AP), parallel (P), and below parallel (BP) depths using HB and LB positions. **METHODS:** 20 individuals (sex: 10M/10F; age: 23.0 ± 2.8 years) participated in this study. On day one, a one repetition maximum (1RM) was measured. On day 2 participants performed squats using 70% 1RM to AP, P, and BP depths using both HB and LB. Motion capture and two force plates were used to record whole body kinematics and ground reaction forces, respectively. pKEMs were calculated using inverse dynamics while PFJRF and PFJS were calculated using a model incorporating knee angles, extensor moments, and estimates of PF contact area. Effects of depth and bar position were evaluated using 3x2 repeated measures ANOVAs. **RESULTS:** For pKEMs, there was a main effect of depth ($p=.047$), with pKEMs being lower at P than either AP ($p=.044$) or BP ($p=.030$) depths. For PFJRF there was a significant depth by load interaction ($p=.024$). For both HB and LB positions, PFJRF was lower at BP compared to the AP ($p=.001$) depths. However, when using LB position PFJRF was also lower at P than AP ($p<.001$) depth. There were no differences in PFJS between depths ($p=.675$) or bar positions ($p=.191$). **CONCLUSION:** Individuals can squat to parallel or deep depths with their preference of bar position without increasing PFJS or PFJRF. However, squatting to parallel may be preferred as pKEM are lowest at this depth.

Table 1: Peak Knee Extensor Moments (pKEM), Peak Patellofemoral Joint Reaction Force (PFJRF), Peak Patellofemoral Joint Stress

	pKEM (Nm)		PFJRF (BW)		PFJS (MPa)	
	HB	LB	HB	LB	HB	LB
AP	100.9 ± 40.5*	102.8 ± 41.9*	17.9 ± 4.2*	18.9 ± 4.4*	7.9 ± 5.5	8.4 ± 5.6
P	96.6 ± 38.3*	96.5 ± 37.9*	17.1 ± 4.7	16.5 ± 4.2	10.1 ± 9.9	7.9 ± 9.6
BP	101.9 ± 41.8*	103.3 ± 45.5*	16.4 ± 3.2	15.9 ± 1.4*	8.8 ± 10.4	7.0 ± 5.9

*Indicates that pKEMs were significantly different, *Indicates that PFJRF were significantly different, *Indicates that LB PFJRF were significantly different, *Indicates that at AP bar positions were significantly different. All significance levels were $p \leq .05$.

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Strength Training Effects on Force Production and Drive Distance in Female Golfers: A Pilot Study

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Strength training (ST) by golfers is a relatively recent phenomena, gaining popularity only over the last two decades. Thus, little quantitative research exists on its benefits. Previous research provides support for golf performance gains, primarily club head speed, following ST. It has also been reported that vertical jump height is positively correlated to vertical thrust during a golf swing with a driver, which positively impacts carry distance of the golf ball. However, there is a paucity of research describing the vertical ground reaction force (vGRF) generated during a golf swing and the relationship of said force to the carry distance of the golf ball.

Purpose: 1) To evaluate if there is a relationship between vGRF produced and drive distance (DD) of the golf ball during a swing with a driver. 2) To determine if an

8-week ST program geared toward increasing vertical jump height affects vGRF and DD. 3) To evaluate the methodology for feasibility with a larger, more diverse population in future studies.

Methods: Participants were six female athletes ($n=6$) from a NCAA Division III varsity golf team (19.3 ± 1.4 years). Data was collected before and after an 8-week ST program focused on increasing vertical jump height. Participants completed two 45-minute ST sessions/week under the supervision of a certified strength and conditioning coach. Exercises included squats, broad jumps, box jumps, lunges with and without rotations, and sprints. vGRF was measured on force plates during the downswing phase of the golf swing with a driver and DD was measured with a golf launch monitor. Vertical jump height and measures of lower extremity and core strength were also collected.

Results: The correlation between vGRF and DD was weak ($r = -0.03$, $p = 0.74$). There were no significant differences between pre and post vGRF ($25.3 \text{ N} \pm 32.8 \text{ N}$, $p = 0.12$) nor DD ($-3.7 \text{ m} \pm 11.6 \text{ m}$, $p = 0.47$) within subjects.

Conclusion: The golf swing is an intricate maneuver with numerous factors impacting ball flight and distance. It is likely that other factors such as club head speed and angle of attack have a greater influence on DD than vGRF. Further research with larger and more diverse populations may determine whether or not significant relationships exist between ST, vGRF production, and golf swing performance. The methodology has been deemed feasible for future studies.

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Poor Pelvic Control During A Knee Lift Test Is Associated With Increased Risk Of Knee Injuries

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(No relevant relationships reported)

PURPOSE: To investigate whether deficits in stance leg, hip and pelvic stability during a standing knee lift test are associated with increased risk of non-contact knee and ankle injuries in youth team sports.

METHODS: At baseline, 263 basketball and floorball players (age range 12–21 y.) participated in a standing knee lift test using 3-dimensional motion analysis. The test was a modified version of the Trendelenburg test to assess stance leg and hip stability. Two trials per leg were recorded from each participant and mean value was used in the analysis. The biomechanical variables calculated were peak anterior pelvic tilt angle (APT) and peak lateral pelvic drop angle (LPD). The APT and LPD were categorized into two groups using the median of the cohort: low group (values less than median value) and high group (values larger than median). All new non-contact knee and ankle injuries, as well as match and training exposure, were then recorded for 12 months. Cox regression models were used to calculate hazard ratios (HRs) and 95% CIs. **RESULTS:** A total of 16 new non-contact knee injuries (of which eight were ACL ruptures, all affecting female players) and 36 new non-contact ankle injuries were registered during the study period. Athletes displaying high lateral pelvic drop angles were at increased risk of knee injuries (adjusted HR for high versus low group 4.22; 95% CI 1.34–13.3). A borderline significant ($p=0.05$) association was found between high lateral pelvic drop angles and ACL injury risk in female athletes (adjusted HR for high versus low group 8.14; 95% CI 0.97–68.6). No potential ankle injury risk factors were found. A receiver operating characteristic curve analysis for the LPD and knee injuries showed an area under the curve of 0.60, which indicates poor combined sensitivity and specificity of the test.

CONCLUSIONS: Poor pelvic control, with increased lateral pelvic drop, is associated with increased risk of non-contact knee injuries among young team sport players. However, the knee lift test cannot predict non-contact knee injuries in youth team sports.

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Effects of Foot Instability Variations on Muscle Activation during Front Plank Exercise

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Adding instability is a common method of increasing the difficulty of an exercise. Front plank exercise is often performed with various instability types and levels; however, how induced instability influences muscle activation during front plank is not well-understood.

PURPOSE: To examine how 4 different foot stability variations of front plank influence activation of 5 different muscles.

METHODS: 19 physically active, healthy individuals (8 males, 11 females; age 39 ± 16.0 years; height 1.68 ± 0.1 m; mass 75 ± 17.5 kg) performed each of 4 plank variations in a randomized order. The foot stability was modified by placing the feet: 1) on a level, stable floor (FLOOR); 2) on an elevated stable step (STEP); 3) in elevated suspension straps (SUSPEND); 4) on a rubber dome (DOME). STEP, SUSPEND and DOME were height-matched for foot placement. Electromyography of 5 muscles, rectus abdominis (RA), external oblique abdominis (EO), rectus femoris (RF), serratus anterior (SA) and erector spinae (ES) during front plank with 4 different foot stability conditions was examined and normalized as % maximal voluntary isometric contraction (%MVIC). Foot stability variation effect on normalized average muscle contraction of 5-second static plank trials was assessed using one-way repeated measure ANOVA and Friedman test for normally and non-normally distributed data respectively.

RESULTS: SUSPEND was associated with greater muscle activation than DOME in RF (43.2 ± 25.8 vs. 32.9 ± 25.9 %MVIC), $p < 0.05$) and in RA (39.5 ± 18.2 vs. 30.3 ± 18.5 %MVIC, $p < 0.05$). Compared to FLOOR, SUSPEND was associated with higher activation of SA (57.2 ± 27.5 vs. 48.2 ± 23.1 %MVIC, $p < 0.05$) and ES (8.9 ± 4.3 vs. 7.5 ± 3.4 %MVIC, $p < 0.05$).

CONCLUSIONS: Plank with suspended feet increased average activation of muscles used in the front plank. The use of RF and RA increased primarily due to foot instability induced by suspension, and the activation of SA and ES increased with combination of instability and increased weight distribution to the upper body.

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Gender Comparisons of Muscle Activation Patterns Across Handle Types During Seated Row Exercise

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Muscular responses and performance during resistance exercise can be affected by handle design and wrist/forearm positioning. **PURPOSE:** To compare the electromyographic (EMG) responses during seated row exercise in the Biceps Brachii (BB), Latissimus Dorsi (LD), and Flexor Carpi Radialis (FCR), using a neutral forearm positioning (NF) handle versus a Wrist flexed positioning (WF) handle. **METHODS:** The protocol was performed on a cable machine by 10 males (21.6 ± 1.2 yrs) and 10 females (21.7 ± 2 yrs) with prior resistance training experience (5.0 ± 2.5 yrs). Participants completed a one-repetition maximal lift (1-RM) followed by one set at 85% 1-RM until failure, using both handle types in randomized order. Root mean square EMG (EMG_{RMS}) from the BB, LD, and FCR were normalized to the 1-RM values. Two-way repeated measures ANOVA was used to analyze EMG differences for each muscle group between genders and handle types. **RESULTS:** The 1-RM lifts were significantly greater ($p < 0.05$) with the WF handle (90.2 ± 30.6 kg) versus the NF handle (87.8 ± 30.4 kg). There were significant differences ($p < 0.05$) between genders for the 1-RM lifts across both handle types. However, there were no significant differences between handles for the total number of repetitions completed (NF 11.9 ± 3.6 ; WF 11.2 ± 2.4). Although there was a trend ($p < 0.07$) for BB EMG activity between the genders, there was no significant difference in the EMG amplitudes between the LD and FCR for either gender or handle type.

CONCLUSION: These findings showed significantly higher maximal lifts with the WF handle type, but non-significant EMG differences in the BB, LD and FCR between genders and across handle types. This indicates similar muscle activation patterns. The possible mechanisms for the 1RM differences may be related to actin and myosin overlap of the forearm flexors, ergonomic factors such as grip comfort and differences in handle contact surface area.

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Modified Supine Bridge Alters Muscle Coordination Patterns

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Contributions of mono- and bi-articular hip extensor muscles while performing single leg supine bridge (SLB) and modified single supine bridge (mSLB) is not quite clear. To identify hip extensor muscles activation patterns among different unilateral-bridges, could be a key point for hip extensor strength and rehabilitation trainings. **PURPOSE:** To compare hip extensor muscles activation patterns during performing SLB and mSLB.

METHODS: We have recruited healthy collegiate students for the project. Participants signed an informed consent form before data collection. They have performed SLB and mSLB at a constant pace (~2s up and ~2s down). mSLB was performed unilaterally with the exercise leg placed up on a box of 40 cm in height. Surface electromyography (sEMG) of the right gluteus maximus (Gmax), biceps long head (BFL), and semitendinosus (STN) muscles was recorded using a wireless surface electromyography system. Peak RMS sEMG of each muscle during SLB define as 100% and used as the base of comparison with that of mSLB. On- and off-set of sEMG bursts threshold were defined as 10% of the peak value. One-tailed paired-test was used for statistic examination. Alpha value was set at 0.05.

RESULTS: The peak RMS of Gmax, BFL and STN sEMG while performing mSLB were 82.1 ± 21.4 , 141.5 ± 36.4 , and 155.0 ± 2.5 , respectively. The peak magnitude of the hamstring muscle activations were greater, although peak Gmax activity was lower ($p < 0.05$), while performing mSLB than that of SLB ($p < 0.05$). Muscle activation burst duration of BFL was 1.6 ± 0.7 s longer while performing mSLB than that of SLB ($p < 0.05$). Muscle activation burst durations of STN (3.82 ± 0.58 s) and Gmax (3.53 ± 1.72 s) were (0.42 ± 0.50 s) and Gmax (0.47 ± 0.44 s) shorter than that of mSLB ($p < 0.05$).

CONCLUSIONS: Comparing to SLB, mSLB increased bi-articular hip extensor (BFL and ST) muscle activation level while reduced mono-hip extensor (Gmax) activation level accompanied by prolonged BFL activities and shortened Gmax/St activation durations.

B-12 Free Communication/Slide - Skeletal Muscle Basic Science

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-306

559 Chair: Graham R. McGinnis. *University of Las Vegas Nevada, NV.*

(No relevant relationships reported)

560 May 29 1:00 PM - 1:15 PM Sites of Disruption in Dystrophic Muscle Following Eccentric Contractions

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PURPOSE: Dystrophin is responsible for maintaining plasmalemmal integrity and cellular homeostasis. A key feature of skeletal muscle that lacks dystrophin, as in the mdx mouse model for Duchenne muscular dystrophy (DMD), is a heightened sensitivity to eccentric (ECC) contraction-induced strength loss. However, the mechanisms responsible for the exaggerated loss of strength in dystrophic muscle have yet to be fully established. The purpose of this study was to determine possible sites within mdx muscle that are disrupted following ECC contractions. **METHODS:** Male wildtype and mdx mice ($n = 8$ per group) were chronically implanted with stimulating electrodes on the left common peroneal nerve and EMG electrodes on the left tibialis anterior (TA) muscle. The left anterior crural muscles (TA and extensor digitorum longus; EDL) of anesthetized mice performed 50 maximal ECC contractions. In vivo peak dorsiflexion torque and M-wave root mean square (RMS) were measured prior to and immediately after the ECC contractions. Following the in vivo assessment, the EDL was removed and ex vivo peak isometric force and caffeine-induced force were analyzed. **RESULTS:** Peak torque and force in wildtype mice were reduced 36 ± 4 and $28 \pm 4\%$ ($p \leq 0.001$) following the ECC contractions, while no changes were observed in M-wave RMS ($10 \pm 2\%$; $p = 0.49$) or caffeine-induced force ($10 \pm 4\%$; $p = 0.20$). To the contrary, both M-wave RMS and caffeine-induced force were reduced in mdx muscle (60 ± 4 and 58 ± 5 ; $p \leq 0.001$), and corresponded to reductions of 60 ± 2 and $67 \pm 8\%$ ($p \leq 0.001$) in peak torque and force. **CONCLUSIONS:** On the basis of the disproportional reductions in strength measured in vivo and ex vivo (36 and 28% , respectively) compared with that of in vivo M-wave RMS (10%) and ex vivo caffeine-induced force (10%), we confirm that ECC contractions uncouple the plasmalemma from the ryanodine receptors (RyRs) in wildtype muscle. However, in mdx muscle, in vivo peak torque and M-wave RMS in addition to ex vivo force and caffeine-induced force were all reduced to a similar degree (58 - 67%), indicating that various sites were disrupted immediately following the injury. These data indicate strength loss in wildtype and mdx mice differ, in that plasmalemmal function and sites at or distal to the RyRs may all be impaired in dystrophic muscle following ECC contractions.

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The Effects of High Intensity Interval Training on Autophagy in Soleus Muscle of Rats

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PURPOSE: The aim of this study was to investigate the impacts of the high intensity interval training (HIIT) on basal autophagy in soleus muscle of rats. **METHODS:** Nine months old, male Wistar rats were randomly divided in 3 groups: control group (C group, $n = 18$, sedentary), traditional moderate-intensity continuous training (MICT) group (M group, $n = 19$, 50-min moderate intensity continuous running at 60% VO₂max) and high intensity interval training (HIIT) group (H group, $n = 19$, 6 bouts $\times 3$ min running at 80% VO₂max interspersed with 6 bouts $\times 3$ min active recovery at 40% VO₂max with a 7-min warm-up and cool down at 60% VO₂max). Before the intervention, a total of 8 rats were killed as the baseline. At the 4th and 8th week, 8 rats of each group were killed 24 h after the last exercise. The test of VO₂max, the observation of autophagosome by transmission electron microscope (TEM) and the expression of autophagy-related proteins by western blot were assayed at three time points: baseline, 4th and 8th week after the intervention. Statistical significance was tested by two-way ANOVA. **RESULTS:** In the 4th week of intervention, compared to the C group, only H group resulted a 30% increase in VO₂max (2732.85 ± 135.43 vs. 2103.53 ± 135.43 , $P < 0.01$), a 82% increase in the number of autophagosomes (0.50 ± 0.04 vs. 0.28 ± 0.04 , $P < 0.05$), a 25% increase in the expression of LC3II (1.62 ± 0.10 vs. 1.29 ± 0.10 , $P < 0.05$), no change in the LC3II/LC3I; M group and H group resulted a 38% and 18% decrease respectively in the expression of P62 (0.75 ± 0.05 vs. 0.99 ± 0.05 vs. 1.21 ± 0.05 , $P < 0.001$, $P < 0.01$). In the 8th week, compared to the C group, only H group resulted a 30% increase in VO₂max (2830.46 ± 135.43 vs. 2182.30 ± 135.43 , $P < 0.05$), a 62% increase in the number of autophagosomes (0.53 ± 0.04 vs. 0.33 ± 0.04 , $P < 0.05$), a 25% increase in the expression of LC3II (1.79 ± 0.10 vs. 1.43 ± 0.10 , $P < 0.05$); a 31% increase in the LC3II/LC3I (2.33 ± 0.12 vs. 1.77 ± 0.12 , $P < 0.01$); M group and H group resulted a 26% and 30% decrease respectively in the expression of P62 (0.89 ± 0.05 vs. 0.84 ± 0.05 vs. 1.20 ± 0.05 , $P < 0.001$, $P < 0.001$ respectively). There was no significant change in the expression of ULK1^{Ser757} and Beclin-1 in all groups across the training period. **CONCLUSION:** An engagement in HIIT might promote the basal autophagy activity and autophagy flux, with prominent effects for HIIT than MICT.

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Bovine Milk Exosome Depletion Affects Skeletal Muscle and Liver in Young Growing Rats

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Exosomes are extracellular vesicles that carry 'cargo', such as microRNA, which may interact with different tissues and regulate cellular signaling pathways. **PURPOSE:** To determine the effects of exogenous bovine exosomes on the liver and skeletal muscle in young, growing rats. **METHODS:** Twenty-eight-day Fisher 344 rats were provided a milk-based diet that either contained exosomes (EXO+, $n=12$) or was exosome depleted via sonication (EXO-, $n=12$) for four weeks. Following the intervention, the liver and gastrocnemius were removed and measurements of respiratory control ratio (RCR), reactive oxygen species emission (ROS), antioxidant levels, cross sectional area (CSA), total RNA, and transcriptomics were performed. Except for transcriptomic data, independent samples t-tests were performed between diet groups and statistical significance was set at $p < 0.05$. For transcriptomic data, all annotated transcripts with FPKM scores > 1.0 were analyzed between groups and any score exceeding a fold-change cut-off > 1.5 fold ($p < 0.01$) were considered meaningful. **RESULTS:** There was no significant change in mitochondrial volume in either the liver ($p = 0.707$) or gastrocnemius ($p = 0.724$), however the liver had increased state 3 and state 4 in the EXO- treated group ($p = 0.040$ and $p = 0.009$) with complex I substrates. No significant differences were detected in liver antioxidant protein levels or oxidative damage markers ($p > 0.050$). There was an increase in GPX protein levels in gastrocnemius in the EXO- rats ($p = 0.020$), which may explain the significant decrease in ROS emission ($p = 0.016$). No significant change was observed in gastrocnemius mitochondria respiration ($p > 0.050$). Interestingly, gastrocnemius CSA and total RNA significantly increased in EXO- group ($p = 0.018$ and $p = 0.001$). Further analysis of the diet verified sonication decreased exosomes, however RNA was enriched per particle by > 7.5

fold. **CONCLUSION:** An exosome depleted diet affects liver and skeletal muscle parameters and resulted in increased muscle hypertrophy. These changes may be due to the enhanced mRNA nature of the EXO- diet. Supported by AU IGP Grant; NIFA 2015-67017-23181 and 2016-67001-25301; NIH 1P20GM104320; Gates Foundation, Gerber Foundation; PureTech Health, Inc. JZ serves as a consultant for PureTech Health, Inc.

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Resolvin E1 Attenuates Inflammatory Induced Muscle Atrophy In Human Derived Muscle Cells

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Purpose Loss in skeletal muscle size and function is a common debilitating comorbidity in an array of chronic disease states as well as during the ageing process. This can lead to a loss of physical activity and ability to perform everyday tasks, leading those affected into a downward spiral of muscle loss and inactivity which has been strongly linked to increased rates of morbidity and mortality. Many factors have been linked to induce such processes, one of which is inflammation, with therapeutic research looking for ways to resolve chronic inflammation to subsequently alleviate related muscle atrophy. Resolvin E1 (RvE1) is a specialised pro-resolving lipid mediator, derived from the metabolism of the omega-3 fatty acid EPA, which has shown to have beneficial pro-resolving properties in an array of cell types, including our previous work in immortalised skeletal muscle cell lines. **Method** This set of experiments cultured human derived skeletal muscle cells from healthy control participants (n = 6). Once differentiated, myotubes were exposed to Lipopolysaccharide (LPS) in the presence or absence of RvE1 (100ng/ml) and compared with a control condition. Post exposure, myotubes were harvested for gene expression and intracellular protein analysis. From the same experiment, wells were also fixed and stained for immunocytochemistry analysis of myotube size and number. **Results** Our work indicates beneficial pro-resolving properties of RvE1 in human skeletal muscle cells. RvE1 was seen to attenuate LPS induced inflammatory related gene expression of both IL-6 (LPS 7.82 ± 0.52 vs. RvE1 3.93 ± 0.32 , $p = 0.015$) and MCP-1 (LPS 21.45 ± 0.92 vs. RvE1 17.31 ± 0.52 , $p = 0.023$) leading to an alleviation in downstream endotoxin induced myotube atrophy (μm) (LPS 20.29 ± 1.36 vs. RvE1 28.76 ± 1.13 , $p = 0.003$). **Conclusion** Preliminary evidence suggests that RvE1 may induce its effects through the inhibition of classical canonical inflammatory signalling. Our novel findings provide initial rationale for further investigation of RvE1 as a naturally occurring nutritional therapeutic in chronic conditions characterised with a degree of inflammatory induced skeletal muscle atrophy.

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Concurrent Exercise of the Arm Extensors Modulates Anabolic Signaling and Gene Expression for Ribosome Biogenesis

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PURPOSE: As most concurrent exercise studies to date have focused on lower-limb muscles, this study explored the acute molecular response to concurrent exercise of the arm extensors. Specifically, the effects of a preceding bout of aerobic exercise (AE) on subsequent anabolic signaling and ribosome biogenesis response to resistance exercise (RE) were explored. **METHODS:** Eleven moderately trained men (28 ± 5 years, $181 \text{ cm} \pm 6 \text{ cm}$, $81 \pm 8 \text{ kg}$) performed a unilateral bout of arm extensor aerobic exercise (~45 min) in a seated isokinetic dynamometer. Subsequently, unilateral resistance exercise (4 sets of 7 reps) was performed for both arms using flywheel technology. Thus, one arm was subjected to RE alone, while the other arm performed consecutive bouts of AE and RE interspersed by 15 min recovery. Peak power (merged across concentric and eccentric actions) was assessed during the resistance exercise bout. Muscle biopsies were taken from the m. triceps brachii of each arm immediately before, 15 minutes and 3 h after the RE bout. Muscle samples were assessed for gene (q-PCR) and protein (immunoblotting) expression of markers involved in the regulation of muscle hypertrophy and ribosome biogenesis. **RESULTS:** The AE bout resulted in reduced (~24%) power performance during the subsequent RE bout ($P < 0.05$). Gene expression of MuRF-1, atrogin-1, and PGC-1 α were significantly greater in AE+RE compared to RE (arm x time interactions $P < 0.05$). Myostatin expression decreased in both AE+RE and RE (main effect of time $P < 0.05$). Phosphorylation of AMPK increased (2.5-fold), and 4E-BP1 decreased (0.5-fold), after the AE bout (arm x time interactions, $P < 0.05$). Phosphorylation of P70S6K remained unaltered.

Gene expression of c-Myc and 45S pre-rRNA (ITS) increased with exercise and was greater in AE+RE compared with RE alone (main effect of time and arm $P < 0.05$). Polr1b expression increased in both AE+RE and RE (main effect of time $P < 0.05$). **CONCLUSION:** The results suggest that post-exercise translational signaling could be compromised by prior aerobic exercise. In contrast, concurrent exercise of the arm extensors accentuates the expression of key regulators of ribosome biogenesis and promotes rDNA transcription.

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The Skeletal Muscle Transcriptome Signature of 84-day Bed Rest and its Reversal by Resistance Exercise

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PURPOSE: Given the poor understanding of the molecular mechanisms regulating skeletal muscle alterations to long-term unloading/microgravity, this study assessed the transcriptomic changes to 84 days of bed rest, and the potential of high-intensity, low-volume resistance exercise (RE) to counteract the bed rest signature. **METHODS:** Healthy men (age range 26-41 yr) were randomized to perform 84-d bed rest with (BRE; n=9) or without (BR; n=12) concurrent RE targeting the knee extensors (i.e. supine squat; 4 sets of 7 maximal concentric-eccentric repetitions every third day) employing Yo-Yo iso-inertial flywheel technology offering eccentric overload. Biopsies from m. vastus lateralis were obtained from all subjects before and after bed rest. The muscle specimens were used to conduct a DNA microarray analysis. **RESULTS:** Three hundred thirty-five probesets were down- and 315 were upregulated after bed rest at a false discovery rate of 0.01. Amongst the downregulated genes, ontologies related to muscle structural and contractile components, and acetylcholine receptors, were highly enriched. Yet, the ontology most substantially affected by bed rest, with 109 genes downregulated, was the mitochondrion. Although RE normalized a large portion of the transcripts affected by bed rest, genes that were upregulated after bed rest were less likely to become normalized by BRE. The greatest counteracting effect of RE was noted in genes belonging to the mitochondrion. This ontology was even slightly elevated by exercise compared with the baseline signature in BRE (Pre-Post within BRE; $P < 0.05$, interaction BR-BRE; $P = 2e-78$). A group of upregulated transcripts were not affected by RE. These genes are involved in transcriptional regulation, and DNA and chromatin stability. **CONCLUSIONS:** Long-term bed rest has a profound effect on muscle mass and function. Our data indicate that such changes are driven by alterations in molecular pathways regulating muscle structure, contractile properties, neuromuscular junction, and importantly, the mitochondrion. This particular RE regimen appears to counteract, and even reverse, selected transcriptomic modifications induced by long-term bed rest. Yet, some genes modulated by bed rest were resistant to RE and thus represent the residual signature of bed rest induced muscle atrophy.

566 May 29 2:30 PM - 2:45 PM

Lifelong Deficiency in Ulk1-Mediated Autophagy Precipitates Skeletal Muscle Aging

Anna S. Nischenko¹, William Michael Southern², Grant Mercer¹, Sarah M. Greisinger², Jarrod A. Call¹. ¹University of Georgia, Athens, GA. ²University of Minnesota, Minneapolis, MN.
(No relevant relationships reported)

Autophagy is a cellular recycling mechanism critical for maintaining cellular homeostasis because it degrades dysfunctional organelles and proteins. Insufficient autophagy is implicated in the pathophysiology of a plethora of diseases (i.e. Type 2 diabetes, obesity, and sarcopenia) and in the process of aging across many cell types. Ulk1 is an autophagy-related protein kinase that initiates autophagy and may be particularly critical for maintaining skeletal muscle cellular homeostasis throughout life. **PURPOSE:** To investigate muscle health and function in an aging mouse model with a lifelong deficiency of Ulk-1-mediated autophagy. **METHODS:** Longitudinal measurements of *in vivo* ankle dorsiflexion torque of muscle-specific Ulk1 knockout mice (Ulk1 KO) and their littermate controls (LM) were performed beginning at 12 months of age. At age 22 months, mice were administered a glucose tolerance test (GTT), followed by *in vitro* force testing of the extensor digitorum longus (EDL) and soleus (SOL) muscles. Mice were then sacrificed and mitochondrial function was measured via oxygen consumption rates of permeabilized muscle fibers from the gastrocnemius muscle. **RESULTS:** Body mass did not change throughout the longitudinal force measurements ($p = 0.58$). Ulk1 KO mice experienced a greater reduction in *in vivo* ankle dorsiflexion torque from age 12 months to age 22 months compared to LM mice (~50% vs. ~36%, $p = 0.026$). *In vitro* peak-isometric force of isolated EDL muscles was less in Ulk1 KO mice ($p = 0.035$) compared to LM mice, but there was no difference in isolated SOL muscle force between genotypes suggesting an accelerated aging phenotype in predominately fast-twitch muscle fibers. There was no difference in the GTT between genotypes ($p = 0.1$). Interestingly, mitochondrial respiration was greater in the Ulk1 KO mice when normalized to muscle fiber mass

($p=0.001$). This may reflect an accumulation of mitochondria due to Ulk1-mediated autophagy insufficiency, or an undetermined compensatory adaptation affecting mitochondrial function. **CONCLUSIONS:** A lifetime of insufficient Ulk-1-mediated autophagy exacerbates age-related skeletal muscle contractile dysfunction and may alter mitochondrial quality and/or quantity.

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A Crtc2/Creb1-mediated Molecular Mechanism for the Beneficial Effects of Exercise on Weight Loss

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(No relevant relationships reported)

Exercise is one of the few behavior modifications that enable long-term weight loss through unknown mechanisms. High-intensity exercise (HIE) induces norepinephrine and calcium signaling, which together, stimulate the Crtc2 coactivator to activate the Creb1-mediated transcriptional program in skeletal muscle. We previously demonstrated that Crtc2 activation drives an adaptive anabolic transcriptional response that includes hypertrophy and enhanced exercise performance (Bruno et al. EMBO J. 2014). **PURPOSE:** Here, we examined the role of skeletal muscle-selective Crtc2/Creb1 signaling in the metabolic response to weight loss. **METHODS:** Crtc2 was selectively overexpressed in skeletal muscle using a doxycycline-inducible transgene. 18-week old, naturally obese control or Crtc2 transgenic (Tg) mice were treated with doxycycline for 2 weeks and then subjected to 8 cycles of alternate day fasting (ADF). **RESULTS:** Compared to control Tg mice, which lost lean body mass ($p = 0.02$), Crtc2 Tg mice lost more weight over time (Crtc2, $p = 0.013$; Crtc2 x Time, $p = 0.00015$) through a selective loss of fat body mass ($p = 0.004$). This effect was due to higher energy expenditure during fasting (1 kcal/hr, $p < 10^{-15}$), and was associated with improved glucose tolerance (Crtc2, $p = 0.037$; Crtc2 x Time, $p = 0.0023$) and insulin sensitivity ($p = 0.012$), increased fatty acid oxidation ($p = 0.05$) and mitochondrial DNA content, and upregulation of Pgc-1 α and cytochrome C expression. **CONCLUSION:** This work reveals Crtc2/Creb1 signaling as a key driver of both anabolic and metabolic adaptations in skeletal muscle and explains how HIE facilitates successful weight loss by preventing the lowering of sympathetic tone, which reduces metabolic rate during fasting. During ADF-induced weight loss, the Crtc2/Creb1-mediated transcriptional program in skeletal muscle upregulates mitochondrial biogenesis to provide the excess energetic capacity required to maintain a higher metabolic rate and selectively burn fat.

B-13 Free Communication/Slide - Testing and Measurement

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-105B

568 **Chair:** Kimberly Reich. *High Point University, Burlington, NC.*

(No relevant relationships reported)

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Accuracy of the Cosmed K5 Portable Metabolic System

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(No relevant relationships reported)

The Cosmed K5 is the latest generation of Cosmed portable metabolic systems. Similar to previous generations of the Cosmed devices, the K5 measures oxygen consumption (VO_2) and carbon dioxide production (VCO_2) on a breath-by-breath (BxB) basis. New to the K5 is the ability to measure VO_2 and VCO_2 using a dynamic mixing chamber (MC) mode that uses micro-proportional sampling. **PURPOSE:** The purpose of this study was to assess the accuracy of the Cosmed K5 MC and BxB modes against the criterion Douglas bag (DB) method. **METHODS:** Eleven healthy males (mean age \pm SD, 33.5 \pm 6.3 yrs) had their metabolic variables measured at rest (17 min) and during cycling at 50, 100, 150, 200, and 250 W (13 min at each work rate). Within each stage, steady-state metabolic variables were measured using three systems (DB, BxB, MC), with the order varied to account for possible order effect. During each stage the participant was connected to the first system for the first four minutes to reach steady state, followed by collection periods of 5-min (DB) or 3-min (MC and BxB) for

the resting condition, or 2-min each for all cycling intensities. The collection periods for the second and third systems were preceded by a washout of 1-3 min. Repeated measures ANOVAs were used to compare metabolic variables measured by each system for rest and each cycling work rate. **RESULTS:** For ventilation (\dot{V}_E) and VO_2 , the K5 MC and BxB modes were not significantly different from the DB \dot{V}_E and VO_2 at rest or any cycling work rate ($p \geq 0.05$). Across all stages, the VO_2 from the K5 MC and BxB modes were within 0.09 L/min of the DB VO_2 . Compared to DB values, VCO_2 was significantly underestimated by the K5 MC mode at 150W (mean difference, -0.17 L/min) and by the K5 BxB mode at 200W (-0.17 L/min) and 250 W (-0.40 L/min, all $p < 0.05$). K5 MC and BxB respiratory exchange ratio (RER) values were significantly lower than DB RER across most work rates by 0.04 to 0.09 ($p < 0.05$). When comparing the K5 MC and BxB modes to each other, \dot{V}_E , VO_2 , VCO_2 , and RER were similar at rest and across all cycling intensities. **CONCLUSION:** These findings suggest that the Cosmed K5 portable metabolic system MC and BxB modes are acceptable for measuring VO_2 during rest and across a wide range of exercise intensities.

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Agreement between Deuterium Oxide and Bioimpedance Spectroscopy Measures of Total Body Water

Zackary Ciccone¹, Clifton Holmes¹, Bjoern Hornikel¹, Todd Freeborn¹, Jordan Moon², Michael Fedewa¹, Michael Esco, FACSM¹. ¹University of Alabama, Tuscaloosa, AL. ²Impedimed, Inc, Carlsbad, CA. (Sponsor: Michael R. Esco, FACSM)
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Reported Relationships: **Z. Ciccone:** Industry contracted research; ImpediMed, Inc..

The inclusion of total body water (TBW) into body composition analyses improves the accuracy of measures. However, the criterion method using deuterium oxide dilution (D_2O) is impractical for clinical settings.

PURPOSE: The purpose of this study was to compare TBW estimates from two commercial bioimpedance spectroscopy (BIS) devices against D_2O .

METHODS: 89 subjects (64% female; age: 18 to 82 years; body mass index [BMI]: 18.0 to 39.5 kg/m²) had TBW determined via D_2O and whole-body BIS using two devices: a standard supine BIS device (BIS_{sup}), and a new commercial standing BIS device (BIS_{new}). Agreement between TBW from D_2O and the two BIS devices was determined using the Bland-Altman method.

RESULTS: Mean differences between D_2O and BIS devices were significantly greater than zero ($p < 0.05$), however the magnitudes of the differences were small (Cohen's $d < -0.20$) and both devices were highly correlated with D_2O (Pearson's $r > 0.90$, $p < 0.01$). Bias and limits of agreement (bias $\pm 1.96 \times \text{SD}$) for BIS_{sup} (-1.5 \pm 5.7) and BIS_{new} (-0.7 \pm 5.8) were small and relatively tight. The BIS devices were strongly correlated with each other ($r = 0.99$).

CONCLUSIONS: The results of this study demonstrate that both the standard and new BIS devices measured TBW with minimal bias and tight limits of agreement compared to D_2O . These findings support the use of both the standard and new BIS device as a surrogate of D_2O for the assessment of TBW in adults across a wide range of both age and BMI.

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Exercise Testing Protocol Matters: Sub-maximal and Maximal Measures Before and After Marathon Training

Christopher J. Lundstrom, Emma J. Lee. *University of Minnesota, Minneapolis, MN.* (Sponsor: Dr. Eric Snyder, FACSM)

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(No relevant relationships reported)

Maximal and sub-maximal physiological testing can assess aerobic variables important in running performance. We compared two protocols to demonstrate the impact of protocol on measures of maximal ($\text{VO}_{2\text{MAX}}$) and submaximal aerobic variables: energy cost of running (ECR), oxygen cost of running (OCR), and substrate utilization, assessed with respiratory exchange ratio (RER). **PURPOSE:** To compare two physiological testing protocols before and after marathon training. **METHODS:** Recreational runners ($n=111$; 72% female; ages 21.2 \pm 1.6) enrolled in a marathon training class participated in the study. Subjects ran a 2-mile time trial (2MI) on a 200m indoor track, followed by laboratory testing 1-2 weeks later, both prior to and after 18 weeks of training for a marathon race. Testing included a sub-maximal 6-minute treadmill run at 75% of 2-mile velocity followed by a graded exercise test to assess $\text{VO}_{2\text{MAX}}$. The final 5 minutes of the 6-minute run were averaged for analysis of ECR, OCR, and RER. For post-testing one cohort ($n=54$) had the treadmill velocities adjusted to their current 2MI ability (ADJ) while another cohort ($n=57$) repeated the pre-test velocities (REP). Repeated measures ANOVA was used to assess the effect of testing protocol on ECR, OCR, RER, and $\text{VO}_{2\text{MAX}}$. **RESULTS:** Subjects improved in 2MI with training (16.3 \pm 2.0, 15.0 \pm 2.0 min; $p < 0.001$), with no group-by-time interaction. RER decreased with training ($p=0.02$). There was an effect of protocol

on RER ($p=0.02$): ADJ did not change but REP decreased (0.90 ± 0.05 , 0.86 ± 0.05 ; $p \leq 0.001$). There were no changes in ECR, but there was a trend towards an effect of protocol ($p=0.085$) with an increase in ECR for ADJ and a decrease for REP. There was an effect of protocol on OCR ($p \leq 0.001$): REP did not change whereas ADJ increased (32.3 ± 4.6 , 35.7 ± 4.5 mL kg⁻¹ min⁻¹). There was a trend toward an increase in VO_{2MAX} with training ($p=0.064$), and an effect of protocol ($p \leq 0.001$), with ADJ increasing in VO_{2MAX} (49.2 ± 6.8 , 52.2 ± 6.6 mL kg⁻¹ min⁻¹) and no change in REP. **CONCLUSIONS:** Marathon training decreases RER during moderate exercise at the same absolute but not relative velocity. Changing the speed of the exercise testing protocol to reflect current running ability helps detect changes in aerobic capacity (VO_{2MAX}), but may mask changes in sub-maximal running variables such as ECR, OCR, and RER.

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The Exercise Response In Blood Flow Restriction Training Varies As A Function Of Cuff Type

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(No relevant relationships reported)

PURPOSE: Blood flow restriction (BFR) training is a popular method to induce muscle hypertrophy. Both conventional blood pressure cuffs and devices specifically developed for BFR are used to achieve vascular occlusion/BFR. However, it is unknown if the training response differs depending on the cuff type. This study elucidated the acute effects and the safety of exercising with a medical blood pressure cuff (MC) and a BFR cuff (BFR-C). **METHODS:** Ten healthy individuals (30 ± 8 years, 5 ± 9) completed three sessions of unilateral low-intensity resistance exercise (30% 1RM) of the knee extensors. In the first session, wearing a BFR-C, the participants performed three sets until maximal exhaustion. In the two other conditions (order selected randomly), the same workload (sets & repetitions) was used for a training session with a MC and without any BFR. Pre and post-intervention, blood lactate, thigh circumference, pressure pain threshold, tissue stiffness and elasticity were measured. During exercise, heart rate, subjective discomfort and fatigue were documented. Twenty-four, 48 and 72 hours after training, muscle soreness was assessed. To judge safety, the pressure [mmHg] needed to provoke full occlusion at rest was determined with Doppler sonography. Differences between conditions were detected by means of Friedman tests including adjusted post hoc Conover comparisons. **RESULTS:** Both, BFR-C (+49%, $p=.03$) and MC (+29%, $p=.03$) induced greater lactate concentrations than the no-BFR control. Compared to the other conditions, BFR-C resulted in higher values for exercise heart rate (+3% vs MC, $p=.015$, +3% vs. no-BFR, $p=.015$) as well as muscle soreness after 24 hours (+81% vs MC, $p=.012$, +150% vs. no-BFR, $p=.004$). 72 hours post training, soreness was still increased in BFR-C (+3.5 pts on NRS vs. no-BFR, $p=.045$). Similarly, BFR-C elicited stronger fatigue sensations (+36%, vs. no-BFR, $p=.005$). Ultrasound examinations revealed that MC could generate a full occlusion while BFR-C did not entirely obstruct blood flow as long as the normal scale was not exceeded. **CONCLUSIONS:** Although BFR-C seems to provide a stronger exercise stimulus than MC, it may be a better choice regarding exercise safety. This finding may particularly be of value if applying the method in elderly/untrained persons or individuals with chronic disorders.

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Influence of Testing Sequence on an Adult's Ability to Achieve Maximal Aerobic and Anaerobic Power

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(No relevant relationships reported)

PURPOSE: To examine how testing sequence affects an adult's ability to achieve maximal aerobic and anaerobic power during a single assessment visit. **METHODS:** Fifty-three adults (31 women, 22 men; 21.9 ± 1.6 years) participated in this investigation. All subjects were tested on three separate occasions. Participants completed two baseline visits (Visits 1 and 2) consisting of either a VO_{2max} or WAnT in a randomized counterbalanced order. Participants then completed an experimental visit (Visit 3) which consisted of both a VO_{2max} and WAnT in randomized order (Group A: WAnT/ VO_{2max} ; Group B: VO_{2max} /WAnT) with 20 minutes of rest between tests. Mixed model ANOVAs with Bonferroni post hoc analyses compared baseline (Visits 1 or 2) and experimental (Visit 3) exercise test performance between and within groups for both relative VO_{2max} and absolute peak power. **RESULTS:** No significant main or interaction effects were observed for relative VO_{2max} at baseline and experimental visits when comparing Group A (42.9 ± 7.2 mL/kg/min and 42.0 ± 8.0 mL/kg/min, respectively) and Group B (40.9 ± 8.6 mL/kg/min and 41.2 ± 8.2 mL/kg/min, respectively). Similarly, no significant main or interaction effects were observed for absolute peak power at baseline and experimental visits when

comparing Group A (747.7 ± 229.4 W and 742.7 ± 221.3 W, respectively) and Group B (747.7 ± 229.4 W and 742.7 ± 221.3 W, respectively) (681.7 ± 209.0 W and 690.2 ± 197.6 W, respectively).

CONCLUSIONS: Our findings indicate that testing sequence had no effect on achievement of maximal aerobic and anaerobic power. Researchers and clinicians can include VO_{2max} testing and a WAnT during the same visit with 20 minutes of rest without compromising maximal performance.

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Effects Of Honest And Dishonest Pre-exercise Placebo Ingestion On VO_{2peak} And Isometric Handgrip Performance

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(No relevant relationships reported)

Pre-exercise consumption of placebo has been shown to improve resistance and endurance exercise performance. However, the effects of placebo ingestion on graded exercise test performance have not been widely reported in the literature. **PURPOSE:** The purpose of this study was to examine the effects of honest (subjects were told they were consuming placebo) or dishonest (subjects were told they were consuming a pre-workout supplement) placebo ingestion on VO_{2peak} values determined during a maximal treadmill graded exercise test. A secondary purpose of this study was to examine the effects of placebo consumption on isometric handgrip performance. We hypothesized that pre-exercise ingestion of both placebo conditions would result in increased VO_{2peak} and handgrip performance compared to control. **METHODS:** 28 males (178.4 ± 6.94 cm, 83.3 ± 14.8 kg, 22.6 ± 2.3 yrs.) and 13 females (166.4 ± 8.49 cm, 73.6 ± 20 kg, 26.4 ± 11 yrs.) participated in this study. In a randomized, cross-over design, subjects performed treadmill VO_{2peak} and isometric handgrip testing after consumption of honest placebo (HP) or dishonest placebo (DP). In addition, a third baseline trial (CON) was performed to establish performance values that were unaffected by a perceived placebo effect due to supplementation. All outcomes were assessed for normality using the Shapiro-Wilks test. When assumptions of normality were violated, log transformations were computed. However, transformations did not improve model assumptions. Therefore, non-transformed data is reported. One-way ANOVAs were used to analyze VO_{2peak} and handgrip strength data across conditions. Alpha was set at 0.05 prior to all analyses. **RESULTS:** Significant between-groups differences ($p < 0.05$) were not detected for relative VO_{2peak} (CON = 46.2 ± 9.3 mL/kg/min; HP = 46.7 ± 10 mL/kg/min; DP = 46.6 ± 9.6 mL/kg/min) or for maximal handgrip strength (CON = 43 ± 9.6 kg; HP = 44.1 ± 12.4 kg; DP = 43.4 ± 12.1 kg). **CONCLUSION:** Administration of honest or dishonest placebo immediately prior to VO_{2peak} and handgrip testing had no effect on performance compared to control. The VO_{2peak} and isometric handgrip tests were found to be robust exercise tests not significantly influenced by perceived pre-workout supplement consumption.

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Using a Stretch Sensor to Evaluate Muscle Contraction Timing During a Neuromuscular Control Screening Activity

Shannon E. Linderman¹, Donna Moxley Scarborough¹, William Day², Daniel Wrafter³, Eric M. Berkson¹. ¹Massachusetts General Hospital, Boston, MA. ²Figur8, Inc, Boston, MA. ³Massachusetts Institute of Technology, Cambridge, MA.

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Reported Relationships: S.E. Linderman: Salary; figur8, Inc.

PURPOSE: Stretch sensors are wearable devices that when applied over a muscle group, can measure the physical output of muscle deformation resulting from a muscle contraction. Electromyography (EMG) is the clinical standard for assessing the electrical signal identifying muscle activation. The well-established challenges in EMG data collection and analysis methods limit utility for wearable wide-spread neuromuscular control screening. The purpose of this study was to investigate the ability of stretch sensors to detect timing patterns of muscle contraction and compare time events to those collected through traditional clinical EMG.

METHODS: 4 healthy subjects (mean age: 23.29 ± 3.45 y) completed 5 repetitions of a unilateral partial squat with a stretch sensor and an EMG unit simultaneously applied to the dominant leg quadriceps muscle. Paired T-test and linear regression analyses assessed differences in key muscle contraction time events (Figure 1) for the stretch sensor (SS) and EMG.

RESULTS: Relative times of peak contraction ($r^2 = 0.99$, mean relative error (RE) = 0.04), activation ($r^2 = 0.98$, RE = 0.14), and deactivation ($r^2 = 0.92$, RE = 0.35) displayed excellent correlation between the EMG and SS. Duration of ascent ($p = 0.103$, EMG: 1.14 ± 0.46 s, SS: 1.36 ± 0.27 s) and descent ($p = 0.079$, EMG: 1.38 ± 0.49 s, SS: 1.14 ± 0.37 s) squat phases and total contraction time ($p = 0.95$, EMG: 2.55 ± 0.83 s, SS:

2.49 ± 0.30 s) did not differ significantly between EMG and SS. Average within-subject variation was not significantly different for EMG timing of ascent ($p = 0.56$) and descent ($p = 0.15$) phases, and total contraction ($p = 0.08$).

CONCLUSIONS: Our findings reveal similarities in time signatures between SS and EMG for assessing quadriceps activation during a standard neuromuscular screening activity. This suggests the potential for utility of SS evaluation of muscle activation timing.

This study was supported in part by figur8 Inc

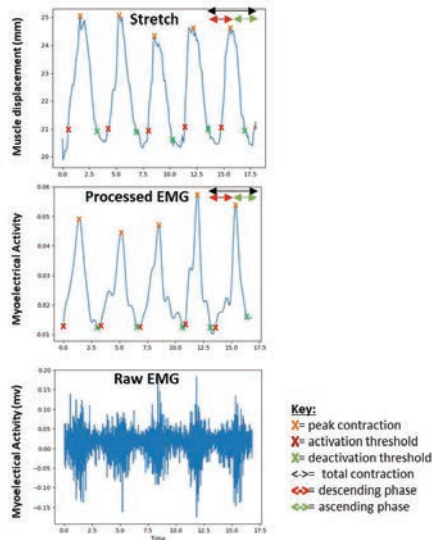


Figure 1: Example of relative muscle contraction timing for stretch sensor and EMG signals during a repeated partial squat task.

A 6th order low-pass Butterworth filter (3 Hz) and rectified TKEO function were applied to raw EMG data. Threshold of activation/deactivation was defined as 3 standard deviations of a resting calibration trial.

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Estimation of Running and Cycling VO_2max Using the Heart Rate Ratio Method

Pat R. Vehrs, FACSM, Sabrina Adams, Kaylee Massey, Nicole Tafuna'i, Brady Hanson. *Brigham Young University, Provo, UT.*

(No relevant relationships reported)

Although the direct measurement of VO_2max during an exercise test provides the most accurate assessment of cardiorespiratory fitness, estimates of VO_2max are often more practical. Prior research suggests that VO_2max obtained during a treadmill maximal graded exercise test can be accurately estimated in men using the Heart Rate Ratio Method. This method estimates VO_2max using the following equation: VO_2max (mL/kg/min) = $(\text{HR}_{\text{max}} / \text{HR}_{\text{rest}}) \times 15$. The validity of this equation to estimate VO_2max has not been established in women or in other modes of exercise, such as cycling.

PURPOSE: This study compared VO_2max values measured during running and cycling to estimates of VO_2max using the Heart Rate Ratio Method in 42 men and women. **METHODS:** Resting metabolic rate (RMR) and VO_2max on the treadmill and cycle ergometer were measured on 21 men and 21 women between 19-39 years of age. Each subject's running and cycling VO_2max was estimated using the Heart Rate Ratio Method and their resting HR measured during the RMR test and their actual maximal HR achieved during the maximal exercise tests. **RESULTS:** The average running and cycling VO_2max values for males (54.2 ± 7.1 ; 50.0 ± 8.9 mL/kg/min) were higher ($p < 0.0001$) than in females (43.4 ± 5.8 ; 39.8 ± 7.4 mL/kg/min), respectively. Resting HR values for males (55 ± 7 bpm) and females (57 ± 6 bpm) were similar as were the maximal HR values during running (186 ± 12 ; 190 ± 12 bpm) and cycling (181 ± 11 ; 184 ± 13 bpm), respectively. The estimates of running and cycling VO_2max under-predicted actual values in males (-2.9 ± 8.0 ; -0.26 ± 7.8 mL/kg/min) and overestimated actual values in females (7.3 ± 7.9 ; 9.3 ± 8.2 mL/kg/min), respectively. There was a significant gender effect in the prediction of VO_2max using the Heart Rate Ratio Method. Regression and Bland Altman analysis for treadmill running yielded an $R^2 = 0.076$, an SEE = 8.19, and a 95% limits of agreement (LOA) of ± 18.46 mL/kg/min. Likewise, regression and Bland Altman analysis for cycling yielded an $R^2 = 0.18$, an SEE = 8.85, and a 95% LOA = ± 18.24 mL/kg/min. **CONCLUSION:** The high SEE and LOA precludes this method for predicting running and cycling VO_2max . Gender differences in maximal HR and VO_2max are not accounted for in predictions of VO_2max using the Heart Rate Ratio Method.

B-14 Clinical Case Slide - Oncology

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-304E

577 **Chair:** Holly Benjamin, FACSM. *University of Chicago, Chicago, IL.*

(No relevant relationships reported)

578 **Discussant**

Allison Betof Warner. *Memorial Sloan Kettering Cancer Center, New York, NY.*

(No relevant relationships reported)

579 **Discussant**

Jason L. Blackham. *Intermountain Healthcare, Ogden, UT.*

(No relevant relationships reported)

580 May 29 1:00 PM - 1:20 PM

Decreased Movement Of Right Arm In A Non-verbal Child

Eric M. Bankert, Scott Annett, Vicki R. Nelson. *Steadman Hawkins Clinic of the Carolinas, Greenville Health System, Greenville, SC.* (Sponsor: Kyle J. Cassas, FACSM)

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(No relevant relationships reported)

HISTORY:

A 4 y/o non-verbal male with Rubinstein-Taybi syndrome presented for poor motion of his right arm. The patient was noted to become fussy when his parents put his shirt on that morning and when they tried to move his right arm. There were no known injuries, trauma, fever, or recent illness. Birth history was unremarkable. He had a tethered cord release in his first year of life. At baseline he uses all extremities and can crawl but not walk.

PHYSICAL EXAMINATION:

T 97.9F BP 104/80 HR 115

Well appearing, nonverbal and wheelchair-dependent male. No ecchymosis or significant erythema to the right arm. Limited active and full passive ROM of right shoulder, elbow and wrist with fussiness noted on manipulation. No focal tenderness noted. 2/4 MSR in bilateral upper and lower extremities.

DIFFERENTIAL DIAGNOSIS:

1. Radial Head Subluxation
2. Non-accidental Trauma - fracture or dislocation
3. Osteomyelitis
4. Septic Arthritis
5. Tumor/Malignancy

TESTS AND RESULTS:

R Shoulder and Elbow XRs: No fracture or soft tissue abnormality seen

CRP 41.7 mg/L, ESR 44 mm/hr, Blood culture No growth

MRI of Right Humerus: Effusion with surrounding enhancement in the right shoulder; subtle changes in the metaphysis of the right humerus with periosteal edema and enhancement

FINAL WORKING DIAGNOSIS:

Pre-B cell Acute Lymphoblastic Leukemia

TREATMENT AND OUTCOMES

1. The patient underwent manual reduction of possible radial head subluxation, which was felt to be successful with improved ROM of the elbow. However, symptoms returned within a day.
2. Labs and imaging were concerning for infection and he was admitted for surgical wash-out of right shoulder and sent home on prolonged IV antibiotics.
3. He developed contralateral shoulder symptoms with prolonged fever and left shoulder MRI showed similar findings.
4. After multiple wash outs and rounds of IV antibiotics, Flow Cytometry was noted to be positive for Pre-B cell acute lymphoblastic leukemia, so patient was started on appropriate chemotherapy regimen and is currently in the maintenance phase.
5. This case demonstrates the difficulty in pediatrics of identifying the cause of medical issues in patients who are non-verbal, as well as the vast differential diagnoses possible in children with musculoskeletal complaints. It also highlights the need for close follow up to resolution of symptoms.

581 May 29 1:20 PM - 1:40 PM

The Use Of Individualized Exercise Prescription To Target Oxidative Metabolism In A Stage Iv Colorectal, Metastatic Cancer PatientInigo San-Millan. *University of Colorado School of Medicine, Aurora, CO.*

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(No relevant relationships reported)

HISTORY: A 42 year-old male was diagnosed with stage IV colorectal, metastatic cancer. In 2017 (2 years post-diagnosis) he came to our laboratory seeking exercise advice. He had received 56 rounds of chemotherapy without signs of remission. He also exercised on the bike 4-5 days/week with a duration of 1-3h/session. **PHYSICAL EXAMINATION:** He performed an incremental cardiopulmonary cycling exercise test. O₂ consumption, blood lactate (BLa) as well as fat and carbohydrate oxidation rates (FATox/CHOox) were measured to assess cardiopulmonary and mitochondrial function. Both his FATox and lactate clearance capacity were poor, suggesting poor mitochondrial function despite exercising 4-5 days/week. He was given an individualized exercise prescription program for 3 months with the same amount of days and hours/week but with specific exercise intensities based on his individual metabolic parameters with the aim to improve oxidative metabolism to try to target the glycolytic phenotype of cancer (Warburg Effect). During the course of this exercise program he continued with chemotherapy. **TESTS AND RESULTS:** 3 months after the individualized exercise program he returned to the lab for re-evaluation. Significant increases in oxidative metabolic capacity at different exercise intensities were observed: -At 115, 150 and 190 Watts his FATox significantly increased (0.11g·min⁻¹ vs 0.29g·min⁻¹; 0.06g·min⁻¹ vs 0.25g·min⁻¹ and 0.0g·min⁻¹ vs 0.25g·min⁻¹ respectively). - Significant decreases in (BLa) were observed at 115, 150, 190 and 235 Watts (2.0 mmol·L⁻¹ vs 1.0 mmol·L⁻¹; 2.6mmol·L⁻¹ vs 1.4 mmol·L⁻¹; 4.4 mmol·L⁻¹ vs 2.2 mmol·L⁻¹ and 9.7 mmol·L⁻¹ vs 4.6 mmol·L⁻¹ respectively) **FINAL/WORKING DIAGNOSIS:** The patient's cardiovascular and oxidative capacity significantly improved after 3 months of individualized exercise program. **TREATMENT AND OUTCOMES:** One month later, he performed a new PET scan showing remission and no evidence of cancer. **CONCLUSIONS:** This case shows a novel approach to individualize exercise prescription in cancer patients to try to elicit improvements in oxidative metabolism to counteract the glycolytic phenotype of many cancers. The mechanisms for this metabolic reprogramming could be a possible crosstalk between skeletal muscle and cancer cells via exosomes could be a possible explanation.

582 May 29 1:40 PM - 2:00 PM

Hand Mass in an Active Military PersonnelBenjamin Tan, Daniel Montero. *Mayo Clinic Hospital, Jacksonville, FL.* (Sponsor: George Pujalte, FACSM)

(No relevant relationships reported)

History:

A previously healthy 21 year-old male, right-hand dominant, presented into sports medicine clinic with a right thumb mass that had been present for approximately a year and a half. Over this period, the mass had grown slowly but had since stabilized. He denied any associated sensitive pain or dysfunction. He presented due to concern regarding the size of the mass, and because it was interfering with tasks related to his physical training and duties in the Air National Guard.

Physical Exam:

Generally healthy-appearing, muscular but thin-built, gentleman in no acute distress. Evaluation of the hand showed an obvious mass on the dorsal aspect of the right first interphalangeal (DIP) joint that was elevated by approximately 3mm and measured 17 mm x 5 mm. It was non-tender to palpation. It did not affect flexion or extension of the right DIP joint. However, it did not transilluminate by penlight. It felt firm on exam.

Differential Diagnoses:

Ganglion cyst of distal interphalangeal joint

Epidermoid cyst

Giant cell tumor

Tests and Results:

Ultrasound briefly performed showed echogenicity and no obvious free fluid within or surrounding the mass. X-rays revealed rounded a soft tissue density overlying the dorsum of the thumb's interphalangeal joint. No radiopaque foreign object was present. No adjacent periosteal reaction or osseous destructive changes were noted. Magnetic resonance imaging (MRI) revealed an enhancing, soft tissue mass measuring 13 mm x 9 mm x 6 mm, along the dorsal aspect of the right thumb at the interphalangeal joint, most compatible with a giant cell tumor, associated with the extensor pollicis longus tendon sheath.

Final Working Diagnosis:

Giant cell tumor, rarely seen on the thumb (2% of cases occur within the hand)

Treatment and Outcomes:

Patient shortly underwent a surgical excision of the giant cell tumor which revealed intraarticular extension into the interphalangeal joint of the right thumb.

Pathology confirmed the diagnosis.

Patient was doing well as of this writing, with no pain or range of motion restriction after surgery

Given reports of recurrence of giant cell tumors, follow-up was recommended in the event that the mass recurred or was noted in other locations.

583 May 29 2:00 PM - 2:20 PM

A Pheochromocytoma in an Elite Collegiate AthletePierre L. Viviers, FACSM¹, Craig Thompson¹, Glen Hageman², Wayne Derman¹. ¹Stellenbosch University, Stellenbosch, South Africa. ²Sharks Medical, Durban, South Africa.

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(No relevant relationships reported)

HISTORY: A 22-Year-old rugby union player presented to the Sports Medicine clinic complaining of a sore throat and skin rash over his back and upper arms for the past week. Further symptoms included rhinorrhoea and dry cough for the previous week, feeling "hot" (especially at night) and constant fatigue. The occurrence of these symptoms coincided with a regional measles outbreak. The clinical symptomatology persisted at subsequent visits over a period of 12 months and ranged from diarrhoea, skin rash, dry cough, headaches, anxiety, night sweats, rapid heart rate and exercise intolerance. Despite follow-up visits when he was asymptomatic, constant weight loss occurred over the period since he first presented. Except for weight loss and a single blood pressure reading of 135/90mmHg previously his medical history was uncompromised. He had a history of various sport related musculoskeletal injuries and there was no family history of note. **PHYSICAL EXAMINATION:** At initial physical examination athlete was afebrile, HR 100 b/min with a blood pressure reading of 110/60mmHg. Palpable tender occipital lymph nodes were present. Except for the non-purulent pharyngitis and maculopapular rash over the back and upper arms, the remainder of systemic physical examination was normal. Although normal or low BP measurements were recorded occasionally, he remained tachycardic and BP mildly elevated (135/90 mmHg) with the skin rash located over the trunk at most visits.

DIFFERENTIAL DIAGNOSIS: Viral infection (measles, rubella, coxaci,EBV), Viral infection unspecified,Hyperthyroidism,Pulmonary tuberculosis,Vasomotor response to immune activation,Essential Hypertension,Pheochromocytoma.**TEST AND RESULTS:** FBC's-normal,ESR-normal,CRP-normal,Rubella/Measles IGM (-),s-Urea(7.7mmol/L),s-Creatinine(108µmol/L),S-ALKP(136µmol/L),s-GGT(140µmol/L),S-ALT(101µmol/L),Coxaci-B AB (+),EBV(+),U-VMA-24hrs (50112 nmol/L),MIBG Scan negative(left) indicated a left adrenal gland mass,CT Abd (Triphasic)-well defined mass left adrenal gland

FINAL WORKING DIAGNOSIS: Benign pheochromocytoma-left adrenal gland
TREATMENT AND OUTCOMES: Laparoscopic adrenalectomy (left), Uncomplicated post operative recovery,Full return to sport

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Anaplastic Oligodendroglioma: Impacts Of Aerobic And Flexibility Training On Physiological, Psychosocial, And Cognitive FunctionBrent M. Peterson¹, Alyse P. Brennecke², Daniel Y.K. Shackelford³, Jessica M. Brown³, Reid Hayward⁴. ¹Biola University, La Mirada, CA. ²University of Colorado Denver Anschutz Medical Campus, Aurora, CO. ³Carroll University, Waukesha, WI. ⁴University of Northern Colorado, Greeley, CO.

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(No relevant relationships reported)

HISTORY: A 44-year old female diagnosed with class III anaplastic oligodendroglioma with 1p19q genetic co-deletion who underwent a left-frontal craniotomy, chemotherapy, and radiation prior to starting an exercise-based cancer rehabilitation program. During initial assessments, she qualified and was enrolled in an ongoing research study examining the impacts of aerobic and flexibility training on cognitive function. **CLINICAL EXAMINATION:** Comprehensive physical, psychosocial, and cognitive assessments were completed pre and post training (36-session intervention). **DIFFERENTIAL DIAGNOSIS:** 1. Brain Metastases 2. Seizure Disorders 3. Glioblastoma Multiforme **TESTS AND RESULTS:** Sought medical assistance following grand mal seizures. Magnetic resonance images (01/15/2013) revealed infiltrative lesions on the anterolateral aspect of the left frontal lobe which measured at approximately 4.6cm x 3.3cm in the axial plane - involved cortex and subcortical white matter Patient underwent craniotomy (01/24/2013) Pathology confirmed grade III anaplastic oligodendroglioma - positive: 1p36 and 19q13 sequence deletions - negative: epidermal growth factor receptor sequences, tumor suppressor gene phosphatase - negative for the loss of the tumor suppressor gene phosphatase and tensin homolog sequences Follow-up (02/12/2013) the patient was awake, alert, and oriented, but physically fatigued New presentations: - blurred visual acuity (left eye), ambulation and postural difficulty, lower right extremity weakness, continual word aphasia with speech interruption **FINAL/WORKING DIAGNOSIS:** Class III anaplastic oligodendroglioma with 1p19q genetic co-deletion; referred to the University of Northern Colorado Cancer Rehabilitation Institute

and recommended participation in study **TREATMENT AND OUTCOMES:** 1. Procarbazine, Lomustine, and Vincristine Sulfate (PCV) chemotherapeutic (6x) with ionized radiation (46Gy followed by 14Gy boost to resection site and G2/FLAIR regions) - temozolomide added as adjuvant to radiation 2. Patient completed 36 sessions of aerobic and flexibility training 3. Improvements observed in physiological, psychosocial, and cognitive variables 4. Patient then made a positive transfer into a standard exercise-based cancer rehabilitation program

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Stomach Cancer - Physical and Functional Tests

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(No relevant relationships reported)

HISTORY: A 53-year-old female patient (Body mass = 71.30 kg; Height, 1.58 m; BMI = 28.74 kg / m²) from the Mato Grosso Cancer Hospital in Cuiabá, Brazil, with stomach cancer, reported stomach pain for at least 12 months, with no improvement in the use of proton pump inhibitors (omeprazole) and/or antacids (sodium bicarbonate). She reported vomiting and increasing pain after consuming beer and using tobacco. The patient denied having decreased body weight over the last six months. Abdominal distension was reported.

PHYSICAL EXAMINATION: Clear awareness, without edema, afebrile, normal blood pressure SARC-F questionnaire: score = 4 (tendency for sarcopenia).

DIFFERENTIAL DIAGNOSIS:

1. Reported muscle strength loss
2. Needed help to walk and lift chair
3. Could not climb stairs

TEST AND RESULTS:

Tomography of the whole abdomen:
— wall thickening of the gastric antrum
Pathological stage:

— T₃ N₂ M₁

Functional evaluation:

— Handgrip test: mean of 30 kg.f in both hands (good); 30-second elbow flexion test: 13 repetitions (good); 30-second chair stand test: 11 repetitions (adequate); Timed Up and Go test: 9 seconds (low risk of falls); Walking speed test: 1m / sec (adequate); 2-minute walk test: 109 knee elevations (good functional capacity)

FINAL/WORKING DIAGNOSIS:

Locomotor difficulties were diagnosed through the physical/clinical examination and there was a tendency for sarcopenia; on the other hand, the physical tests did not corroborate this information and did not independently confirm physical incapacity prior to the total gastrectomy

TREATMENT AND OUTCOMES:

1. Total gastrectomy.
2. Need to develop physical/functional tests to be applied, specifically, in cancer patients, regardless of tumor type.
3. Currently available physical tests were developed for an elderly population, which may compromise the interpretation of the results obtained (low specificity and sensitivity).
4. Prescription of physical exercises (as a non-pharmacological treatment) for patients with stomach cancer should begin before surgery, because the current patient presented, in advance, with locomotor difficulties.
5. The SARC-F questionnaire seems to be a good tool to detect sarcopenia in a patient with stomach cancer, although it also requires future adaptations for this purpose.

B-15 Clinical Case Slide - Shoulder

Wednesday, May 29, 2019, 1:00 PM - 3:00 PM
Room: CC-305

586 **Chair:** Cheri Blauwet. *Harvard Medical School, Boston, MA.*

(No relevant relationships reported)

587 **Discussant**
Dennis Khalili-Borna, FACSM. *Kaiser Permanente, Fontana, CA.*

(No relevant relationships reported)

588 **Discussant**
Mederic M. Hall. *University of Iowa Sports Medicine, Iowa City, IA.*

(No relevant relationships reported)

589 May 29 1:00 PM - 1:20 PM

Severe Shoulder Pain in a Healthy Adolescent Child

Ashkan Alkhamisi, M.D., J. Parker Chapman, M.D., Laurel Blakemore, M.D., Jason Zaremski, M.D., FACSM. *University of Florida, Gainesville, FL.*

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(No relevant relationships reported)

HISTORY:

A 12-year-old child presented to sports medicine clinic with his grandfather for evaluation of 4 days of diffuse left shoulder and upper arm pain. Pain developed hours after holding onto a rope while tubing in a lake. He denies being thrown off the tube or shoulder pain while riding. Pain was 4/10 pain at rest and 9/10 pain with movement. Pain gradually worsened over previous past 4 days. He denied any previous injury to the left arm or shoulder. He denied any numbness, or tingling of the left arm. He denied any changes in vision, headaches, chest pain, shortness of breath, or rashes. Of note, he went to the ED two days prior due to subjective fevers and diagnosed with a viral upper respiratory infection.

Physical Exam:

Vitals signs were normal. He was distressed and tearful. He had no tenderness and full range of motion (ROM) of his cervical spine. There was diffuse left sided tenderness over the sternum, ribs, mid-humerus, biceps, upper trapezius, and rhomboids. Pain with active and passive ROM of the elbow and shoulder. Shoulder strength was limited due to pain. Sensation was intact throughout the left upper extremity. No skin discoloration, breaks, or increased warmth of the left arm or shoulder.

Differential Diagnoses:

1. Rotator cuff tendinopathy
2. Shoulder dislocation and/or glenoid labral tear
3. Occult Humerus fracture
4. Infection

Initial Test and results:

Left shoulder and humerus radiographs were normal. Due to the disposition of the patient, the patient and his family were advised to go to the pediatric ER. A work-up revealed a normal WBC count, and an elevated CK and CRP. Urine and blood cultures were positive for MSSA. MRI of the shoulder and elbow revealed osteomyelitis of left scapular body with left periscapular abscess. Pediatric Orthopedic Surgery was then consulted and performed an incision and drainage (I&D) of the left supraspinatus, infraspinatus, and subscapularis abscesses.

Final Diagnosis:

Acute MSSA osteomyelitis of left scapula with left periscapular abscess

Treatments and Outcomes:

After surgical I&D, the patient clinically improved over a two-week hospital course and discharged after 4 weeks of IV antibiotics. He was then transitioned to oral antibiotics for an additional 8 weeks. At the 8-week clinical follow-up there was a complete resolution of shoulder and upper extremity pain.

590 May 29 1:20 PM - 1:40 PM

Treatment of Neurogenic Thoracic Outlet Syndrome in a Professional Baseball Pitcher with Soft Tissue TechniqueJean-Paul Lucke. *Rothman Orthopaedic Institute, Philadelphia, PA.*

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(No relevant relationships reported)

HISTORY: A 28-year-old male, left hand dominant professional baseball pitcher, with a several year history of persistent left upper extremity numbness presented with increased pain and numbness of the elbow and forearm after throwing a pitch.

PHYSICAL EXAMINATION: On physical examination, the patient had decreased cervical range of motion with hypertonicity and tenderness of the supraclavicular fossa. Spurling's maneuver was negative and his shoulder and elbow had full range of motion and strength. There was no significant laxity or pain with valgus stress of the elbow and his wrist and intrinsic hand muscle strength was intact. Skin was intact without discoloration or edema. Tinel's was negative at the cubital and carpal tunnel, however, his sensation was slightly diminished throughout the ulnar nerve distribution. Roos and Adson tests were positive. **DIFFERENTIAL DIAGNOSIS:** UCL tear, Flexor pronator strain, ulnar neuritis, cervical radiculitis, thoracic outlet syndrome

TEST AND RESULTS: Radiographic evaluation included views of the left elbow and cervical spine which were unremarkable. An MR arthrogram of the elbow was negative for any significant pathology.

FINAL WORKING DIAGNOSIS: Acute on Chronic Neurogenic Thoracic Outlet Syndrome

TREATMENT AND OUTCOMES: Access to formal physical therapy was limited. The patient's pain and numbness persisted despite oral medications and daily treatment by the athletic trainer so he was referred to the team chiropractor. During the initial chiropractic treatment, which consisted of trigger point release and stretching applied to the anterior scalene musculature and cervical distraction manipulation, the patient experienced a sudden and complete resolution of his pain and numbness. He remained symptom free for the rest of the season.

591 May 29 1:40 PM - 2:00 PM

Abnormal Anatomical Etiology and the Resultant Bilateral Thoracic Outlet Syndrome: An Exploration Case ReportJennifer Rizzo¹, Brent M. Peterson². ¹*Concordia University Irvine, Irvine, CA.* ²*Biola University, La Mirada, CA.*

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(No relevant relationships reported)

HISTORY: 32-year-old healthy female presented to the vascular surgeon for right arm pain (pn) and a hand tremor. She was a mesomorph with forward head posture and was a volleyball athlete and triathlete.

PHYSICAL EXAMINATION:

Patient reported years of pn and dysfunction with no mechanism of injury. Symptoms began as stabbing pn 8/10 along right ulnar and radial nerves. Pn increased when the arms were unsupported. Right hand tremor increased with ADLs, and arm above 100 degrees. Feeling of heaviness and tingling in the arms impaired sleep and decreased effective grasping of objects causing patient to often drop things. Left arm pn 6/10 in trapezius, radiated to the forearm. Trapezius felt as if it needed to be stretched, but stretching increased pn 7/10. Pn was felt in the jaw and teeth 5/10 and the ear had a "cloudy" sensation. Patient had three root canals yet the facial pn persisted.

DIFFERENTIAL DIAGNOSIS:

Paget-Schroetter syndrome

Rotator Cuff injury

Multiple Sclerosis

TEST AND RESULTS:

MRA right shoulder:

-Labrum tear, infraspinatus atrophy, rotator cuff tear. Suprascapular nerve laceration with maximal involvement of infraspinatus

MRI c-spine:

-Minor arthrosis, slightly desiccated discs with no bulging at C5-C6

X-ray c-spine:

-No cervical ribs or narrow facets

MRI brain:

-No multiple sclerosis

Electromyography:

-Infraspinatus atrophy

Special Tests - Adson, Allen, Military Brace:

-Absent bilateral pulse

DASH score:

-Significant ADL impairment

Lidocaine muscle block, scalenes and right pec minor:

-Patient reported 50% decrease in pn

MRI bilateral brachial plexus:

-Post-surgical edema, asymmetrically large right jugular vein, pec minor and subclavian muscle atrophy with scarring at SC joint. Brachial plexus matted in scalene compartment; left side normal

FINAL/WORKING DIAGNOSIS:

Bilateral TOS with right pec minor impingement

TREATMENT AND OUTCOMES:

1.

Sx 1: Subtotal resection of subclavius, scalenes, resection of scalene minimus, division of pec minor, brachial plexus neurolysis, and subclavian artery lysis

2.

Sx 2: Subtotal resection of subclavius, scalenes, brachial plexus neurolysis, and subclavian artery lysis

3.

Sx 3: Scaleneotomy of right scalenes and scar tissue removal

4.

Paralyzed right diaphragm from surgery complication

5.

Patient reports 75% improvement on right, 90% improvement on left.

592 May 29 2:00 PM - 2:20 PM

Shoulder Injury - WeightliftingAndrew G. Cheung. *John Muir Health, Walnut Creek, CA.*

(Sponsor: Mark Lavallee, MD, FACS)

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(No relevant relationships reported)

History: 27-year-old male weightlifter with history of left UCL sprain and chronic bilateral partial-thickness supraspinatus tears was training for the 2017 FISU Summer World University Games in Taipei, Taiwan at the end of August 2017.

He was finishing his training session with pull-ups, when he felt a tearing sensation in his left anterior shoulder during the eccentric portion of the pull-up, with pain with flexion of that shoulder and tenderness to the area. Two days later, he felt a pop in his left anterolateral arm when he caught an 88 kg snatch slightly forward. He did not have any pain at that time and stopped his training session that day.

Physical Examination:

Left arm: Neurovascularly intact. Mild tenderness to palpation over bicipital groove.

"Popeye" deformity of proximal lateral biceps without ecchymosis or significant tenderness, accentuated by active flexion of the forearm.

Differential Diagnosis:

1. Rupture of the left biceps brachii long head proximal tendon

2. Partial thickness tear of the left biceps brachii distal tendon

3. SLAP tear of the left shoulder

4. Exacerbation of left elbow UCL injury

Tests and Results: Patient was sent 2 days later for ultrasound, which showed disordered muscle fibers and fluid collection over the area of the left proximal biceps deformity. Proximal biceps long head tendon not directly visualized in the bicipital groove on ultrasound.

Final Working Diagnosis: Rupture of the left biceps brachii long head proximal tendon

Treatment and Outcomes: Over the following month, the patient was seen by a physical therapist twice a week for manual therapy, including ice, compression, e-stim, and therapeutic ultrasound to the area in an effort to prevent potential myositis ossificans. Throughout this period, the patient continued to have intermittent left anterior arm pain while training, worse with snatches and other barbell exercises involving a wide grip; he continued to train at lighter weights, avoiding snatching more than 60% of his maximum in this period. Given the time proximity to competition, the patient decided against surgical evaluation. In competition, he snatched 99 kg (just 2 kg under his best), clean and jerked 125 kg (also 2 kg under his best), and had no significant discomfort or pain.

593 May 29 2:20 PM - 2:40 PM

Scapular Winging II - A New ApproachKevin M. Mullins, Brian A. Davis, FACS. *University of California, Davis, Sacramento, CA.* (Sponsor: Brian A. Davis, FACS)

(No relevant relationships reported)

HISTORY: A 62-year-old woman sustained a right shoulder injury after falling onto an outstretched arm. Initial workup with essentially normal cervical x-rays, MRI, and shoulder x-rays. On shoulder MRI mild increased T2 signals at insertion sites of supraspinatus and long head biceps. NCS for median/ulnar nerves and EMG of deltoid, infraspinatus, serratus anterior and rhomboid major were normal. She was treated with a subacromial corticosteroid injection and therapy without improvement.

EXAM: On inspection decreased bulk in right trapezius, rhomboids and supraspinatus. No palpation tenderness. Full passive ROM. Right scapular hike with abduction greater than 90 degrees and loss of adduction control of scapula into anterior/superior supraclavicular region. Active shoulder abduction pain limited to 54 degrees when

standing, but full 170 degrees when supine. Right trapezius strength 4/5, remaining muscles 5/5 with scapula stabilized. Sensation intact and impingement maneuvers negative.

DIFFERENTIAL: 1. Spinal accessory nerve lesion. 2. Long thoracic nerve lesion. 3. Supraspinatus tendinopathy. 4. Long head biceps tendinopathy. 5. Adhesive capsulitis.

RESULTS: NCS: Normal left spinal accessory nerve CMAP to trapezius, abnormal right spinal accessory nerve with decreased amplitude and onset latency compared. EMG: Normal right deltoid, infraspinatus, serratus anterior, rhomboid major but abnormal right upper/middle trapezius findings with increased insertional activity, fibrillation potentials, positive sharp waves, polyphasic MUAPs and reduced recruitment.

DIAGNOSIS: Right incomplete spinal accessory neuropathy

OUTCOME: Custom anterior-wrapped to posterior shell scapular stabilization brace fabricated. Once donned, improvement in abduction/flexion ROM quantified utilizing the Microsoft Kinect Motion Analysis. However, there was decrease in cross body adduction, and poor compliance long term due to weight and bulk. An updated lighter weight orthosis was fabricated, including a primary dynamic force strap for anteriorly directed pressure with a scapula plate shield intended to provide a superiorly directed force. The newer materials and design have provided significant improvement in function and compliance, indicating future treatment options for spinal accessory neuropathy.

594 May 29 2:40 PM - 3:00 PM Shoulder Injury - Rower

Rahul Khapekar. *Advocate Lutheran General Hospital, Park Ridge, IL.* (Sponsor: Mark Hutchinson, FACSM)
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(No relevant relationships reported)

HISTORY: A 64-year-old expert male rower presented with persistent overhead weakness for 27 months of his right shoulder. He initially felt pain when lowering his arm after placing his canoe on top of his car. Patient denied any acute popping, tearing or swelling. After failed alternative treatments, patient completed MRI shoulder showing full thickness supraspinatus tear and subsequently underwent arthroscopic repair. Despite adherence to physical therapy, patient reported persistent weakness with overhead activity. After an MR arthrogram showed massive supraspinatus re-tear without labral pathology, patient obtained a second opinion at which time he was instructed that he has an "unrepairable torn rotator cuff". **PHYSICAL EXAMINATION:** On inspection of his right shoulder, there is marked atrophy superior and inferior to spine of scapula. Patient has excellent functional ROM actively with significantly limited ROM when shoulder is stabilized - he is able to abduct to 100° and forward flex to 110°. Empty can, drop arm, lift off and belly press test are positive. Labral testing is negative and there is full ROM of neck. There is adequate deltoid musculature with equal sensation bilaterally. Patient has significant winging of scapula in all planes of motion. **DIFFERENTIAL DIAGNOSIS:** 1. Massive rotator cuff tear 2. Acromioclavicular joint arthritis 3. Glenohumeral joint arthritis **TEST AND RESULTS:** EMG: no deltoid denervation with carpal tunnel findings XR: glenohumeral and AC joint arthritic changes MRI right shoulder w/o contrast: massive rotator cuff (supraspinatus and subscapularis) tear **FINAL WORKING DIAGNOSIS:** Chronic right massive rotator cuff tear without deltoid denervation

TREATMENT AND OUTCOMES: 1. Physical therapy 2. No reverse total shoulder arthroplasty indicated given no pain 3. Resume all activities as tolerated, may resume kayaking and canoeing

B-16 Rapid Fire Platform - Physical Activity and Health in 2019: An Expansive Snapshot

Wednesday, May 29, 2019, 1:00 PM - 2:20 PM
Room: CC-Hall WA2

595 Chair: Geoffrey Whitfield. *Centers for Disease Control and Prevention, Atlanta, GA.*

(No relevant relationships reported)

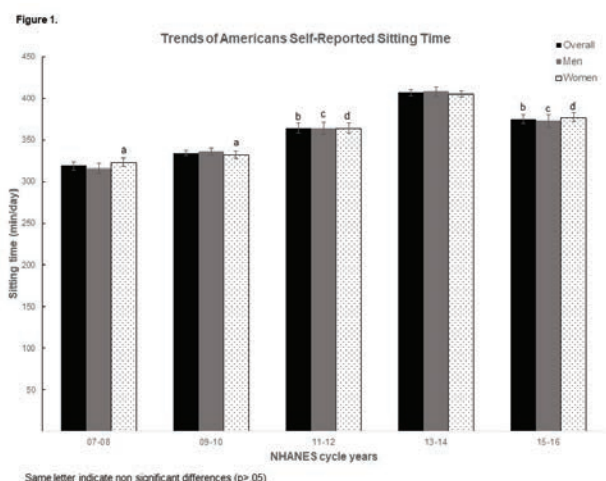
596 May 29 1:00 PM - 1:10 PM 10-year Trends In Americans Sedentary Behavior (Sitting).

Tiago V. Barreira¹, Deirdre M. Harrington², Ted W. Zderic³, John M. Schuna Jr.⁴. ¹Syracuse University, Syracuse, NY. ²University of Leicester, Leicester, United Kingdom. ³University of Houston, Houston, TX. ⁴Oregon State University, Corvallis, OR.
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(No relevant relationships reported)

Sedentary behavior is recognized as a detrimental behavior to one's health.

PURPOSE: To describe 10-year trends in Americans sitting time. **METHODS:** Data from 5 cycles (2007-2016) of the National Health and Nutrition Examination Survey (NHANES) were used in this analysis. During the 07-08 NHANES cycle, participants were asked: "How much time do you usually spend sitting or reclining on a typical day?" For the following NHANES cycles (09-16), participants were asked: "How much time do you usually spend sitting on a typical day?" Mean sitting time for the overall sample and for each sex separately were quantified. Regression analyses accounting for the complex, multi-stage design of NHANES were conducted to examine for linear trends and mean differences in sitting time between cycles. **RESULTS:** 26,771 participants (51.5% females, 20 years of age or older) provided sitting time data for all cycles. Data are presented in Figure 1. Significant positive linear trends across cycles were observed for the overall sample and for each sex separately (all $p < .001$). For the overall sample and men, mean sitting time was significantly higher at each successive cycle between 07-08 to 13-14. During 15-16 cycle, mean sitting time was significantly lower than 13-14 but not different from 11-12 for the overall sample ($p = .16$) and men ($p = .34$). For women, sitting time trends were similar to those observed among the overall sample and men with the exception that the 07-08 and 09-10 cycles were not significantly different from each other ($p = .30$). **CONCLUSIONS:** Americans' average self-reported sitting time increased between 2007 and 2014. 2016 data showed lower sitting time compared to 2014. Future NHANES waves will help determine whether Americans sitting time has reached a peak or if 2016 data were an exception.



597 May 29 1:10 PM - 1:20 PM

Effects of an Acute Physical Activity Intervention on Classroom Behavior in Off-Task Preschoolers

Sarah Burkart, Christine W. St. Laurent, Sofiya Alhassan, FACSM. *University of Massachusetts Amherst, Amherst, MA.*
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Evidence suggests that physical activity (PA) may improve classroom behavior in elementary school children. Further, studies have shown that the most off-task children may exhibit greater benefit from acute bouts of PA. However, limited data exists in preschoolers. **PURPOSE:** To examine baseline relationships between PA and classroom behavior, and to identify if the most off-task preschoolers responded differently to PA compared to those least off-task. **METHODS:** Participants ($n=31$, age=3.8±0.8 years, 61% male) attended a university-based preschool. In week one of this two-week pilot study, children engaged in their typical curriculum. Week two included daily short bouts of PA that were integrated into early learning standards. PA was assessed with accelerometers worn on the lower back during preschool attendance. Trained researchers conducted weekly 10-minute classroom observations to quantify children's classroom behavior [active engaged time, (AET); passive engaged time, (PET); off-task motor, (OFT-M); off-task verbal, (OFT-V); off-task passive, (OFT-P)] using the Behavioral Observation of Students in Schools (BOSS) tool. Spearman correlations were used to examine baseline relationships between PA and classroom behavior variables. To test if children with high off-task behavior (HIGH) responded differently to PA compared to children with low off-task behavior (LOW), participants were categorized into tertiles based on baseline off-task behavior and groups were compared using *t*-tests. **RESULTS:** A negative correlation was observed between light intensity activity (min/day) and AET at baseline ($r=-0.44$, $p=0.02$). No other significant relationships were observed. However, when classroom behavior following PA in the most off-task children was examined, improvements were observed in OFT-M (HIGH=-36.5±5.4%, LOW=10.5±5.7%; $p=0.0001$), OFT-V (HIGH=-16.7±2.8%, LOW=5.7±3.3%; $p=0.0004$), and OFT-P behaviors (HIGH=-19.6±7.6%, LOW=12.0±7.1%; $p=0.01$). **CONCLUSION:** Initial evidence for PA to improve classroom behavior among children who exhibited greater off-task behavior was observed and is consistent with previous findings. Future work should build on this acute study and examine chronic PA to limit classroom off-task behaviors. Supported by: NASPEM Marco Cabrera Student Research Award

598 May 29 1:20 PM - 1:30 PM

Improving Research Dissemination and Reach: Impact of a Daily Twitter Campaign in Exercise Oncology

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Approaches to communicating health research has changed with the widespread adoption of digital and social media platforms. Knowledge exchange and research dissemination can now occur at exponential rates compared to traditional methods, providing an opportunity for improved research understanding, impact and implementation. However, it is unclear how effective scientists have been at using digital platforms for knowledge translation. The use of Twitter as a dissemination tool may prove to be an effective strategy to enhance the reach and impact of research and assist with implementation of exercise into healthcare.

PURPOSE: To understand the engagement and reach of a daily academic-delivered twitter campaign focused on disseminating scientific publications specific to exercise oncology.

METHODS: The Clinical Exercise Physiology Lab at the University of British Columbia (@CEPL_UBC) delivered a #365papers Twitter campaign that posted one academic paper daily specific to exercise oncology. The first 9-months of this digital campaign were analyzed in 3-months periods (first, middle, last) to understand the project reach, using Twitter metrics (engagements and impressions) and Altmetric attention scores.

RESULTS: Overall, 499,899 impressions and 16,741 engagements occurred from 1 January 2018 to 30 September 2018 from 273 exercise oncology article posts. Average engagement rate increased by 35% from the first period compared to the last period (3.1 to 4.2%, $p<0.001$). Link clicks per daily article averaged 23.1 ±25.9 and ranged from 0 to 227 clicks. Followers increased by 296% from 229 to 677 users ($p<0.01$) and were predominantly female (64%) from 39 countries including United States (24%), Canada (23%), United Kingdom (23%) and Australia (10%). Altmetric attention scores indicate 76% of articles had engagement scores in the top 25% of all research outputs and high attention scores compared to outputs of the same age (85% ±12.4) and source (84% ±13.2).

CONCLUSIONS: A daily exercise oncology twitter campaign was able to engage a broad international audience and provide high levels of reach, indicating that this may be an effective strategy for communication and dissemination of exercise research.

599 May 29 1:30 PM - 1:40 PM

Increasing Non-Exercise Physical Activity With Training Reduces Chance Of Non-Response To Exercise

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Evidence of cardiorespiratory fitness (CRF) non-response is growing in both clinical and exercise training studies. Along with aerobic training, an increase in non-exercise physical activity may reduce CRF non-response contingency. **PURPOSE:** To determine if increases in non-exercise physical activity mitigates CRF non-response to exercise training among sedentary, overweight/obese adults. **METHODS:** Thirty-six adults (age: 54.19±7.14 years; BMI: 35.83±4.66 kg/m²; 77.8% female) were assessed from a previous exercise study (>70% adherence to 4 weekly sessions across 24 weeks). Participants were randomized to an aerobic training group or an aerobic training and increasing non-exercise physical activity group (increase 1,000 to 3,000 steps per day from baseline). Both groups performed the same supervised aerobic training (50-75% VO₂ max) for 24 weeks at a dose of 12 kcal per kg per week. CRF non-response was determined via calculated delta (Δ) values (follow-up minus baseline values) for absolute VO₂ max (L/min) and participants were categorized as non-responders via technical error (TE) ($\Delta<0.71$ L/min) and classical measures ($\Delta<0$ L/min). Pearson Chi-square test of independence was conducted for categorical variables (i.e. responders vs. non-responders) in TE and classical non-responders, separately. A binary multivariable logistic regression was used to estimate odds of CRF non-response based on baseline demographic factors (age, race, BMI, fitness, waist circumference). **RESULTS:** Participants increasing non-exercise physical activity with aerobic training were significantly more likely to increase CRF based on TE analysis, X^2 (2, $N=36$) = 10.99, $p=.004$, compared to aerobic training alone. Whereas, classic non-response did not show a significant relationship X^2 (2, $N=36$) = 2.77, $p=.251$. Baseline age ($p<.05$) was a significant predictor of TE response, while baseline BMI ($p<.05$) was a significant predictor for classic response. **CONCLUSION:** Increasing non-exercise physical activity concurrent with aerobic training may improve likelihood of increasing CRF and, thus, reduce risk of cardiovascular disease and mortality. Supported by a grant from the American Heart Association (13SDG17140091).

600 May 29 1:40 PM - 1:50 PM

Trainability Genes Provide Answers To The Cardiorespiratory Fitness Deficit In Childhood Acute Lymphoblastic Leukemia Survivors.

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PURPOSE: As the survival rate of acute lymphoblastic leukemia continues to improve, it has been shown that survivors' exposure to chemotherapeutic agents leads to multiple long-term side effects. Thus, the decrease in the cardiorespiratory fitness of childhood acute lymphoblastic leukemia (ALL) survivors may be due to their cardiovascular response to the chemotherapeutic agents. The first aim of this study was to determine whether cardiorespiratory fitness and physical activity levels were lower among survivors than control subjects, while the second aim was to reported associations between genetic variants and cardiorespiratory fitness in survivors. **METHODS:** Cardiorespiratory fitness (VO₂peak) and moderate to vigorous physical activity (MVPA) were compared between childhood ALL survivors ($N=221$) and control subjects ($N=825$). We performed whole-exome sequencing in survivors ($N=239$). Germline variants (both common and rare) in a selected set of genes ($N=238$) were analyzed for an association with cardiorespiratory fitness. **RESULTS:** A difference of 9.2mL·kg⁻¹·min⁻¹ for VO₂peak between survivors and control subjects was observed. For an identical level of MVPA, the increase in VO₂peak was different between the both studied cohorts. Also, the VO₂peak decreased more rapidly with age among survivors, especially in females. Genetic association analyses showed that the common variant in the TTN gene was significantly associated with a

low cardiorespiratory fitness level, while the LEPR, IGF1 and ENO3 genes were significantly associated with a low cardiorespiratory fitness level in female survivors. Positive associations between the cardiorespiratory fitness level and trainability genes were mainly observed in females.

CONCLUSIONS: For an identical level of MVPA in both survivors and control subjects, the cardiorespiratory fitness was significantly lower in survivors, which can be associated with variants in genes related to subjects' trainability. These findings could allow better follow-ups tailored to survivors' genetic profile and cardiorespiratory fitness. This study has important implications for survivors, physicians and researchers, which could help reduce at least some of the burden of long-term adverse effects of treatments.

601 May 29 1:50 PM - 2:00 PM

Physical Activities in Northern Song Dynasty (906-1127), China: A Painting Analysis

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"Qingming Shanghe Tu, 清明上河图" (Painting of "Along the River during the Qingming Festival") is a historical Chinese painting collected in Palace Museum, Beijing, China. Painted around 1101-1108 by artist Zeduan Zhang (1085-1145), this 24.8 cm x 528 cm painting captures the daily life of people and the landscape of the capital Bianjing of North Song Dynasty. Together, a total of 814 persons were included in the painting revealing the lifestyle and activities of all levels of the society then. Thus, it provides a golden opportunity to study physical activity (PA) pattern of people in China about 900 years ago.

PURPOSE: To examine people's PA pattern in North Song Dynasty, China through analyzing a historical painting.

METHOD: After each person in the painting was numbered, they were coded by their age category, sex, activity engaged (using 2011 Compendium PA codes when apply), activity context, if labor-saving means was used, etc. The coded information was then analyzed using descriptive statistics.

RESULTS: Except for very few female adults and young children and two older adults, most of persons in the painting are male adults, reflecting the male-centered culture then. Most of PA, due to likely the painting was used to record activities related to a major festival, are recreation (miscellaneous) - standing; only one person is running; a few fast walking; many sitting either on chairs or on the ground; and none was doing traditional Chinese exercise. Some labor-saving efforts were already made then, e.g., using donkeys or cows to pull carriage, horses for riding and one case camels for carrying goods. Meanwhile, human power was still the most important source of mechanical energy then, e.g., rowing or pulling boats, carry persons using sedan chair, pushing wheelbarrow for transportations etc. Most noticeable and frequent human power activities are carrying heavy goods on men's shoulders directly or through a carry pole.

CONCLUSION: It was noticed that labor-saving efforts were already made in a well-developed civilization society about 900 years ago in China although human power was the major source of mechanical energy then. Painting analysis of ancient paintings and graphics provides a unique and useful means to understand the evolution of human PA.

602 May 29 2:00 PM - 2:10 PM

A Spring in Your Step: Exercise Training Increases Stretch-Shortening Cycle Potentiation and Walking Economy

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PURPOSE: Our objectives were to: (1) examine the effects of combined strength and aerobic training program on stretch-shortening cycle potentiation (SSCP) and net $\dot{V}O_2$ (inverse of walking economy) among older women and; (2) determine the relationship between SSCP and relative exercise intensity on walking economy. **METHODS:**

Participants were 93 postmenopausal women (60-74 years), 67 of which completed 16 weeks of supervised strength and aerobic training. Participants were randomized into one of three groups: 1 d-wk⁻¹ of resistance training and 1 d-wk⁻¹ of aerobic training; 2 d-wk⁻¹ of resistance training and 2 d-wk⁻¹ of aerobic training or; 3 d-wk⁻¹ of resistance training and 3 d-wk⁻¹ of aerobic training. Body composition (DXA), peak \dot{O}_2 uptake on a cycle ergometer, concentric velocity during a counter-movement leg press throw (CM: 100% of body weight), concentric velocity during a static leg press throw (CO; 100% body weight), SSCP (difference between CO and CM), and net $\dot{V}O_2$ while

walking at 2 mph were measured before and after the training. Net $\dot{V}O_2$ was calculated by subtracting resting $\dot{V}O_2$ from steady-state $\dot{V}O_2$ during flat ground walking at 2 mph. A paired samples *t*-test was used to determine differences in measures before and after exercise training. Multiple linear regression of baseline measures was used to determine associations of walking economy adjusted for SSCP and relative exercise intensity (% peak $\dot{V}O_2$) during the walking task. **RESULTS:** Among all participants, body weight did not significantly change (-0.4 kg, $p = .067$), however, percent body fat decreased (-1.3%, $p < .001$). All groups increased peak $\dot{V}O_2$ (+1.2 mL·kg⁻¹·min⁻¹, $p = .002$). In the 2 d-wk⁻¹ group ($n = 24$) mean CM velocity increased ($p = .004$), but mean CO velocity did not change ($p = .711$). Mean SSCP increased ($p = .048$), while net $\dot{V}O_2$ during the walk task decreased ($p = .002$). Linear regression analysis showed SSCP and relative exercise intensity were independently related to net $\dot{V}O_2$ while walking at 2 mph ($r = 0.54$, $p < .001$; $r = -0.21$, $p = .047$; respectively). **CONCLUSION:** These results reveal exercise training in older women, not only increases walking economy, but increases SSCP. Multiple regression reveals SSCP is associated with walking economy independent of relative exercise intensity among older women.

603 May 29 2:10 PM - 2:20 PM

Differences in Sleep Quality and Adherence to Energy Intake and Physical Activity Recommendations during an 18-Month Behavioral Weight Loss Intervention

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PURPOSE: Long-term adherence to EI and PA recommendations during a behavioral weight loss interventions is difficult. It is possible that short sleep duration and/or poor sleep quality makes adherence to these recommendations challenging. In this analysis, we explored the association between sleep duration and sleep quality and adherence to EI and PA recommendations during an 18-month behavioral weight loss intervention.

METHODS: Adults ($n=104$, age: 18-55 years, BMI: 27-42 kg·m⁻²) were enrolled in a behavioral weight loss program. Participants were prescribed a calorie-restricted diet (1200-1900 kcals/day) and were instructed to complete ≥ 300 min of moderate to vigorous physical activity (MVPA) per week. In this post-hoc analysis, participants were grouped based on adherence to EI (measured using 3-day food records) and PA (measured using the SenseWear armband) recommendations at 18-months. Adherence to the EI recommendation was defined eating \leq individually prescribed calories determined using a validated prediction equation at 18 months. Adherence to the PA recommendation was defined as accumulating ≥ 300 min/week of MVPA in bouts of ≥ 10 min at 18 months. Sleep duration, sleep onset latency (SOL), wake after sleep onset (WASO), and sleep efficiency were calculated at baseline and 18 months using the armband.

RESULTS: Individuals who were adherent to both the EI and PA recommendations had significantly lower WASO at baseline (65.7 \pm 11.2 min) compared to non-adherent individuals (82.9 \pm 49.1 min; $p<0.05$). Individuals who were adherent to only the EI recommendation had significantly lower WASO (61.0 \pm 30.7 min) at baseline compared to those who did not meet the EI recommendation (81.5 \pm 44.0 min; $p<0.05$). Individuals who were adherent to only the PA recommendation had significantly lower SOL (37.0 \pm 21.1 min) at baseline compared to individuals who did not meet the PA recommendation (44.2 \pm 28.4 min; $p<0.05$). There were no differences in sleep duration or sleep efficiency between any of the groups.

CONCLUSIONS: Sleep quality at the beginning of an 18-month weight loss intervention may influence adherence to EI and PA recommendations during the behavioral intervention. Future behavioral weight loss interventions may be improved by focusing on improving sleep quality in addition to EI and PA.

B-36 Thematic Poster - Acute and Predicted Physiological Responses to Altitude

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM
Room: CC-101B

673 Chair: Billie K. Alba. *USARIEM, Natick, MA.*
(No relevant relationships reported)

674 Board #1 May 29 3:15 PM - 5:15 PM
Resting Heart Rate Variability at Sea Level does not Predict Arterial Desaturation or Ventilatory Responses to Acute Hypoxia Exposure

Grace K. Becker, T. Hunter Embry, Kelsey J. Short, Kenneth W. Kambis, M. Brennan Harris. *William & Mary, Williamsburg, VA.* (Sponsor: Joseph W. Starnes, FACSM)

(No relevant relationships reported)

Acute exposure to hypoxia results in a stress response categorized by sympathetic dominance, resulting in increased ventilation to prevent arterial desaturation. Heart rate variability (HRV) can be used as an estimation of overall stress and provides understanding of the balance between sympathetic and parasympathetic autonomic regulation. **PURPOSE:** The purpose of this study was to determine whether resting heart rate variability at sea level is correlated with arterial desaturation and respiratory responses to acute normobaric hypoxia exposure equivalent to an altitude of 3500 meters. **METHODS:** Resting HRV, %SpO₂, and respiratory rate was measured in 24 male and female subjects at sea level for 15 minutes. HRV was measured using Firstbeat Bodyguard2 and included RMSSD, High Frequency (HF), and Low Frequency (LF) components. Subjects then returned for a subsequent visit and resting HRV, SpO₂ and respiratory rate were measured at rest in a normobaric hypoxic chamber (Colorado Altitude Training) set at either 3500 meters or sea level for control subjects. Correlation analysis using RStudio was performed. **RESULTS:** No significant correlation was observed between HRV in the time domain (RMSSD) and %SpO₂ at rest ($r=0.26$, $p=0.39$), %SpO₂ during exercise ($r=-0.15$, $p=0.62$), or respiratory rate during rest ($r=0.42$, $p=0.15$) when exposed to hypoxia. No significant correlation was observed between HRV in the frequency domain (LFHF Ratio) and %SpO₂ at rest ($r=-0.10$, $p=0.74$), %SpO₂ during exercise ($r=-0.18$, $p=0.53$), or respiratory rate during rest ($r=-0.39$, $p=0.19$) when exposed to hypoxia. **CONCLUSION:** Although exposure to acute hypoxia exerts a physiologic stress response, HRV as a measure of overall stress and the balance of sympathetic and parasympathetic balance does not seem to be predictive of the change in %SpO₂ or respiratory rate.

Supported by The Doug Morton/Marilyn Brown Endowment for Biomedical Research, The Foundation for Aging Studies and Exercise Science Research, and The Borgenicht Program.

675 Board #2 May 29 3:15 PM - 5:15 PM
Biological Variation of Resting Ventilation and its Diagnostic Accuracy for Acute Mountain Sickness at Altitude

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(No relevant relationships reported)

Individuals who develop acute mountain sickness (AMS) upon exposure to high altitude (HA) exhibit differential responses in resting measures of minute ventilation (V_E) and end-tidal partial pressure of carbon dioxide ($P_{ET}CO_2$). **PURPOSE:** To determine the biological variation and diagnostic potential of ventilatory parameters in association with AMS. **METHODS:** We performed a retrospective analysis via the Mountain Medicine Database of 22 studies completed by the U.S. Army Research Institute of Environmental Medicine (N = 424). First, we determined the biological variation of resting measures of ventilation and defined the accompanying static and dynamic thresholds that indicate a significant deviation from normal at sea level (SL). Second, the diagnostic accuracy of ventilatory measures for AMS development was assessed at HA (4300 m). **RESULTS:** Resting measures of ventilation demonstrated substantial variability within (range 0.4 - 7.7%) and between (range 1.0 - 24.5%) subjects. Based on the index of individuality (II), end-tidal partial pressure of oxygen ($P_{ET}O_2$) and respiratory exchange ratio (RER) may be useful in the static assessment of physiological deviations from normal (II = 0.57 and 0.60, respectively) at HA. Based on the index of heterogeneity (IH), $P_{ET}O_2$ and peripheral oxygen saturation (SpO₂) may be useful in the dynamic assessment of deviations from normal (IH = 1.91 and 0.41, respectively) at HA. RER and SpO₂ showed significant diagnostic accuracy in

the static assessment of AMS (sensitivity/specificity = 53/86 and 24/96, respectively). Ventilatory efficiency for oxygen (V_E/V_{O_2}), RER, and SpO₂ showed significant diagnostic accuracy in the dynamic assessment of AMS (sensitivity/specificity = 72/54, 53/74, and 25/98, respectively). Among all measures, RER showed the greatest Youden's Index, a value indicative of the combined sensitivity and specificity of a given predictor (static: 39, dynamic: 28). **CONCLUSION:** Many resting ventilation measures do not demonstrate potential for AMS prediction. However, the few measures identified as potential predictors of AMS following SL biological variation analysis also demonstrated the greatest diagnostic power for AMS at HA. RER shows particular promise as a potential AMS prediction tool. **DISCLAIMER:** Author views not official US Army or DOD policy.

676 Board #3 May 29 3:15 PM - 5:15 PM
Arterial Desaturation during Moderate Aerobic Exercise in Hypoxia is Positively Correlated to VO₂ Peak at Sea Level in Men and Women

Thomas H. Embry, Grace K. Becker, Kelsey J. Short, Kenneth W. Kambis, M. Brennan Harris. *William & Mary, Williamsburg, VA.*

(No relevant relationships reported)

Predicting responses to acute hypoxia based on physiologic measures at sea level may be valuable in anticipating adverse responses to acute hypoxia. **PURPOSE:** The purpose of this study was to determine the arterial saturation response in men and women (18-33 years old) of varying fitness levels, at a normobaric altitude of 3500 meters. **METHODS:** 91 subjects (54 women, 37 men) completed a VO₂ peak test on a stationary exercise bike at sea level; to determine aerobic fitness (range 27.7-72.2 ml/kg/min). Each subject then performed an 8-10-minute bout of cycling in normobaric hypoxia corresponding to 3500 meters at 65% of their maximal heart rate at VO₂peak (sea level). **RESULTS:** VO₂peak was positively correlated with decreased oxygen saturation during exercise at normobaric hypoxia corresponding to 3500 meters. For women (n=54), a greater predictive response was observed with a linear model depicting a strong positive correlation between VO₂ peak and oxygen desaturation in hypoxia ($r=0.1643$, $p=0.001028$). For men (n=37), a predictive response was also observed with a linear model that was slightly less significant compared to women subjects ($r=0.1139$, $p=0.04412$). Furthermore, a relationship between average oxygen saturation difference (resting SpO₂ minus exercise SpO₂) at normobaric altitude, and VO₂ peak at sea level in women subjects ($r=0.1855$, $p=0.01719$) was observed. **CONCLUSION:** These results demonstrate that increased VO₂ peaks in individuals at sea level, is predictive of higher arterial oxygen desaturation during exercise, in normobaric altitude (3500m), especially in women which may make them more susceptible to adverse responses to acute altitude exposure. Supported by The Doug Morton/Marilyn Brown Endowment for Biomedical Research, The Foundation for Aging Studies and Exercise Science Research, and The Borgenicht Program.

677 Board #4 May 29 3:15 PM - 5:15 PM
Variability in Human Plasma Volume Responses during High-Altitude Sojourn

Andrew J. Young, FACSM, Claire E. Berryman, Scott J. Montain, FACSM, Beth A. Beidleman, Stefan M. Pasiakos, FACSM, J. Phillip Karl. *US Army Research Institute of Environmental Medicine, Natick, MA.*

(No relevant relationships reported)

Hematocrit (Hct) and hemoglobin concentrations (Hb) rapidly increase when sea-level (SL) residents ascend to high altitude (HA) due to a decrease in plasma volume (PV), generally but not universally, attributed to changes in oncotic pressure. The Δ PV at HA varies, depending on exposure duration and elevation, and sojourner age, sex and SL red cell mass. A quantitative model for predicting individual PV changes (% Δ PV) over the first 7d at HA was recently published (Beidleman et al., 2016). That model, developed from measurements of those parameters and the measured % Δ PV in 393 HA sojourners, was internally cross-validated using boot-strap resampling, but has not been validated against an independent sample of sojourners, or for sojourns >7d in real world conditions, e.g. energy deficit (ED). **PURPOSE:** To compare measured % Δ PV with % Δ PV predicted by the model in 17 young, healthy, male, SL natives sojourning 21 d at HA and consuming a diet designed to elicit 40% ED. **METHODS:** Hct, Hb and total circulating protein (TCP) measured in blood of fasting participants at SL and after living 2, 7, 13 and 19 d (HA2, HA7, HA13 & HA19, respectively) at 4300m were used to calculate % Δ TCP and % Δ PV from SL. Correlations between % Δ PV and % Δ TCP were calculated, and means and individual values of measured % Δ PV were compared to predicted % Δ PV. **RESULTS:** Body mass loss was 8 kg by d21 at HA, but body mass loss was not associated with % Δ PV or % Δ TCP on HA2, 7, 13 or 19. Mean [95%CI] measured % Δ PV on HA2, 7, 13 and 19 were -2.5 [-8.2, 3.1], -11.0 [-16.6, -5.5], -11.7 [-15.9, -7.4], and -16.8 [-22.2, -11.3], respectively. % Δ PV and % Δ TCP were positively correlated ($P<0.001$) at HA2, 7, 13 & 19 ($r^2=0.77$, 0.88, 0.78, 0.89, respectively). The model over-predicted mean [95% CI] decrease

in %ΔPV on HA2 (-12.5 [-13.9, -11.1]) and HA7 (-21.5 [-23.9, -19.1]), accurately predicted the mean decrease on HA13 (-14.3, [-20.0, -8.7]), and predicted a mean increase in %ΔPV on HA19 (12.4 [-5.0, 29.8]). On HA2, 7, 13 and 19 only 2, 2, 6 and 1, respectively, of 17 individual measures of %ΔPV were within 95% CI for predicted %ΔPV. **CONCLUSION:** These observations indicate that human PV responses to HA exposure are oncologically mediated, vary considerably among individuals, and available quantitative models require further refinement to reliably predict %ΔPV exhibited by individual HA sojourners.

678 Board #5 May 29 3:15 PM - 5:15 PM
Resting and Submaximal Exercise Hemodynamic Changes When Sea Level Individuals Are Exposed to Altitude (11,237ft)

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(No relevant relationships reported)

Hypertension is a major risk factor for cardiovascular disease, and is present in 46% of the US adult population. An increase in one's blood pressure (BP) (~10mmHg) has been observed when individuals are exposed to altitude for 10-12 months. Less is known of the acute effect on BP in young healthy individuals when exposed to altitude. **PURPOSE:** The purpose of this study was to observe BP changes during rest and submaximal exercise in normotensive sea level (SL) individuals after 24 and 96 hours of altitude exposure (11,237ft). **METHODS:** Nine college students were asked to participate in five trials. Trials 1&2 determined their $\dot{V}O_2$ max and 60% HRR workload (WL) at SL, respectively. Trials 3-5 assessed BP, $\dot{V}O_2$ saturation, heart rate and double product (DP = ((SBP*HR)/100)) during rest and submaximal exercise. Trial 3 was completed at SL and trials 4&5 were completed at 11,237ft after 24 and 96 hours of altitude exposure. **RESULTS:** 5 males and 4 females; age=21.9±1.4 y; weight=72.3±14.3 kg; height=174.2±6.1 cm; $\dot{V}O_2$ max=43.6±8.3 ml/kg/min, completed the study. Oxygen saturation decreased (p=0.00) during rest and exercise at 24h (89±1.68, 82±2.5%) and 96h (90.3±0.75, 83.6±0.21%) vs SL (97.7±0.45, 95.8±0.82%), respectively. Heart rate increased at rest (p=0.00) and exercise (p<0.05) at 24h (77.2±7.9, 160.5±3.6 bpm) and 96h (73.5±10, 155.5±2.2 bpm) vs SL (65.9±8.5, 139±1.8 bpm), respectively. Resting SBP increased (p<0.05) at 24h (119.5±9.5 mmHg) and 96h (122.2±11.6 mmHg) vs SL (115.9±10.9 mmHg). Resting DBP increased (p<0.05) at 24h (78.5±8.5 mmHg) and 96h (80.5±8.9 mmHg) vs SL (71.3±9.6 mmHg). Exercise SBP increased (p<0.05) at 96h vs SL (160.6±15.6 to 153.4±16.5 mmHg), respectively. Double product increased during rest (p=0.00) and exercise (p<0.05) at 24h (91.4±9.6, 254.2±8.2) and 96h (91±12.5, 249.6±10) vs SL (77±10, 214.4±10), respectively. **CONCLUSION:** These results demonstrate that when sea level individuals are acutely exposed to altitude (11,237ft), there is a significant decrease in $\dot{V}O_2$ saturation, and a significant increase in HR, BP and DP after 24h and up to 96h. These hemodynamic changes are tolerable in young healthy individuals, but could be concerning in individuals with documented or latent CVD.

679 Board #6 May 29 3:15 PM - 5:15 PM
Hypoxic Cerebrovascular Reactivity Does Not Predict Cognitive Function in Mt. Everest Basecamp Trekkers

Jacob P. DeBlois¹, Wesley K. Lefferts², Taylor S. Harman¹, Kevin S. Heffernan¹, Trevor A. Day³, Tom D. Brutsaert¹. ¹Syracuse University, Syracuse, NY. ²University of Illinois, Chicago, IL. ³Mount Royal University, Calgary, AB, Canada.
 (No relevant relationships reported)

Cognitive function may be negatively impacted at high-altitude, which has important implications for decision making in such environments. The ability to predict changes in cognitive function at high-altitude may safeguard against potential adverse events in both novice and experienced high-altitude trekkers. Hypoxia results in compensatory increases in cerebral blood flow to maintain oxygen delivery. An inability to increase blood flow in this setting may contribute to cognitive performance at high-altitude. Cerebral reactivity to hypoxia at low-altitude may thus be a useful predictor of cognitive performance at high-altitude. **PURPOSE:** Determine if hypoxic reactivity of middle cerebral artery (MCA) mean blood velocity (V_m) at low-altitude predicts changes in cognitive function on a trek to Mt. Everest Basecamp. **METHODS:** 17 Mt. Everest Basecamp trekkers (n = 8 females; age = 26 ± 13 yrs; body fat = 19.5 ± 6.5%) underwent a 10-day trek from Kathmandu, Nepal to Gorak Shep, Nepal. Cerebral reactivity testing occurred at low-altitude (116 m). V_m of the left MCA was determined via transcranial Doppler under normobaric normoxia (NN, ~21% FiO₂) and hypoxia (NH, ~10% FiO₂). Each condition lasted 4 min. V_m was measured between 2.5 and 3.5 min and the average V_m over the 1-min period was used for analysis. Change in V_m was calculated as $\Delta V_m = V_{m\text{ NH}} - V_{m\text{ NN}}$. Cognitive function was assessed as accuracy and reaction time (RT) on a working memory task (2-back number matching task)

performed at NN (116 m) and hypobaric hypoxia (HH; Gorak Shep, Nepal 5,160 m). Changes in cognitive function were calculated as the change in accuracy and RT from NN to HH. **RESULTS:** Accuracy was reduced at HH compared with NN (9.8 ± 10.0% reduction; p = 0.001) while RT was faster (0.06 ± 0.08 s faster; p = 0.007). Univariate regression analysis showed that ΔV_m did not predict changes in accuracy ($\beta = -0.064$, p = 0.807) or RT ($\beta = 0.341$, p = 0.181) at HH. **CONCLUSIONS:** Cognitive function was reduced at high-altitude hypoxia, as is consistent with previous work. Changes in MCA V_m during a hypoxic reactivity test at low-altitude did not relate to changes in cognitive function with ascent to high-altitude. Hypoxic cerebral reactivity tests at low-altitude may not be suitable for predicting high-altitude cognitive function.

680 Board #7 May 29 3:15 PM - 5:15 PM
Effects of High-Altitude Hypoxia on Neurovascular Coupling During Cognitive Activity

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Neurovascular coupling (NVC) describes the ability to deliver continuous, non-pulsatile blood flow to working regions of the brain. NVC during visual stimulation appears maintained in posterior cerebral blood vessels under high-altitude hypoxic conditions. It is unknown, however, if high-altitude hypoxia impairs NVC in frontal regions of the brain undergoing cognitive activation. **PURPOSE:** Examine the effect of high-altitude hypoxia on NVC by measuring anterior (ACA) and middle cerebral artery (MCA) hemodynamic responses to sustained cognitive activity (Stroop task). **METHODS:** Nine adults (23 ± 7 yr, 23.5 ± 2.4 kg/m², 4 female) underwent simultaneous, continuous, bilateral measurement of ACA and MCA mean velocity and pulsatility index (PI) via transcranial Doppler during a 3-min Stroop task at 1400m, 3440m, and 4240m. Mean arterial pressure and arterial oxygen saturation were assessed via oscillometric cuff and pulse oximetry at rest and during the Stroop task. **RESULTS:** Blood pressure increased, MCA and ACA PI, and arterial oxygen saturation decreased with high-altitude hypoxia (p<0.05). Cognitive activity resulted in similar increases in MCA and ACA mean velocity and arterial oxygen saturation, and decreases in MCA PI (p<0.05) at all altitudes. No significant high-altitude hypoxia by Stroop interactions were detected, indicating NVC was similar with increasing high-altitude hypoxia. **CONCLUSION:** Our data suggest high-altitude hypoxia does not disturb compensatory increases in mean velocity and reductions in pulsatility in vessels feeding the frontal regions of the brain during cognitive activity. These data agree with a growing body of evidence that NVC is maintained in hypoxic environmental conditions.

Table 1: Cerebrovascular hemodynamics at rest and during activation (mean ± SD).

	1400m		3440m		4240m	
	Rest	Stroop	Rest	Stroop	Rest	Stroop
SPO ₂ (%) ^{a,b}	94±2	96±1	88±3†	89±3†	85±2*†	86±1*†
Mean pressure (mmHg) ^a	84±8	85±9	87±4†	89±11†	95±7*†	98±7*†
MCA						
PI ^{a,b}	0.93±0.08	0.86 ± 0.06	0.80±0.12	0.76±0.10	0.83±0.12	0.78±0.10
V _m (cm/s) ^b	64±10	67±11	65±10	68±9	65±12	70±11
ACA						
PI ^a	1.07±0.17	0.96±0.14	0.83±0.12†	0.81±0.12†	0.87±0.17	0.84±0.12
V _m (cm/s) ^b	55±9	58±11	56±15	58±17	54±15	56±14

MCA, middle cerebral artery; ACA, anterior cerebral artery; SPO₂, arterial oxygen saturation; MP, mean pressure; PI, pulsatility index; V_m, mean velocity. †p<0.05 effect of Stroop, *p<0.05 effect of high-altitude hypoxia, †p<0.05 vs 1400m, *p<0.05 vs 3440m

681 Board #8 May 29 3:15 PM - 5:15 PM
The Effects of Hypoxia on Cerebral Blood Flow Velocity and Hemodynamics during Ergometer Bicycle Exercise

Seongdae Kim¹, Hee-Hyeok Lee¹, Sangho Kim², Moon-Hyun Hwang³, Ilgyu Jeong¹. ¹Hannam University, Daejeon, Korea, Republic of. ²Korea University, Sejong, Korea, Republic of. ³Incheon National University, Incheon, Korea, Republic of.

(No relevant relationships reported)

The cerebral blood flow velocity (CBFV) response to acute hypoxia during exercise has been known to increase. But, how hemodynamics might respond to exercise in hypoxic condition and be associated with the change of CBFV remains unclear. **PURPOSE:** To determine the effects of hypoxia on CBFV and hemodynamics during bicycle ergometer exercise. **METHODS:** In a randomized, double-blind, crossover study, Twelve healthy volunteers (22.1±0.6yrs) were asked to perform the bicycle ergometer exercise three times in two hypoxic (3150m and 1900m altitudes) and control (sea level) condition with a week interval, respectively. Exercise intensity was set initially at 50W and increased by 25W every 2 minutes to 125W. Acute normobaric hypoxic condition corresponding to the altitudes of 3150m and 1900m was maintained using low oxygen gas mixture for the whole procedure of 40 minutes. CBFV in middle cerebral artery (MCA) were measured at rest 15 minutes, 5 and 10 minutes during exercise, 10 minutes recovery using transcranial-Doppler sonography. Non-invasive electrical cardiometry was used to obtain cardiac output (CO), thoracic fluid content (TFC) and flow time corrected (FTC). All data were analyzed using two-way ANOVA with repeated measures and Pearson's correlation. **RESULTS:** CBFV in MCA in 3150m and 1900m was significantly higher than in control condition at 10 minutes during exercise (110±28 and 99±25 vs. 75±18 cm/s, p<.05). Heart rate (HR) in 3150m was significantly higher than in 1900m and control condition at 10 minutes during exercise (163±10 vs. 154±6 and 152±8 bpm, p<.05). TFC in 3150m and 1900m was significantly lower than in control condition at 10 minutes during exercise (27±1 and 26±1 vs. 30±2, p<.05). FTC in 3150m and 1900m was significantly lower than in control condition at 10 minutes during exercise (240±20 and 254±16 vs. 265±18 ms, p<.05). However, CO and stroke volume (SV) were not significant different between three conditions. **CONCLUSIONS:** These results suggest that exercise in normobaric hypoxic condition might increase CBFV, which might be independent of hemodynamic changes.

B-37 Thematic Poster - New Findings in Physical Activity Assessment

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM
 Room: CC-102A

682 Chair: Nicholas Wareham. *Institute of Metabolic Science, Cambridge, United Kingdom.*

(No relevant relationships reported)

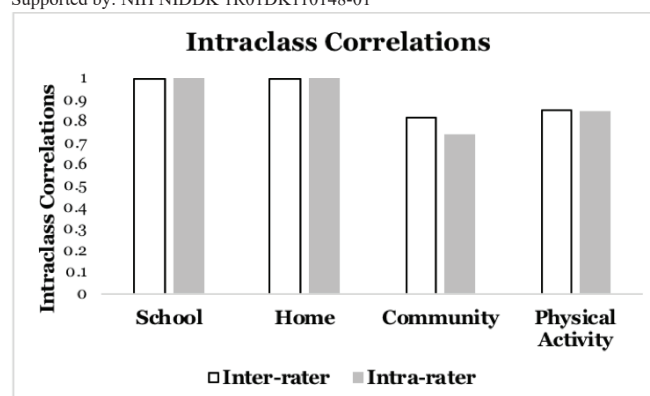
683 Board #1 May 29 3:15 PM - 5:15 PM
Free-Living Accelerometer Calibration: A Novel Direct Observation System

Melanna F. Cox, Greg J. Petrucci, Robert T. Marcotte, Brittany R. Masteller, John Staudenmayer, Patty S. Freedson, FACSM, John R. Sirard, FACSM. *University of Massachusetts, Amherst, MA.* (Sponsor: John R. Sirard, FACSM)

(No relevant relationships reported)

PURPOSE: To develop a direct observation (DO) system to serve as a criterion measure for model calibration using free-living (FL) accelerometer data. **METHODS:** Ten participants (19.4±0.8 yrs) were video-recorded during four, 1-hr FL sessions in different settings: school, home, community and physical activity (PA). For each setting, 10-min clips from three, randomly selected sessions were extracted and coded by a criterion coder and assistant coders (ACs) using the Observer XT software (Noldus, Wageningen, the Netherlands). Coders identified the movement/body position and four modifiers: locomotion (yes or no), activity type (e.g. reading), MET value, and intensity category. For intra-rater agreement, the criterion coder coded all 12 videos twice, separated by at least one week. For inter-rater agreement, all 12 videos coded by each AC were compared to the criterion coder. Intraclass correlation coefficients (ICCs) were calculated to assess agreement of intensity category for intra- and inter-rater comparisons. **RESULTS:** Intra-rater agreement ranged from 91% to 100% across all variables in all four settings. Inter-rater agreement between the criterion coder and the ACs ranged from 88±3.5% to 100±0% across all variables in all four settings. As shown below, ICCs for intensity category ranged from 0.74-1.00

and 0.81-1.00 for intra- and inter-rater comparisons, respectively. **CONCLUSION:** The DO system is reliable and feasible to serve as a criterion measure of FL physical activity in young adults. The DO system can serve as a standardized instrument to develop accelerometer models for estimating PA and sedentary behavior in FL settings. Supported by: NIH NIDDK 1R01DK110148-01



684 Board #2 May 29 3:15 PM - 5:15 PM
Reliability Analysis of the COSMED K5 Portable Metabolic System

Lindsey E. White, Jacob P. DeBlois, Tiago V. Barreira. *Syracuse University, Syracuse, NY.*

(No relevant relationships reported)

Increased energy expenditure via physical activity has been shown to improve health outcomes. It is difficult to measure energy expenditure and physical activity outside the laboratory. **PURPOSE:** To determine the reliability of the COSMED K5 portable metabolic system. **METHODS:** 27 (n = 14 females) healthy adults (27 ± 5 yrs; 21.0 ± 8.2% body fat) completed a treadmill walking protocol. Participants completed 3 identical trials of 5-min stages that included standing and 6 walking speeds from 1.5 to 4.0 mph in 0.5 mph increments, with a 2-min rest between stages for a total of 47 minutes. Visit 1 consisted of wearing the K5 system. During visit 2 (1-7 days later), participants wore the K4 and K5 systems in a randomized, counter-balanced order. Oxygen consumption (VO₂, ml·min⁻¹), carbon dioxide production (VCO₂, ml·min⁻¹), ventilation (V_E, L·min⁻¹), metabolic equivalents (METs), respiratory exchange ratio (RER), and energy expenditure (EE, kcal·min⁻¹) were recorded breath-by-breath and averaged from minutes 2.5 to 4.5 from each stage for analysis. Reliability of the K5 was determined using an intraclass correlation coefficient (ICC) and coefficient of variation (CV). **RESULTS:** As shown in Table 1, the ICC for standing ranged from 0.26-0.75 and CV ranged from 4.0-11.0%. During walking, ICC ranged from 0.41-0.88 and CV from 3.0-8.0%.

Table 1. Reliability of COSMED K5 in standing and at various walking speeds

Variable		Standing	1.5 mph	2.0 mph	2.5 mph	3.0 mph	3.5 mph	4.0 mph
VO ₂	ICC	0.47	0.64	0.72	0.76	0.76	0.78	0.85
	CV (%)	11.0 ± 9.0	8.0 ± 5.0	6.0 ± 6.0	7.0 ± 5.0	7.0 ± 5.0	6.0 ± 4.0	5.0 ± 4.0
VCO ₂	ICC	0.53	0.50	0.64	0.67	0.73	0.75	0.80
	CV (%)	11.0 ± 9.0	8.0 ± 6.0	7.0 ± 7.0	7.0 ± 6.0	6.0 ± 5.0	7.0 ± 5.0	7.0 ± 5.0
V _E	ICC	0.75	0.74	0.80	0.77	0.79	0.83	0.88
	CV (%)	10.0 ± 7.0	6.0 ± 5.0	6.0 ± 6.0	6.0 ± 5.0	5.0 ± 4.0	4.0 ± 3.0	4.0 ± 3.0
METs	ICC	0.65	0.54	0.56	0.65	0.66	0.74	0.82
	CV (%)	11.0 ± 8.0	8.0 ± 5.0	6.0 ± 6.0	7.0 ± 5.0	6.0 ± 5.0	6.0 ± 4.0	5.0 ± 4.0
RER	ICC	0.26	0.41	0.55	0.49	0.44	0.62	0.80
	CV (%)	4.0 ± 3.0	4.0 ± 3.0	3.0 ± 2.0	4.0 ± 3.0	4.0 ± 3.0	5.0 ± 3.0	6.0 ± 4.0
EE	ICC	0.50	0.62	0.71	0.74	0.75	0.78	0.84
	CV (%)	11.0 ± 9.0	8.0 ± 5.0	6.0 ± 6.0	6.0 ± 5.0	6.0 ± 5.0	6.0 ± 4.0	5.0 ± 4.0

CONCLUSIONS: The K5 provided reliable measures of VO_2 , VCO_2 , \dot{V}_e , METs, RER, and EE across a variety of walking speeds, with higher reliability noted at 3.0–4.0 mph. Future studies should examine the reliability of the K5 during running and other activities.

685 Board #3 May 29 3:15 PM - 5:15 PM
Free-living Evaluation Of Laboratory-based Machine Learning Algorithms For Activity Classification In Preschool Children

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 (No relevant relationships reported)

Machine learning (ML) classification models for accelerometer data are a potentially more accurate method to measure physical activity in young children than conventional cut-point methods. However, existing algorithms have been trained on laboratory-based activity trials. To our knowledge, no studies have evaluated the performance of classification algorithms trained on structured activity trials for preschool-aged children under free-living conditions, and none have used fine-grained video-based direct observation to evaluate algorithm performance.

Purpose:

To evaluate the performance of hip and wrist Random Forest (RF) and Support Vector Machine (SVM) activity classification algorithms for preschool-aged children (Trost et al. 2018) under free-living conditions.

Methods:

31 children (4.0 ± 0.9 yrs) were video recorded using a GoPro during a 30-minute unstructured active play session in a park while wearing an ActiGraph GT3X+ accelerometer on their right hip and non-dominant wrist. Direct observation was used to continuously code ground truth activity type and activity class using the Noldus Observer XT. Algorithm performance was assessed using overall accuracy and confusion matrices were generated to summarize class-level classification accuracy.

Results:

Accuracy for the hip and wrist RF algorithms was 69.4 (95% CI: 67.4 – 71.2), and 59.1 (95% CI: 57.1–61.1), respectively. Accuracy for hip and wrist SVM algorithms was 66.4 (95% CI: 64.4 – 68.3), and 59.3 (95% CI: 57.3 – 61.3), respectively. Classification was moderate for sedentary (71–77%), poor-moderate for light activity and games (58–79%), and moderate-good for moderate to vigorous activity and games (71–84%) and running (66–75%). Classification for walking (9–15%) was poor. When 15-sec windows with multiple activities were excluded from analysis, overall accuracy was improved by 8–10%. Prediction of walking improved by 19–34%.

Conclusion:

The accuracy of laboratory-based activity classification algorithms for preschool-aged children was attenuated when tested on new data collected under free living conditions. Future studies should develop and evaluate the performance of activity classification algorithms trained on accelerometer data collected under true free-living conditions.

686 Board #4 May 29 3:15 PM - 5:15 PM
Insights On Free-living Sedentary Behavior Estimates Using A Hip- Or Wrist-worn Accelerometer

Robert T. Marcotte, Greg J. Petrucci, Jr, Melanna F. Cox, Patty S. Freedson, FACSM, John W. Staudenmayer, John R. Sirard, FACSM. *University of Massachusetts Amherst, Amherst, MA.*
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PURPOSE: The primary purpose was to validate existing methods to estimate sedentary behavior (SB) under free-living conditions using ActiGraph GT3X+ accelerometers (AG). The secondary purpose was to identify method-specific systematic errors that result in the misclassification of SB. **METHODS:** Forty-eight participants (age: 20.4 ± 1.3 years, 45.8% male) were video-recorded during four 1-hour sessions in different settings (home, community, school, environment) while wearing an AG on the right hip and non-dominant wrist. Videos were coded for postural orientation and activity type (e.g. walking). Observed time in sitting and lying postures were classified as SB (criterion measure). Twelve methods were applied to hip and wrist accelerometer data to estimate time spent in SB (see Figure 1). Repeated measures linear mixed models were used to estimate method bias (estimate - criterion SB) and a 95%CI around the bias. **RESULTS:** On average, participants spent 34.1 of the 57.2 minutes/session in SB. Four of the hip methods were unbiased (Soj1x, Soj3x, CPM100, CPM150), however SB was underestimated using CPM200vm (-5.5 minutes, 95%CI: -7.1, -3.8) and overestimated using ENMO47.4 (12.2 minutes, 95%CI: 9.9, 14.5). For the wrist, Sed Sphere was the only unbiased method. SB was overestimated using ENMO44.8 (3.7 minutes, 95%CI: 1.8, 5.5) and underestimated using Wrist RF, CP15s376vm, Wrist TR, and CPM1853vm, ranging from -9.5 to

-5.7 minutes. The majority of misclassified SB occurred during standing or sitting behaviors (67.0–96.7%). **CONCLUSION:** Accurate estimates of SB from a hip-worn AG can be achieved using either simpler count-based approaches (CPM100, CPM150) or machine learning models (Soj1x, Soj3x). Only the Sedentary Sphere may be suitable to estimate SB from the non-dominant wrist. Future work to distinguish standing from SB may lead to improvements in estimating SB. Supported by NIH NIDDK 1R01DK110148

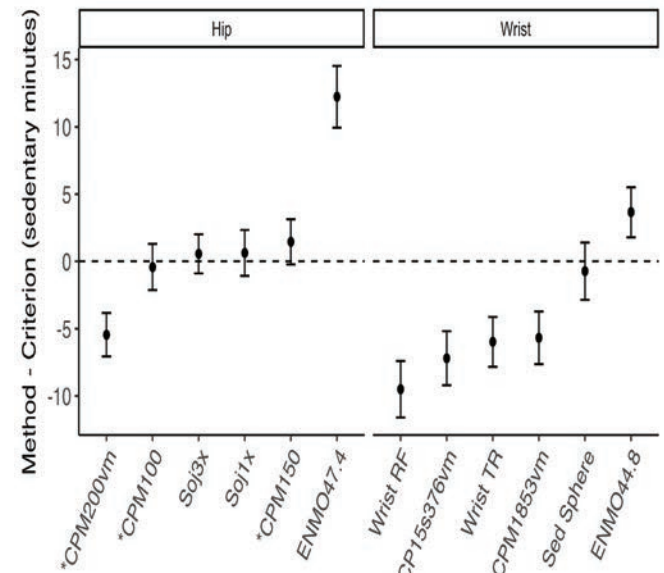


Figure 1: Mean bias and 95%CI for hip- and wrist-method estimated time spent in sedentary behavior. * indicates method was applied to low-frequency extension processed accelerometer data

687 Board #5 May 29 3:15 PM - 5:15 PM
Using A Thigh Worn Accelerometer To Identify Periods Of Seated Car Travel

Kate Lyden¹, Craig Speirs¹, David Loudon¹, Cami Christopher², Rachel Barnett², Julian Martinez², Mami Takeda², Sarah Keadle².
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 Reported Relationships: K. Lyden: Consulting Fee; PAL Technologies.

Thigh inclination has been shown to be a highly specific discriminator between upright and seated activities. During periods of sitting, the background noise in the acceleration signal can provide important contextual information about the seated behaviour.

PURPOSE: The purpose of this study was to develop and validate a simple algorithm to distinguish periods of seated car travel. The algorithm is based on the premise that during seated car travel, 1) body-worn accelerometers register a background level of external dynamic acceleration due to forces generated by the road surface and car engine and 2) leg movements are restricted due to the spatial constraints of the car. **METHODS:** Participants (n=26, mean age=30.5yrs, 16 female, 20 male) were directly observed in their free-living environment on two separate occasions, for two hours each. Raw accelerometer data were summarized in 15-second epochs and synced with direct observation video. Using knowledge based on *a priori* observations of car travel, four features of the accelerometer signal were extracted from periods of sitting and tested 1) median vector magnitude (VM), 2) lower VM decile, 3) maximum VM and 4) range of inclination angles. Parameter constants were chosen based on grid search methods with the objective of maximizing positive and negative predictive value (PPV, NPV). **RESULTS:** Threshold constants identified included 1) median VM < 500, 2) lower VM decile > 5, 3) maximum VM < 5000 and 4) inclination angle range < 40. 100% of car travel events were correctly identified, with a single false positive (1%). PPV and NPV were 95.5% and 100%, respectively. **CONCLUSION:** Using a thigh worn accelerometer, seated behaviours can be identified as car travel or not. Importantly, acceleration features pertaining to both the inclination angle and vector magnitude were needed to optimize classification accuracy.

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Board #6

May 29 3:15 PM - 5:15 PM

Automatic Segmentation of Walking Strides in Wearable Accelerometry Data with Adaptive Empirical Pattern Transformation

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(No relevant relationships reported)

Quantifying gait parameters and ambulatory monitoring of changes in these parameters has become increasingly important for epidemiological and clinical studies. Wearable accelerometers provide objective high-density measurements of human gait dynamics through recording of acceleration. Many studies use accelerometry to objectively measure physical activity using the activity counts, vector magnitude, or number of steps. These measures use just a fraction of the information in the raw accelerometry data as they are typically summarized at the minute level. To address this problem, we focus on raw, sub-second level accelerometry data and define a set of gait characteristics based on these data. Additionally, to overcome the analytical challenges of these complex and voluminous data we develop automatic and unsupervised methodology for precise segmentation of stride patterns. **PURPOSE:** We propose Adaptive Empirical Pattern Transformation (ADEPT) and maximization-tuning procedure for automatic identification of individual walking strides from raw accelerometry data that uses data-derived baseline patterns, representing a population-specific strides.

METHODS: Data were collected as a part of the study on Identification of Walking, Stair Climbing, and Driving Using Wearable Accelerometers, funded by the Indiana University CTSI grant and conducted at the Department of Biostatistics, RM Fairbanks School of Public Health at Indiana University. The study enrolled 32 healthy participants between 23 and 52 years of age. Participants wore accelerometers on a wrist, hip and both ankles during a 450-meter outdoor walk. **RESULTS:** ADEPT yields results that are in most cases visually indistinguishable from manual segmentation and reduces strides segmentation time radically. The average absolute deviation of estimated stride duration across study participants was 4.74, 1.42, 1.28 and 1.31 percent, for wrist, hip and both ankles respectively.

CONCLUSIONS: Our results indicate that the errors are small relative to the signal for all body locations suggesting that ADEPT is a robust and universal tool for segmentation of strides in accelerometry data.

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Board #7

May 29 3:15 PM - 5:15 PM

Development And Testing Of An Integrated Score For Physical Behaviors

Sarah Keadle¹, Eli Kravitz², Charles E. Matthews, FACSM³, Marilyn Tseng¹, Raymond J. Carroll⁴. ¹California Polytechnic State University, San Luis Obispo, CA. ²Texas A&M University, College Station, TX. ³National Cancer Institute, Bethesda, MD. ⁴Texas A&M, College Station, TX. (Sponsor: Charles Matthews, FACSM)

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(No relevant relationships reported)

There is expanding interest in the 24-hr activity cycle in relation to health outcomes, creating a need for new statistical approaches to analyze the joint effects of distinct but inter-related physical behaviors (e.g., exercise, sitting time, sleep). **PURPOSE:** To develop and test an integrated physical behavior score (PBS) in relation to all-cause and cause specific mortality.

METHODS: NIH-AARP Diet and Health Study participants (N=163,016) completed a questionnaire (2004-2006) asking about time spent in five exercise and non-exercise physical activities, two sedentary behaviors (television and non-television), and sleep. In half of the sample, we used shape constrained additive regression to model the relationship between each behavior and survival. Maximum logit scores from each of the eight behavior-survival functions were summed to produce a PBS that was proportionally rescaled to range from 0-100. We examined predictive validity of the PBS in the other half-sample using Cox Proportional Hazards models after adjustment for covariates for all-cause and cause-specific mortality.

RESULTS: In the testing sample, over an average of 6.6y of follow-up, 8,732 deaths occurred. We found a strong graded decline in risk of all-cause mortality across quintiles of PBS (Q5 vs Q1 hazard ratio [95%CI] = 0.53 [0.49, 0.57]). Risk estimates for the PBS were higher than any of the components in isolation. Results were similar but stronger for cardiovascular disease (Q5 vs Q1 = 0.42 [0.39, 0.48]) and other mortality (Q5 vs Q1 = 0.42 [0.36, 0.48]). The relationship between PBS and mortality was observed in stratified analyses by median age, sex, BMI and health status.

CONCLUSIONS: Although widespread in other areas of epidemiology, this is one of the first attempts to characterize integrate multiple distinct physical behaviors into

a single composite score. In a large sample of US adults, we showed this score has strong predictive validity for both men and women. Future research is needed to test this approach in an independent sample. Supported by the National Institutes of Health U01-CA057030 and the Intramural Research Program.

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Board #8

May 29 3:15 PM - 5:15 PM

Estimating Free-living Physical Activity Using A Wrist-worn Actigraph Accelerometer: Can It Be Done?

Greg J Petrucci Jr., Robert T. Marcotte, Melanna F. Cox, John Staudenmayer, Patty S. Freedson, FACSM, John R. Sirard, FACSM. *University of Massachusetts Amherst, Amherst, MA.* (Sponsor: John R. Sirard, FACSM)

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(No relevant relationships reported)

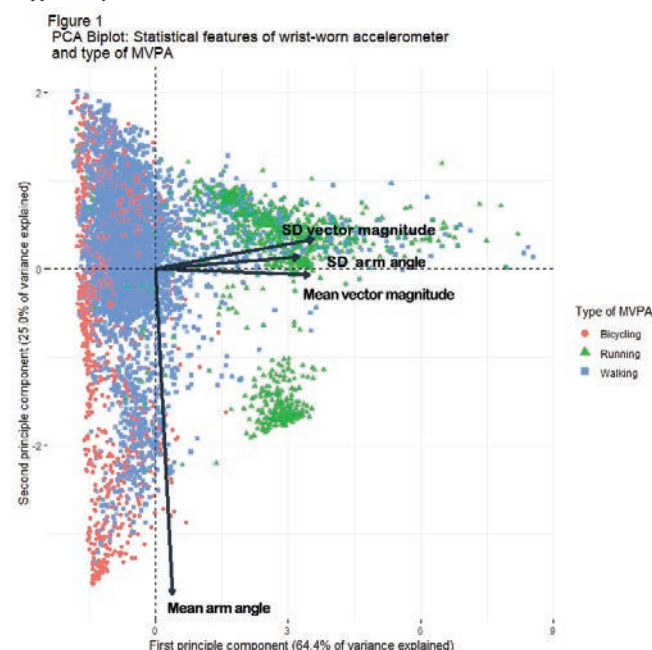
PURPOSE: Determine the accuracy of wrist-worn ActiGraph GT3X+ accelerometer (AG) data processing models and examine relationships among model features and type of MVPA.

METHODS: Forty-eight participants (20.4 ± 1.3 years, 45.8% male) wore an AG on their non-dominant wrist during four, 1-hour sessions in free-living settings. Sessions were video-recorded and coded using a direct observation (DO) system that provided criterion measures for minutes and type of MVPA. Four previously developed AG processing models were applied to estimate MVPA minutes: raw acceleration and arm angle cut-point (sed-sphere), Euclidean norm corrected for gravity cut-point (ENMO), random forest (RF) and decision tree (DT) models. Mixed models were used to assess the difference between model estimated and DO measured MVPA minutes. Principle components analysis (PCA) was used to examine features of the AG data that were associated with MVPA.

RESULTS: DO identified 12.8 minutes of MVPA/session. Sed-sphere was the only model to accurately estimate MVPA minutes (bias [95% confidence interval] = 1.0 [-0.4, 2.5] minutes). MVPA was overestimated using RF and DT (5.9 [3.3, 8.5] and 4.0 [2.4, 5.6] minutes, respectively) and ENMO significantly underestimated MVPA minutes (-10.7 [-12.9, -8.4] minutes). PCA showed that two principle components account for 89.4% of the variance in MVPA type (64.4% and 25.0%, respectively; Figure 1). The first principle component placed equal weight on three features (mean, standard deviation of acceleration vector magnitude and standard deviation of arm angle) while the second loaded on mean arm angle.

CONCLUSIONS: Sed-sphere was the only model to accurately estimate minutes of MVPA. PCA indicates that arm angle estimates aspects of MVPA beyond acceleration vector magnitude, and future research should use that feature.

Supported by NIH NIDDK R01DK110148



B-38 Thematic Poster - Special Needs

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM
Room: CC-102B

691 **Chair:** Jennifer Lee Trilk, FACS. *University of South Carolina School of Medicine Greenville, Greenville, SC.*
(No relevant relationships reported)

692 Board #1 May 29 3:15 PM - 5:15 PM
A Fit 5 Program for Adults with Developmental Disabilities in a Day Program

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(No relevant relationships reported)

ACSM Scientific Abstract Submission 2019

PURPOSE: Fit 5 is a resource published by Special Olympics that provides instruction for making healthy choices including exercise, diet, and hydration. The purpose of this study was to examine the effectiveness of the Fit 5 program at improving the health of persons with developmental disabilities when promoted through a community day program. **METHODS:** Individuals with developmental disabilities were invited to participate in a weekly fitness program that utilized the Fit 5 resources at their community day program. Participants were given a Fit 5 booklet that provided instruction on making healthy choices. Participants attended one 45-minute group exercise session per week for a total of six weeks. Exercise sessions included Level 1 and Level 2 exercises from the Fit 5 resource and targeted aerobic endurance, muscular fitness, flexibility, and balance. At each group exercise session, participants submitted a weekly record of their exercise, diet, and hydration and were prompted to continue healthy behaviors. A pre-test/post-test design was used. Exactly one week before (pre-test) and one week after (post-test) the 6-week intervention, waist circumference, total modified push-ups performed, and total modified curl-ups performed were recorded for each participant. Repeated measures MANOVA was used to test the effect of time (pre-test, post-test) on the measures of waist circumference, total push-ups, and total curl-ups in order to evaluate the effectiveness of the intervention for improving body composition and muscular fitness. **RESULTS:** 18 individuals (Mean age: 43 ± 19; 11 females) have participated in the intervention to date. Pillai's trace repeated measures MANOVA revealed a significant difference between measures of fitness on the pre-test and post-test ($F_{(df=3,13)} = .582$; $p < .01$, $\eta^2 = .58$). The total curl-ups ($p < .001$) performed increased between the pre-test (15±11) and post-test (23±13). Neither total push-ups performed nor waist circumference was significantly changed by the intervention ($p > .05$). **CONCLUSIONS:** A 6-week intervention using the Fit5 resources was effective at improving muscular fitness for persons with developmental disabilities within a local community day program.

693 Board #2 May 29 3:15 PM - 5:15 PM
Feasibility of a 6-week Handcycling High Intensity Interval Training Program for Spinal Cord Injury

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PURPOSE: Spinal cord injury (SCI) can be debilitating to one's health, functional capacity, and quality of life. Specifically, SCI contributes to an elevated risk of preventable cardiometabolic and hypokinetic diseases. Many individuals with SCI have low levels of fitness due to barriers including lack of time, accessible equipment and awareness of exercises that are safe and effective. Using an indoor stationary handcycle to perform a high-intensity exercise program (HIIT) could be a time-efficient and accessible means of improving fitness. The primary aim of this study was to determine adherence, acceptance and fitness outcomes of a 6-week HIIT program for non-ambulatory persons with SCI.

METHODS: Three men with SCI have completed the study to date (Table). At baseline, S2 did not participate in regular physical activity (PA). S1 and S3 participated in 1-3 hours of PA 2 times/week. Participants completed a baseline and post graded exercise test. The HIIT program consisted of 2, 25 min supervised at-home sessions (2-3 min warm-up, 10, 1:1 min work/recovery phases at 90% peak power output (PPO) and 0-20% PPO and 2-3 min cool-down). Real-time power, heart rate (HR), cadence and velocities were recorded via sensors and an app (Garmin Connect).

RESULTS: Subjects completed all 12 sessions and 10 bouts with the exception of S2 (7/10 and 8/10 bouts for sessions 1 and 4). S2 performed 3 unsupervised sessions

verified via the app. Fitness outcomes were not apparent for S2 and S3 while S1 showed increases in VO₂ (16.0 to 17.1 ml/kg), minute ventilation (37.9 to 42.0 ml/kg), and tidal volume (1.2 to 1.5 L) peaks after training.

Table: Baseline and training data averaged over the 12 sessions (work phases)

Subject	Age, SCI level, Years Post Injury	Baseline HR	Baseline PPO	HR Beats/min	Power Watts	Cadence Rev/min
S1	58, L5/S1, 24	89	50	85 (3)	51.8 (6.0)	57 (5)
S2	17, C5, 2	133	50	100 (3)	41.4 (4.5)	51 (13)
S3	30, C5/C6, 15	100	40	102 (3)	29.0 (2.8)	59 (5)

CONCLUSION: Feasibility was demonstrated by excellent adherence and remote monitoring of compliance with HIIT intensities. A greater number of weekly sessions and/or a longer training period are likely to lead to improvements in fitness parameters.

694 Board #3 May 29 3:15 PM - 5:15 PM
Physical Activity, Sleep, And Stereotypic Behaviors In Youth With Autism Spectrum Disorder

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to compare the associations between moderate-to vigorous physical activity (MVPA), sedentary behavior (SB), sleep quality, and stereotypic behaviors in children with Autism Spectrum Disorder (ASD). **METHODS:** Activity levels and sleep quality were measured in 16 children with ASD (ages 8-17) using Actigraph GT9X Accelerometers. All participants wore the device on their non-dominant wrist for a period of seven days and nights. Parents completed the Aberrant Behavior Checklist (ABC) which examined child irritability, stereotypic behaviors, hyperactivity, inappropriate speech, and lethargy. Spearman correlations were used to examine associations between minutes of MVPA, sleep duration, and adverse behaviors.

RESULTS: Greater levels of MVPA were correlated with less stereotypic behaviors ($r = -.62$, $p = .02$). Although they did not quite reach statistical significance, trends were seen for the associations between 1) longer sleep duration and lower ratings of hyperactivity ($r = -.43$, $p < .1$); and 2) greater amounts of SB and higher ratings of lethargy ($r = .4$, $p < .1$).

CONCLUSIONS: Adequate duration of sleep and participation in MVPA may be linked with fewer adverse behaviors in children with ASD. Future studies should examine larger samples of children with ASD over a longer duration to better determine causal mechanisms that may explain these associations between MVPA, sleep habits and ASD-related behaviors.

695 Board #4 May 29 3:15 PM - 5:15 PM
Comparison of Energy Expenditure in Wheelchair Users During Active Video Gaming with Adapted Game Controllers

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(No relevant relationships reported)

Active video gaming (AVG) options are limited for individuals with mobility impairments due to inaccessibility of the gaming controllers. Two gaming controllers (Wii Fit balance board and gaming mat) were recently adapted for individuals with physical disabilities (www.rectech.org), thereby providing increased opportunities for AVG play. **PURPOSE:** To compare energy expenditure in persons with mobility impairment during seated AVG play using an adapted Wii Fit balance board (WFBB) and adapted gaming mat. **METHODS:** During the first lab visit, demographic data were collected, and participants completed a game play familiarization period. During the next two lab visits, metabolic data (COSMED) were collected during a 20-minute baseline, followed by two 10-minute bouts of game play. During one visit, participants played select Wii Fit Plus games on the adapted WFBB and during the other visit Active Life Explorer and Outdoor Challenge games were played on the adapted gaming mat. For all AVGs participants played seated. The adapted WFBB was designed so that the player could wheel onto the platform. For play using the adapted gaming mat, the mat was placed on a height-adjustable table. A paired sample t-test was computed to compare mean energy expenditure during game play on the adapted WFBB and gaming mat. **RESULTS:** Sample included 26 participants, 16 men, mean age 37.50 ± 12.77 yrs. All participants utilized a wheelchair for mobility and daily activities. Mean energy expenditure (METs) during game play was significantly greater

($p < .05$) on the adapted WFBB (2.24 ± 0.68 kcal/kg/hr) as compared to the gaming mat (1.99 ± 0.68). **CONCLUSION:** The adapted WFBB and gaming mat provided an opportunity for persons with mobility impairments, specifically wheelchair users, to engage in AVG. Although mean MET values achieved during AVG represented light intensity exercise, several participants ($n = 12$) achieved moderate intensity (3-4 METs) on at least one game set. Factors not accounted for that may have influenced exercise intensity include game selection, limited familiarization, and discomfort wearing the COSMED system. Adapted controllers for AVG play provide a viable option for increasing leisure-time physical activity in persons with mobility impairments. Supported by NIDRR grant 90RE5009-01-00.

696 Board #5 May 29 3:15 PM - 5:15 PM
Prediction of Energy Expenditure from Accelerometers during Physical Activity in Adults with Down Syndrome: The Effect of Accelerometer Placement

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INTRODUCTION: For accurate physical activity assessment with accelerometers in adults with Down syndrome (DS), there is a need to examine if the relationship between the rate of oxygen uptake ($\dot{V}O_2$) and output from hip-and wrist-worn accelerometers across different activities and sedentary behaviors is different between adults with and without DS. In this study, we examined this question and we also evaluated the accuracy of hip- and wrist-worn accelerometers in estimating the $\dot{V}O_2$. **METHODS:** The sample included 16 adults with DS (10 men; age 31 ± 15 years) and 19 adults without DS (10 men; age 24 ± 6 years). We measured $\dot{V}O_2$ with a portable spirometer (K4b2, Cosmed) and accelerometer output (Vector Magnitude [VM]) with a hip- and a wrist-worn accelerometer (wGTX-BT, Actigraph). We used multi-level regression to predict $\dot{V}O_2$ from VM and group. Additional predictors included body mass index (BMI), age, height, weight, and sex. We evaluated the accuracy of the prediction with the absolute percent error and Bland-Altman plots.

RESULTS: For both the hip and the wrist accelerometer, VM and group were significant predictors of $\dot{V}O_2$ ($p \leq 0.021$). However, when BMI was added to the models, BMI was a significant predictor and DS was no longer significant for both accelerometer models. The final models included Vector Magnitude and BMI ($p \leq 0.001$; $R^2 = 0.78$ and 0.57 , for hip and wrist accelerometer model, respectively). For the hip accelerometer, absolute percent error across all tasks and for both groups combined was $22.5 \pm 27.4\%$, whereas, for the wrist accelerometer, error was $37.8 \pm 38.0\%$. Absolute percent error across tasks combined and for each task separately did not differ between groups. The Bland-Altman plots indicated nearly zero mean error for both groups. However, error had somewhat greater 95% confidence intervals for the wrist- than the hip-accelerometer models.

CONCLUSION: Adults with DS have different $\dot{V}O_2$ to VM responses, but this is due to their higher BMI. Predictability of $\dot{V}O_2$ from accelerometer output is better for a hip- than a wrist-worn accelerometer. These results may help advance physical activity assessment for adults with DS.

697 Board #6 May 29 3:15 PM - 5:15 PM
Comparing Gross Efficiency Between Rigid And Hydraulic Prosthetic Ankles During Graded Treadmill Walking

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(No relevant relationships reported)

Recent advancements have led to the development of prosthetic ankles that actively plantar and dorsiflex using hydraulics during walking. In theory, hydraulic ankles allow for more efficient locomotion due to the increased ROM, but these ankles are often heavier than rigid ankles. It is unclear if the increased ROM leads to decreased oxygen consumption during graded walking. **PURPOSE:** To determine which type of ankle prosthesis, a rigid ankle (RA) or a hydraulic ankle (HA) is most efficient when walking uphill. **METHODS:** A female transfemoral amputee (age = 56 y, height = 173 cm, body mass = 77.8kg) walked on a treadmill set at $4.02 \text{ km} \cdot \text{h}^{-1}$, 5% grade, for six min using two types of ankles. A total of four trials were completed in a counterbalanced fashion, with a 15 min recovery between trials. The subject was accustomed to wearing a rigid prosthetic, so a one week acclimation period to walking in the HA was allowed before testing. Expired gases were collected using open-circuit spirometry and gas analysis was completed using a metabolic measurement system. Gross efficiency (GE) was calculated in $\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, and averaged over the two trials. Percent differences were compared between prostheses and trials. **RESULTS:** The HA weighed 0.4kg more than the RA. Compared to RA (average GE = $184 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), GE was 7.2% (+6.4% trial 1, +8.2% trial 2) less when using a HA (average GE = $197 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$). **CONCLUSIONS:** Walking uphill using a HA incurs a greater O₂ cost than does

walking with a RA. The greater mass of the HA may explain the lower GE observed during graded treadmill walking. Longer familiarization with HA may improve GE during walking.

698 Board #7 May 29 3:15 PM - 5:15 PM
Feasibility and Effectiveness of Community-Based Virtual Reality Group Exercise Training in Persons with Spinal Cord Injury

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(No relevant relationships reported)

Persons with spinal cord injury (SCI) are at an increased risk of physiological morbidity compared to their ambulatory counterparts in whom well-established, beneficial correlations exist between exercise, cardiorespiratory health and body composition. Furthermore, SCI who participate in sport may have reduced risk of physiological morbidity than SCI who are sedentary. **PURPOSE:** This pilot study was two-fold: 1) to determine whether differences exist in cardiorespiratory health and body composition between SCI athletes (ATHL) and sedentary SCI (SED), and 2) to determine whether an 8-week handcycle exercise training program is feasible in an SED SCI population, and if improvements in cardiorespiratory fitness and body composition occur. **METHODS:** Twenty-seven SED and six ATHL were recruited to participate in the study. All SCI completed a graded hand cycling maximal exercise test for cardiorespiratory fitness ($\dot{V}O_{2\text{max}}$) and body composition testing (iDEXA). SED participants were then randomized into a virtual reality intervention (VR) or waitlist (WL) group (e.g. offered VR after 8 weeks of WL). The intervention consisted of an 8-week community-based VR group hand cycling exercise training with a USA level 1 coach two days/week. Pre-post outcomes were measured in each group. **RESULTS:** Thirty-three SCI were recruited to participate (SED $n=27$; ATHL $n=6$). All ATHL and 17 SED participants (VR=9, WL=8) completed study protocol, with 10 (VR=1 and WL=9) lost to follow up. One participant was dropped from analysis due to not giving a full effort during testing as determined by investigators. ATHL had 23 physiological and anthropometric variables that were significantly different ($p \leq 0.01$) compared to SED including higher $\dot{V}O_{2\text{max}}$ (19.1 ml/kg/min), lower BMI (-4.6 kg/m^2), and lower total body fat percentage (-10.4%). $\dot{V}O_{2\text{max}}$ increased 16% in VR and 9% in WL, which was not statistically different. **CONCLUSION:** This study demonstrates the feasibility of a hand cycling program in SCI. ATHL had better outcomes associated with long term health compared to their SED counterparts. Though no significant changes were noted in VR compared to WL, changes in $\dot{V}O_{2\text{max}}$ may be clinically relevant. A larger sample size or longer training period may be needed to observe significant differences in physiological health in an SED SCI population.

699 Board #8 May 29 3:15 PM - 5:15 PM
Effects Of Virtual Reality On Pain And Fatigue In Individuals With SCI

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(No relevant relationships reported)

Background: Pain and fatigue are among the most commonly reported barriers to exercise for individuals with spinal cord injury (SCI). Previous studies have documented virtual reality's (VR) pain and fatigue reducing properties. However, no study has investigated the benefits of using VR for reducing pain and fatigue during exercise in individuals with SCI. **Purpose:** To investigate the effects of using VR during exercise on perceptions of pain and fatigue in individuals with SCI. **Methods:** A total of 18 individuals with traumatic SCI (aged 43.29 ± 17.5 years) participated in this repeated measure comparative study. Three visits were required from each participant. Baseline data was collected during the first visit. The following two visits consisted of a 6-minute exercise test using arm ergometry. Participants were randomly assigned to an exercise condition, either VR or non-VR. Participants rated their pain and fatigue using visual analogue scales and qualitative data was collected following the completion of the exercise test. Dependent variables included pain and fatigue. **Results:** Repeated measures ANOVA showed statistically significant improvements in pain and fatigue scores. VR sessions decreased pain and fatigue by 34% and 36% respectively, as compared to the non-VR exercise sessions. All p values were $p < .05$. In addition, three higher order themes emerged from qualitative analysis, positive psychological impact, positive physiological impact, and virtual reality enhancing exercise experience. **Conclusion:** Our results indicate that exercise in combination with VR can be effective in reducing pain and fatigue in individuals with SCI.

B-39 Free Communication/Slide - Adolescent and Young Adult Female Athlete

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM
Room: CC-202C

700 **Chair:** Nancy I. Williams, FACSM. *Pennsylvania State University, State College, PA.*
(No relevant relationships reported)

701 May 29 3:15 PM - 3:30 PM
Assessment of Sport Specialization and Menstrual Dysfunction in High School Athletes During Pre-season Screening

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Sport specialization and menstrual dysfunction (MD) are of concern for high school athletes as they may contribute to sports injury. Limited evidence exists on the extent of sport specialization and prevalence of MD assessed at pre-season screening. **PURPOSE:** The objectives of this study were to 1) determine the prevalence of sport specialization and MD, and 2) determine if sport specialization and MD are higher in team/ball sports than individual sports. **METHODS:** Seven hundred ninety-two (250 females, 542 males) athletes from 14 San Diego high schools participated in a pre-season screening clinic. The athletes completed a questionnaire regarding sport specialization, sport type (individual vs. team/ball sport), menstrual health. Sport specialization was determined by the athletes' responses to 1) declared a primary sport, 2) quit other sports to focus on primary sport, and 3) trained >8 months/year in primary sport in the past year. Scores of 0-1 were considered low specialization, and scores of 2 and 3 indicated moderate and high sport specialization, respectively. MD was defined as <9 menstrual periods reported in the past year. **RESULTS:** Overall, 54.8% of the athletes were classified as low sport specialists, 38.4% as moderate sport specialists, and 6.8% as high sport specialists. Golf (42.9%), swimming/diving (18.8%), and tennis (15.8%) had the greatest percent of high sport specialization. High sport specialization was almost two times (OR=1.81, 95% CI: 0.9-3.4; p=0.07) greater among those whose primary sport was an individual sport (10.0%) than athletes participating in a team/ball sport (6.0%). Females (9.2%) were twice as likely (OR=1.94, 95% CI: 1.1-3.5; p=0.02) to highly sport specialize than males (5.7%). Twenty-four (9.7%) female athletes reported MD. Tennis (33.3%), cross-country (15.8%), and swimming (14.3%) had the highest percent of MD. Although a non-significant trend, females who reported MD were twice as likely (OR=2.01, 95% CI: 0.9-4.9; p=0.10) to participate in an individual sport (14.5%) as their primary sport than those whose primary sport was a ball/team sport (7.6%). **CONCLUSIONS:** Females were more likely to sport specialize than males. High sport specialization was most common among individual-type sports.

702 May 29 3:30 PM - 3:45 PM
Association Between Sport Specialization and Low BMD Among Female High School Distance Runners
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Sport specialization has become increasingly common and has been related to sports injury and menstrual dysfunction among female high school distance runners. The association between sport specialization and low bone mineral density (BMD) is poorly described in this population. **PURPOSE:** To determine the association between sports specialization and low BMD in female high school distance runners. **METHODS:** Participants consisted of 64 female runners (age 15.6 ± 1.4y), not currently on birth control medication, who competed in interscholastic cross-country and distance track events in southern California. Each runner completed a survey on sport participation and menstrual function, and had her height and weight measured.

Each runner's spine and hip BMD were assessed using DXA, standardized to BMD Z-score by age and sex normative values. Sport specialization classifications were: low specialization (distance running sport(s) for ≤8 months/year and participation in ≥1 other non-running high school sports); moderate specialization (only distance running sport(s) for ≤8 months/year, or participation in distance running sport(s) ≥9 months/year and ≥1 other non-running sports); and high specialization (participation in distance running sport(s) for ≥9 months/year and no other sports. Multivariable logistic regression was performed to determine the adjusted odds ratio (OR) and 95% confidence interval (CI), adjusting for BMI and gynecological age. **RESULTS:** Overall, 21.9% of the runners were high sport specialists, and 37.5% and 40.6% were moderate and low sport specialists, respectively. Twenty-three (35.9%) runners had low BMD (Z-score < -1.0). After adjusting for gynecological age and BMI, high sport specialists were five times more likely (OR=5.4, 95% CI: 1.3-23.3; p=0.02) to have low BMD than low sport specialists. **CONCLUSIONS:** Our findings indicated that high sport specialization was associated with low BMD among female high school distance runners. Further investigation of this association is warranted as low BMD has been related to increased risk of stress fracture.

703 May 29 3:45 PM - 4:00 PM
The Relationship between Bone Mineral Accrual and Changes of Body Composition in Competitive Girl Runners
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Low bone density is a complication of a long-term strict weight control during adolescence in women. **PURPOSE:** To assess whether decrease in percent body fat (%BF) is associated with an impaired bone mineral accrual in girl runners. **METHODS:** Consecutive 22 freshmen girl runners (15y/o, 158cm, 45kg) during 7 years in competitive high school teams were evaluated over 2 years of training. DXA was performed at the preparatory phase (baseline) and repeated after 23 ± 2 months (follow-up). The runners were divided into 2 groups; negative (DEC, n=11) or positive (GAIN, n=11) changes of %BF (Δ%BF) during the period. The effect of the period and the group on the changes in bone mineral content (BMC) and density (BMD) of total body less head and z-score were analyzed by 2-way repeated measures ANOVA. As for lean soft tissue mass (LSM) and fat mass (FM), paired t-test was used to compare between baseline and follow-up. Bivariate correlation analysis was used to examine the relationship between bone mineral accrual (ΔBMC and ΔBMD) and Δ%BF as well as the changes of FM (ΔFM) and LSM (ΔLSM). Written informed consent was obtained from the runners and their parents. P<0.05 was considered as statistically significant. **RESULTS:** %BF changed from 17.4 to 14.3 (DEC) and 15.0 to 18.4 % (GAIN). The period had significant effects on BMC, BMD, and z-score without interactions. Contrast showed significant increases in those variables, while the group of Δ%BF had no significant effect, indicating the values of DEC and GAIN were similarly increased; 1.57 to 1.64 and 1.66 to 1.77 kg, 0.98 to 1.00 and 1.00 to 1.03 g/cm², and -0.25 to -0.20 and 0.04 to 0.22, respectively. The DEC runners gained LSM (34.2 to 36.1 kg) and reduced FM (7.7 to 6.4 kg) significantly, while the GAIN runners significantly increased FM (6.9 to 9.0 kg) without LSM change (36.6 to 37.0 kg). Neither Δ%BF nor ΔFM, but ΔLSM was significantly correlated with ΔBMC (r=0.45) and ΔBMD (r=0.55). **CONCLUSIONS:** Bone mineral was equally accrued among the runners of which %BF increased or decreased, where the accretion was associated with LSM gain. Competitive distance runners would develop leanness by not only losing FM but also gaining LSM (i.e., skeletal muscle) along with long-term exercise training. This would ameliorate an impairment of bone mineral acquisition by strict weight control.

704 May 29 4:00 PM - 4:15 PM
Examination of Energy Availability and Injury Prevalence in Collegiate Dancers
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(No relevant relationships reported)

Performing arts is an emerging population in the realm of sports medicine. Health care professionals must first understand the types of demands placed on dancers including risks associated with the Female Athlete Triad (Triad; low energy availability [LEA], reproductive hormonal disruption, and compromised bone mineral density [BMD]). **Purpose:** Examine the relationship between energy availability (EA) & musculoskeletal injuries, nutritional behaviors (carbohydrates [CHO] and protein [PRO]), and fat, and prevalence of eating disorders/disordered eating (ED/DE) amongst female collegiate dancers.

Methods: A cross-sectional design of 26 female college ballet & contemporary dancers (age: 20.5 ± 3.6 , weight: 56.4 ± 7.0 kg, height: 165.2 ± 6.9 cm) was conducted at a local university. Dancers completed 1 week of dance classes/rehearsals and data collection included: anthropometric data, questionnaires (e.g., demographics, health history, Eating Disorder Inventory-3, RMR, a 7-day food log to measure dietary energy intake (EI) and wore a SenseWear armband to calculate exercise energy expenditure (EEE).

Results: Overall, 69.2% (n=18) were at risk for LEA (< 30 kcal/kg/FFM) and none were at risk for low BMD. Energy needs assessments measured: RMR (1155 ± 206.54 kcal), EI (1473.9 ± 321.5 kcal), and EEE (884.7 ± 324.8 kcal). Macronutrient profile included: 100% (n=26) below the recommended CHO and 73.1% (n=19) were below PRO, and fat was within limits. There were 88.5% (n=23) dancers with elevated ED/DE risks. Retrospective injuries demonstrated: 96.2% (n=25) dancers self-reported a previous dance related injury, 15.4% (n=4) were previously diagnosed and treated for a stress fracture, and during their current dance season 61.5% (n=16) of dancers were diagnosed with an injury. Of those diagnosed within the current season, 34.6% (n=9) presented with LEA and 19.2% (n=5) had ED risk.

Conclusion: Overall, there were high occurrences of LEA & injuries among dancers. LEA and Triad symptoms diminish musculoskeletal integrity, thus negatively affecting overall health. Primarily, dancers' LEA was due to diet restriction (low CHO and PRO). Understanding more about the effects LEA and the Triad have on dancers will aid clinicians in treating injuries, maintaining nutritional balance, and improving the health of performers.

705 May 29 4:15 PM - 4:30 PM

How are Adolescent Ballet Dancers' Eating Attitudes Related to Social Media Viewing Habits?

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(No relevant relationships reported)

Social media has a great impact on adolescent's behavior. Since many young ballet dancers spend many hours on dance websites, they may adopt unhealthy eating attitudes and behaviors that are depicted on-line. **Objective:** The purpose of this descriptive study was to evaluate dancers aged 10-16 years in Northeastern Pennsylvania (NEPA) to determine if there was a relationship between social media exposure and disordered eating attitudes. **Methods:** Participants included 39 white adolescent female dancers (13.7 ± 1.8 years) from five dance studios in Northeastern Pennsylvania who completed the Children's Eating Attitude Test (ChEAT-26) and the Questionnaire of Exposure and Reinforcement Through Facebook (QERF) to assess eating attitudes and social media viewing practices. Data were analyzed using descriptive statistics and Pearson correlations. **Results:** Mean time spent dancing each week was 6.2 ± 2.0 hours. Mean ChEAT-26 score was 20.8 ± 15 . Over one-third (36%) of the dancers scored 20 or above indicating disordered eating attitudes and/or behaviors. Mean QERF score was 26.5 ± 5.7 . 87.5% of the dancers scored 23 or greater out of a possible 45, exposure to social media. Mean time spent on Facebook was 4.7 ± 2.8 hours per week, while mean time spent on Facebook looking at dance websites was 1.3 ± 1.2 hours per week. Although we did not observe a significant relationship between ChEAT and QERF, there was a trend ($r=.27$, $p=.10$); as social media exposure increased, disordered eating attitudes and behaviors also increased. **Conclusions:** Adolescent dancers are at risk of developing unhealthy eating attitudes and behaviors. Their substantial exposure to social media, especially on dance websites, may play a role in accelerating problematic eating patterns. Since limiting young dancers' social media exposure may well be problematic, parents, dance teachers, nutritionists and other health professionals must become aware of these issues and should consider interventions that model positive eating attitudes and behaviors.

706 May 29 4:30 PM - 4:45 PM

Surgical Outcomes of Os Trigonum Syndrome in Dancers

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(No relevant relationships reported)

PURPOSE: Management of ankle pain in dancers can be challenging due to the complex demands placed on their ankles and feet. Despite the prevalence of ankle pain or injuries in this population, literature on the outcomes of surgical approach is limited. The hypothesis of this study was that dancers return to their previous level of activity following open excision of a symptomatic os trigonum syndrome. **METHODS:** We followed 54 ankles (44 patients, 91% female, mean age 18.2 years) in patients who underwent surgery for posterior impingement. Dance style varied across patients but was largely ballet and included many professionals. All patients completed a specific rehabilitation protocol prior to surgical discussions and eventual excision of the os trigonum was done through an open approach. All patients then

committed to a specific rehabilitation program and gradually returned to dance. Outcomes were evaluated with the Veterans Rand 12 Item Health Survey (VR-12) Mental and Physical Scores, Foot Function Index-Revised (FFI-R), Visual Analog Scale (VAS) scoring, and patient satisfaction preoperatively and postoperatively. This study was conducted in compliance and approved with a local Institutional Review Board (IRB). **RESULTS:** Most recent follow-up was a mean 32.3 months with data collected across a range of 6 weeks to 8 years post-operative. Between pre-operative and most recent postoperative follow-up, there was no significant difference in VR-12 Mental Scores (mean scores of 55.4 and 53.9), however Physical Scores increased 37.8 to 51.2, respectively. Significant improvement was also seen in both the FFI-R cumulative score (63.2 to 42.4) and VAS (54% to 17%). Major complications included transient sural nerve paresthesia and scar tissue buildup that resolved over time. Overall, patients were extremely satisfied with their result (82.7% post-operative satisfaction). **CONCLUSIONS:** An open os trigonum excision is fairly simple, has a low complication rate, and proves to have a high success rate in returning athletes back to their sport of choice. In this study, dancers of varying level and primary style improved significantly according to various clinical measures and maintained thriving postoperative careers. Successful return to dancing relied greatly on well-structured physical rehabilitation therapy.

707 May 29 4:45 PM - 5:00 PM

Comparison of Total Body Composition and Bone Mineral Density Measures in Female Collegiate Athletes

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(No relevant relationships reported)

Body composition and bone mineral density (BMD) are important factors in sport performance and the overall short and long-term health of athletes. Despite this function, few investigations to date have documented total body composition in female collegiate athletes. Further, we are unaware of any studies examining both total body composition and BMD in this population. **PURPOSE:** To generate descriptive data for total body composition and BMD in a large sample of female collegiate athletes using dual X-ray absorptiometry (DXA) and examine differences between 10 competitive sports. **METHODS:** A total of 211 female collegiate athletes (19±1 yrs; 167.8 ± 8.9 cm; 45.9 ± 6.1 kg; 2.4% Asian, 15.2% Black, 1.4% Hispanic, 80.6% White, 0.5% Other) underwent DXA: basketball (BB; n=22), cross country (CC; n=11), field hockey (FH; n=25), gymnastics (GYM; n=23), lacrosse (LAX; n=42), soccer (SOC; n=27), swimming (SW; n=27), tennis (TN; n=11), track (field only); (TR; n=7), and volleyball (VB; n=16). Descriptive statistics were calculated for total body fat percentage (BF%), and BMD. Differences in total BF% and BMD between sports were examined using a one-way Welch's ANOVA test. Post-hoc testing was completed using the Games-Howell test. **RESULTS:** The mean total BF% was 27.8 ± 5.1 (range: 23.0 - 37.5%) while BMD was 1.30 ± 0.11 g/cm² (range: 1.17 - 1.45 g/cm²); TR had the highest BF% (37.5±5.5%), followed by TN (31.1±4.0%) and LAX (29.3±3.8%), CC (23.0±6.0%) and GYM (23.5±2.9%) had the lowest. For BMD, TR had the highest (1.45 ± 0.07 g/cm²), followed by BB (1.40 ± 0.12 g/cm²) and VB (1.36 ± 0.10 g/cm²); CC (1.17 ± 0.07 g/cm²) and SW (1.22 ± 0.06 g/cm²) had the lowest. Group mean differences in BF% ($p<0.001$; $\omega^2 = 0.26$) and BMD ($p<0.001$; $\omega^2 = 0.35$) were observed between teams. Specifically, GYM had lower BF% than BB, FH, LAX, SOC, SW, TN, and TR (mean difference range: -4.0 to -13.9%, all $p<0.05$). CC had lower BMD than BB, FH, GYM, LAX, SOC, TR, and FH (mean difference range: -0.11 to -0.28 g/cm², all $p<0.01$). **CONCLUSION:** Total body composition and BMD measures varied across female collegiate sports. These findings may assist sports medicine and strength and conditioning practitioners with identifying appropriate goal values for BF% and BMD in female collegiate athletes across various sports.

708 May 29 5:00 PM - 5:15 PM

Awareness of the Female Athlete Triad in NCAA Cross Country Coaches

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(No relevant relationships reported)

The Female Athlete Triad is a pervasive, multifactorial morbidity amongst collegiate female athletes, particularly those participating in endurance sports. Cross country coaches' awareness of the Triad within all NCAA divisions is unknown. **PURPOSE:** To assess National Collegiate Athletic Association (NCAA) cross country coaches' awareness of the Triad components. **METHODS:** Ninety-nine Division I-III NCAA compliance officers were sent an email containing a request to disseminate a web-based survey to cross country coaches in their respective conferences. The web-

linked instrument included: a study synopsis; an informed consent statement, and; the IRB-approved survey tool. Reminder emails were sent approximately two months after the original participation request. Statistical analysis, using JMP software, included frequency distributions and chi-square tests for categorical association. Significance level was set at $p < 0.05$. **RESULTS:** Coaches ($n = 143$; mean age = 40.7 ± 11.9 years; mean coaching experience = 14.1 ± 10.3 years) from 45 conferences participated; 74% of respondents were male. All NCAA Divisions were equitably represented (I = 29.7%, II = 35.5%, III = 34.8%). While respondent majorities: coached male and female athletes (82.1%); reported they were familiar with the Triad (73.4%), and; felt comfortable/very comfortable discussing diet (87.6%) and menstruation (65.6%) with female athletes, only 54% correctly identified all three Triad components (re: low energy availability, amenorrhea, low bone mineral density). Female coaches, however, were more comfortable than male coaches discussing menstrual issues ($X^2 = 94.7$, $p < 0.001$). When compared to the other divisions, Division I coaches were more likely to: have Triad awareness ($X^2 = 10.1$, $p < 0.05$), and; have athletes with access to registered dietitians ($X^2 = 16.5$, $p < 0.01$) and sports psychologists ($X^2 = 18.0$, $p < 0.01$). **CONCLUSION:** A slim majority of NCAA cross country coaches demonstrated comprehensive understanding of Triad components, but; resource disparities to effectively address the Triad exist between the NCAA divisions. Future research should examine how to increase coaches' Triad awareness and education, and; optimize resources across NCAA divisions to reduce the negative outcomes associated with this common morbidity.

B-40 Free Communication/Slide - Behavioral Approaches to Increasing Physical Activity

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM
Room: CC-105B

709 Chair: John M. Jakicic, FACSM. *University of Pittsburgh, Pittsburgh, PA.*

(No relevant relationships reported)

710 May 29 3:15 PM - 3:30 PM

A Comparison Between Physician and Patient Perceptions Regarding Barriers to Exercise

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(No relevant relationships reported)

PURPOSE: To compare physician vs patient perceptions regarding barriers to exercise, preferred physical activities, and amount of time spent exercising.

METHODS: A survey was given to patients and their physicians at a family medicine residency clinic. The survey consisted of a Likert scale of barriers to exercise, a checklist of preferred exercise activities, and the amount of exercise their patients engaged in. Barriers to exercise were categorized as motivational, physical, or external barriers.

RESULTS: Physicians consistently overestimated the importance of external barriers to exercise ($t = -2.38$, $df = 19.473$, $p\text{-value} = .0275$) when compared to their patients (e.g. "There are no facilities in my area.", "It's too dangerous in my area"). Residents also consistently overestimated the importance of internal motivational barriers ($t = -2.2355$, $df = 18.77$, $p = 0.03774$). ("I hate to fail, so I will not start.", "Exercise is boring"). There was an 80% correlation between the activities physicians predicted their patients enjoyed and what patients actually endorsed enjoying. Physicians predicted 54% less exercise than that endorsed by their patients.

CONCLUSIONS: Our data show that physicians overestimate their patients' external and motivational barriers to exercise. This suggests an opportunity for physicians to enhance motivational interviewing by reducing their focus on external and motivational barriers. Physicians were excellent predictors of the exercise modalities preferred by their patients but significantly underestimated the amount of exercise endorsed by their patients, suggesting a missed opportunity to acknowledge patient efforts towards a healthy lifestyle.

SIGNIFICANCE: Exercise prescriptions and motivational interviewing are the two most effective tools physicians have to increase physical activity in their patients. Our study and survey can be a template to facilitate and enhance this discussion.

711 May 29 3:30 PM - 3:45 PM

Physical Activity Promotion: Content Analysis of Nationally Representative Elementary School Websites

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(No relevant relationships reported)

School choice legislation has increased the number of public charter schools and about 7000 were licensed in DC and 44 states in 2018. Health authorities advocate that schools provide diverse physical activity (PA) programs to enable students accrue at least 50% of their daily recommended 60 min of moderate-to-vigorous physical activity (MVPA). School websites have great potential to provide information about PA and be a catalyst for students participating in school PA programs. Investigations of websites relative to PA are rare, and no studies assessing the PA content of charter school websites have been published. **PURPOSE:** To complete a quantitative content analysis of PA-related information on the websites of U.S. charter elementary schools. **METHODS:** During spring 2018 we conducted a content analysis of a stratified random sample of U.S. charter elementary schools ($n=759$) for information specific to PA. **RESULTS:** Nearly all schools (97%) had a functioning website, but these rarely mentioned PA program opportunities: PE (34.1%), PA clubs (13.7%), interscholastic sports (9.1%), recess (7.9%), and intramurals (5.5%). No website identified all 5 program types and 52.0% did not mention their school provided a PA program at all. Information on PE was scarce. Only 7.1% of sites mentioned a PE curriculum and only 2.8% and 2.0%, respectively, mentioned its sequence or content. A PE teacher was mentioned on 37.4% of websites, but only 6.1% indicated he/she had specialist PE training. Only 4.6% of sites identified PE frequency and only 2.7% mentioned lesson length. Similarly, only 7.9% of websites mentioned recess. There were no significant associations between school age, size, or type (i.e., elementary vs. elementary/middle combination) with websites mentioning PE, having a PE teacher, or offering one or more PA programs. **CONCLUSIONS:** This is the first study to complete a quantitative content analysis of information about PA programs on the websites of a nationally representative sample of elementary charter schools. Results show that PE and PA is essentially ignored on elementary charter school websites across the country. As they are public "windows" designed to convey important information to constituents, we recommend all schools assess their websites to ensure they provide comprehensive messaging about PA.

712 May 29 3:45 PM - 4:00 PM

Generating and Applying a Physical Activity Model for an Underserved Community: A Mixed Methods Approach

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Physical activity (PA) determinants differ depending on the population being studied. **PURPOSE:** A PA predictive model for an underserved community was generated and further insight of the results were gained by conducting focus groups with parents and school staff. **METHODS:** Previous literature was used to identify PA predictors and to form constructs of a survey. The survey was given to 35 families at a school-based event. Cronbach's alpha was used to assess construct reliability, and a stepwise regression was run to determine predictors. Significant predictors were presented and discussed with community focus groups. **RESULTS:** Parental PA support ($a=.9$), parental perceived barriers ($a=.8$), parental dietary intake ($a=.8$), PA beliefs ($a=.6$), screen time ($a=.6$), and gender were included in a forward stepwise regression. The overall model was significant ($p=.001$), where parental support of PA ($B=.567$, $p=.024$), gender ($B=.462$, $p=.010$), and PA beliefs ($B=.579$, $p=.016$) were significant predictors of PA. **CONCLUSION:** This innovative approach enabled community participants to prioritize their actions more efficiently in addressing the most pressing determinants contributing to low levels of physical activity among their children. These results will contribute significantly to the design of a subsequent physical activity intervention among community children and their families.

713 May 29 4:00 PM - 4:15 PM

Variations in Preschoolers' Physical Activity Across the School Year

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(No relevant relationships reported)

PURPOSE: To examine variations and sex differences in preschoolers' physical activity (PA) across the school year, with and without a PA intervention

METHODS: The *Kiddie CATs on the Move* PA curriculum was implemented in preschools over 22-weeks, 2-3 times per week by classroom teachers and college students enrolled in a service-learning course. Accelerometry was used to measure PA during the school day at 5 time points across the year [2 Baseline (Fall, Winter), 3 Intervention (Fall, Winter, Spring)]. A total of 68 children ($M_{age} = 4.15 \pm 0.6$, 33 males, 35 females) with ≥ 2 days of valid data at each time point were included in analyses. Minutes per hour of moderate-to-vigorous (MVPA) and total PA (light + MVPA) were calculated. Paired-samples *t*-tests were used to compare sex differences at each time point. A series of 5 (time) \times 2 (sex) mixed model ANOVAs were used to examine PA across assessments and whether or not patterns of change in PA varied by sex.

RESULTS: Boys engaged in significantly more total PA than girls only during the Winter Baseline assessment (17.3 ± 4.0 vs 15.0 ± 4.8 min/hr, $p < 0.04$). Boys engaged in significantly more MVPA (min/hr) than girls during the Fall Baseline (9.6 ± 2.4 vs 8.3 ± 2.7 , $p < 0.04$), Fall Intervention (10.2 ± 3.1 vs 8.7 ± 2.8 , $p < 0.04$) and Winter Baseline (9.2 ± 2.5 vs 7.4 ± 2.9 , $p < 0.01$). For the combined sample, total PA, $F(4, 264) = 6.81$, $p < 0.001$, and MVPA, $F(4, 264) = 9.43$, $p < 0.001$, varied across the time points. Total PA (min/hr) was significantly higher at all intervention time points compared to winter baseline (17.2 , 17.4 , 17.9 vs 16.1 , $ps < 0.01$) and spring intervention also significantly higher than fall baseline (17.9 vs 16.9 , $ps < 0.01$). MVPA (min/hr) was significantly higher at all intervention time points compared to winter baseline (9.4 , 9.1 , 9.8 vs 8.3 , $p < 0.05$) and spring intervention was significantly higher than fall baseline MVPA (9.8 vs 8.9 , $p < 0.01$). The pattern of change in PA across assessments did not vary based on child sex.

CONCLUSIONS: Findings highlight the importance of structured programs to promote preschoolers' PA, especially during winter months when PA appears to decline. Although there were no sex differences in the pattern of PA change for boys and girls, girls consistently engaged in less PA than boys during the year and future work should examine factors related to this sex difference.

714 May 29 4:15 PM - 4:30 PM

Supporting Physical Health Of Black Male Faculty Through A Wellness-integrated Professional Development Program: FIT Leaders

Emily R. Martini¹, Turhan Carol¹, Carl M. Maresh, FACSM¹, Joshua J. Joseph², David A. Delaine¹. ¹*The Ohio State University, Columbus, OH.* ²*The Ohio State University Wexner Medical Center, Columbus, OH.* (Sponsor: Carl M. Maresh, FACSM)

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(No relevant relationships reported)

Purpose: An intervention strategy examining the integration of professional development and wellness for black male faculty at an R1 university was conducted. The intervention was directed at supporting the retention and academic promotion of black male faculty through minimizing the impact of culturally relevant physical (i.e., hypertension, obesity) and cognitive (i.e. John-Henryism, social isolation, discrimination, etc.) challenges. The implications on the physical health of the participants are presented here. **Method:** A 24-week intervention brought together black male faculty of differing ranks at a university fitness center twice per week. Each session included a 45 min trainer lead exercise session followed by a 30 min semi-guided discussion on culturally relevant professional development topics. A series of assessments implemented in a pre-/post-structure around the intervention included cardiovascular measures including central aortic pressure, brachial blood pressure (BP) and carotid-femoral pulse wave velocity (cf-pwv) measured via the Sphygmocor Xcel Device, body composition via BodPod, strength and cardiorespiratory fitness via graded exercise treadmill test. Pre-post analyses using paired T-tests were performed using STATA 13.4. **Results:** Among 9 participants the mean age was 40.4 ± 4.1 years. Cardiovascular measures improved including Aortic Systolic Pressure 123 ± 11 vs 117 ± 12 mmHg, $p=0.007$; Brachial systolic BP 136 ± 10 vs 128 ± 12 mmHg, $p=0.002$; Brachial diastolic BP 87 ± 10 vs 84 ± 10 , $p=0.057$; and Cf-pwv 8.3 ± 1.4 vs 6.9 ± 0.6 m/s ($n=6$, $p=0.007$). Adiposity measures improved including body mass index 29.6 ± 5.0 vs 29.0 ± 4.9 kg/m², $p=0.014$; waist circumference 96.6 ± 11.8 vs 93.4 ± 12 cm, $p<0.001$; and body fat percentage 26.9 ± 7.7 vs 23.4 ± 7.6 %, $p=0.005$. Max chest press improved from 174.4 ± 52.1 vs 191.4 ± 45.9 lbs, $p=0.008$. There were no improvements in cardiorespiratory fitness, highest VO₂max 37.1 ± 7.4 vs

37.5 ± 6.9 ml/kg/min ($n=7$), $p=0.801$. **Conclusion:** Changes in the physical health of participants indicate that this intervention shows promise for supporting the physical wellness of black male faculty in parallel with culturally relevant leadership support.

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Effects Of A National School Intervention Programme On The Levels Of Physical Activity

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(No relevant relationships reported)

Since the school context greatly influences children and youth and can ensure that a large number of school children participate in activities and maintain active behaviors during the school day.

PURPOSE: The aim of this study was to compare the level of physical activity during the school day of a group of children participating in the school intervention program in comparison to a control group.

METHODS: A randomized sample of 154 school children (7-11 y) was obtained out of the Integral Sports Schools of the National Sports Institute of Chile, (70 intervention group; 84 control group), all belonging to socioeconomic vulnerable public schools.

The program is structured as a comprehensive sports practice workshop with a duration of 90 min/session and performed three times/week. Each session develops activities to strengthen the skills for life and healthy lifestyles, and children experience a wide range of pre-sports and sports activities. Physical activity levels were recorded continuously with triaxial accelerometers during the school day, recess, physical activity session (PA) or physical education session (PE), and lunch. A value of $p < 0.05$ was defined as statistically significant in Student's *t*-test.

RESULTS: Fifty per cent of the children in the intervention group complied with the recommendations of moderate-to-vigorous physical activity (MVPA), vs. 22.7% of the control group. During the first recess, the MVPA time of the control group was double that of the intervention group ($p < 0.001$), where the recommendations of MVPA were not met, but at lunch it was possible to add important minutes of physical activity. None of the groups complied with the recommendations for steps in the PA or PE. During the PA, sedentary time was less and MVPA was greater in the intervention group (Table 1).

CONCLUSIONS: It was concluded that although the MVPA in recesses and lunchtime was greater in the control group, the activity in the PA of intervention group was greater and contributed more MVPA to the school day. This highlights the role of physical education classes in meeting MVPA's daily recommendations.

716 May 29 4:45 PM - 5:00 PM

Acceptability of a Walking Intervention Among Inactive Adults Using a Smartphone-Based Gaming Application

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(No relevant relationships reported)

Routine physical activity and maintenance of a normal body mass are critical for cardiovascular health. However, most adults do not meet the ACSM recommendations for physical activity. Previous research has shown that adding video games to traditional exercise programs may increase adherence. In recent years, smartphones allow much of the population to utilize games while engaging in exercise, particularly walking, and have a great potential for public health impact. **PURPOSE:** This study tested the acceptability of a 12-week walking intervention that used an active game delivered on a smartphone among community-dwelling adults. **METHODS:** Forty adults were randomized to receive the intervention or a wait list control. The 20 randomized to the intervention (18 females, age 46.9 ± 13.4 years, BMI 33.1 ± 9.37 kg/m², 70% Caucasian) chose an activity goal starting at ≥ 60 mins/week, increasing it over the 12-week duration to ≥ 150 mins/week. They were instructed to use the smartphone game "Zombies, Run!" while walking due to its popularity and low-cost, and received weekly brief phone counseling to assist with adjusting goals, problem solving, and relapse prevention. Acceptability of the intervention was determined using satisfaction scales that evaluated the smartphone interface, game application, and technical issues; a Likert-scale rating of > 4 (from 1 to 5) was the threshold for acceptability. **RESULTS:** Satisfaction of the smartphone hardware was 4.25 ± 0.63 , with 2 participants indicating that the device was overly complicated; satisfaction of the gaming application was 4.37 ± 0.75 , although 2 participants found the zombie game disinteresting; and, avoidance of technical issues was 4.11 ± 0.74 , with 2 participants reporting problems with either the game or device. **CONCLUSION:** Among our target population, a smartphone-based gaming intervention was acceptable over a 12-week walking program. This intervention has the potential to be a valuable

tool in promoting routine physical activity among a large population of individuals who desperately need a lifestyle modification, although adding alternate game choices may be beneficial in future studies. Supported by American Heart Association grant #13BGIA17110021.

717 May 29 5:00 PM - 5:15 PM

Use of Wearable Technology and Social Media to Improve Physical Activity and Dietary Behaviors among College Students: A 12-week Randomized Pilot Study

Zachary C. Pope, Daheia J. Barr-Anderson, FACSM, Beth A. Lewis, Mark A. Pereira, Zan Gao, FACSM. *University of Minnesota, Minneapolis, MN.* (Sponsor: Zan Gao, FACSM) Email: popex157@umn.edu

(No relevant relationships reported)

PURPOSE: Evaluated efficacy of combining smartwatch use and a theoretically-based, social media-delivered health education intervention on improving college students' (CS) health behaviors/outcomes relative to a comparison arm. Intervention use/acceptability were also assessed.

METHODS: Thirty-eight CS (28 female; $M_{age} = 21.5 \pm 3.4$ years) participated in this two-arm randomized 12-week pilot trial. After screening, participants were randomized into two groups: (a) experimental: consisted of Polar M400 use and a twice-weekly theory-based Facebook-delivered health education intervention; or (b) comparison: enrolled in separate, but content-identical, Facebook group. ActiGraph Link accelerometers and the National Cancer Institute's ASA24 food recall measured PA and dietary behaviors, respectively. Health-related Social Cognitive Theory and Self-Determination Theory psychosocial constructs were measured using psychometrically-validated questionnaires while the YMCA 3-Minute step test and bioelectrical impedance assessed cardiorespiratory fitness and body fat percentage, respectively. **RESULTS:** Only whole grain consumption differed between groups at baseline, $t = 2.3$, $p = 0.03$. For PA, a trend toward a significant main effect for time was observed for moderate-to-vigorous PA, $F(2, 72) = 2.6$, $p = 0.08$; partial eta-squared = 0.07, with experimental and comparison groups demonstrating 4.2- and 1.6-minute/day increases, respectively, at 6 weeks. For secondary outcomes, both groups demonstrated non-significantly decreased weight from baseline to 12 weeks (experimental: -0.6 kg; comparison: -0.5 kg). Further, significant main effects for time were observed for self-efficacy, social support, and intrinsic motivation (all $p < 0.01$; partial eta-squared: 0.18-0.38) as both groups improved over time. Finally, both groups demonstrated lower daily caloric consumption over time (experimental: -41.0 calories; comparison: -143.3 calories). Intervention adherence was high (~86%), with participants implementing health education tips at least once weekly.

CONCLUSIONS: While both arms demonstrated initial efficacy in improving CS health outcomes, observations did not indicate the experimental intervention as more efficacious than comparison. Future research warranted.

B-41 Free Communication/Slide - Exercise and Cardiovascular Risk Factors

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM
Room: CC-105A

718 Chair: Bradley Fleenor. *Ball State University, Muncie, IN.*

(No relevant relationships reported)

719 May 29 3:15 PM - 3:30 PM

Ambulatory Central Blood Pressure Over 24 Hours Following Intermittent Vs. Continuous Moderate Intensity Exercise

McKenzie A. Williams, Erika Silva, Nicholas Carlini, Brandon Kistler, Bradley Fleenor, Matthew Harber, FACSM. *Ball State University, Muncie, IN.* (Sponsor: Matthew Harber, FACSM)

(No relevant relationships reported)

Ambulatory blood pressure (BP) derived from the large central arteries has been shown to be a better predictor of cardiovascular events and mortality compared with peripheral ambulatory brachial blood pressure. Currently, however, it is unknown if exercise, either intermittent or continuous bouts, influence ambulatory central BP.

PURPOSE: To examine the ambulatory central blood pressure response over 24 hours following a moderate intensity intermittent (MII) bout of aerobic exercise compared to a moderate intensity continuous (MIC) bout. **METHODS:** Eight, non-hypertensive males (61.5 ± 2.4 yrs) performed three trials in a randomized order: control, MII (3X10

minutes at 50-60% heart rate reserve (HRR) with 5 minutes of seated rest), and MIC (30 minutes continuous at 50-60% HRR). Total work performed during the exercise trials was matched. Ambulatory brachial and central hemodynamics (Suntech Oscar 2 with SphygmoCor) were averaged over 24 hours, and divided by time of day (Morning, Afternoon, Evening, and Nighttime) and compared among each trial.

RESULTS: No differences ($P > 0.05$) between CON, MII, and MIC were observed for any variable. Brachial and central hemodynamic variables were lower ($P < 0.05$) during Nighttime (Nt) compared to other times of day, independent of trial. Brachial SBP was lower ($P < 0.05$) during Nt (120.5 ± 4.5 mmHg) compared to morning (Mn, 131.6 ± 5.6 mmHg); afternoon (An, 132.3 ± 5.2 mmHg) and evening (Evn, 134.4 ± 5.3 mmHg). Central SBP was lower during Nt (112.7 ± 4.4 mmHg) compared to morning (Mn, 120.8 ± 4.9 mmHg); afternoon (An, 119.3 ± 4.5 mmHg) and evening (Evn, 123.0 ± 4.5 mmHg). **CONCLUSION:** An acute bout of moderate intensity exercise in accordance with the physical activity guidelines, independent of delivery mode (continuous or intermittent), did not influence 24 hour ambulatory brachial or central hemodynamics in middle-aged and older men. Moreover, we show that reductions in central hemodynamics during night time hours (i.e., dipping) is not compromised after exercise. Future work should explore different exercise parameters to better understand the influence of acute exercise on ambulatory central hemodynamics.

720 May 29 3:30 PM - 3:45 PM

Maximal Exercise Blood Pressure and Glycemic Responses: Association with Resting Parameters in Healthy Young Adults.

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(No relevant relationships reported)

Hypertension and hyperglycemia are known components of the metabolic syndrome. Massive adrenergic stimulation during high-intensity exercise has been associated to high blood pressure (BP) and blood glucose concentration. The predictive value of exercise-induced hypertension is an area of active research. An exaggerated and persistent hyperglycemia induced by intense exercise has been described in type-1 diabetics. For healthy subjects is not clear if BP and glycemic responses during maximal exercise are correlated with resting BP and glycemic values within the span of normal range.

PURPOSE: To find the association between resting and maximal exercise BP and glycemic responses in healthy young adults.

METHODS: An exploratory analysis was conducted on 145 young adults (63 female) aged 18-25 deemed healthy by medical and anthropometric evaluation (body mass index $18.4 - 24.9$) as well as laboratory tests, including a complete metabolic profile. All subject had normal resting BP, glycated hemoglobin A1c (HbA1c) and fasting glucose concentration (FG) values. On a separate day subjects performed a maximal ramp cardiopulmonary exercise test (CPET) on a cycle ergometer; capillary blood glucose concentration (cBG) and BP were measured every 2.5 minutes. Pearson product-moment correlations between resting and exercise parameters were assessed with a significance level < 0.05 . Separate analysis were made for males and females. **RESULTS:** The analysis for the female group is presented: at maximal workload, cBG was correlated with HbA1c ($r = 0.29$, $p = 0.016$) while diastolic BP was correlated with resting diastolic BP ($r = 0.26$, $p = 0.034$). Overall, maximal cBG was correlated with HbA1c ($r = 0.27$, $p = 0.025$) and FG ($r = 0.27$, $p = 0.026$) and maximal systolic BP was correlated with resting systolic BP ($r = 0.27$, $p = 0.0009$).

CONCLUSIONS: For healthy young females BP and glycemic parameters at rest were positively associated with cBG and BP responses at or near maximal workloads during CPET. In otherwise healthy adults with resting BP and BG values in the upper limit of normal, acute intense exercise could play a role unmasking early subclinical cBG and BP changes in the metabolic syndrome continuum. The predictive and prognostic role of these findings remains to be determined. Supported by COLCIENCIAS Grant number 120356934972, 713-2013.

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Ambulatory Blood Pressure Reduction In Response To Supramaximal Interval Exercise; Interactions With Antihypertensive Medication.

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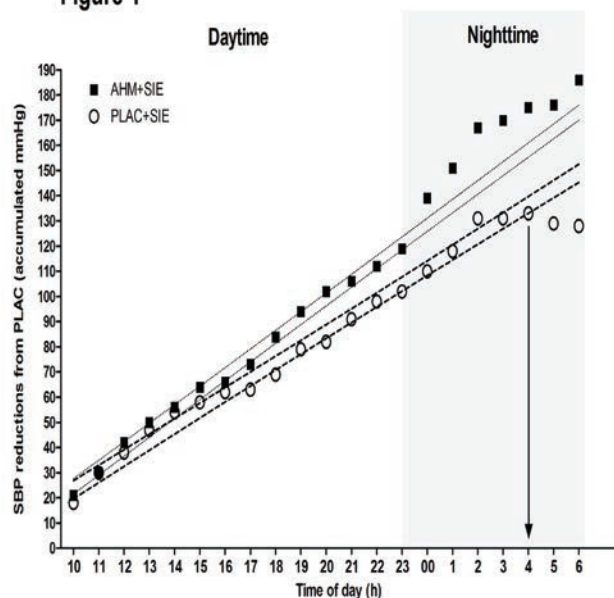
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(No relevant relationships reported)

Metabolic Syndrome (MetS) increases the risk of cardiovascular and all-cause mortality. High blood pressure is the most frequent factor of MetS. General guidelines for hypertension recommend both pharmacological and exercise treatment while their combined effects on blood pressure have not been thoroughly explored yet. **Purpose:**

To compare the blood pressure (BP) response to a bout of supramaximal aerobic interval exercise (SIE) alone or in combination with antihypertensive medication in MetS hypertensive patients. **Methods:** Twelve patients chronically medicated with angiotensin II receptor 1 blockade antihypertensive medicine (AHM), underwent 3 trials separated by 1 week in a randomized order: *a)* control trial without exercise and substituting their AHM by a placebo (PLAC); *b)* placebo medicine and a morning bout of SIE (PLAC+SIE) and *c)* combining AHM and exercise (AHM+SIE). Acute and ambulatory blood pressure responses were measured for 21-h after treatments. Repeated-measures crossover, double-blind, placebo randomized design was used. **Results:** Acutely (i.e., 20 min after treatments), systolic blood pressure (SBP) were reduced similarly after PLAC+SIE (-9.7 ± 6.0 mmHg, $P<0.001$) and AHM+SIE (-10.4 ± 7.9 mmHg, $P=0.001$). Chronically, (21-h following treatments) SBP remained reduced after PLAC+SIE (125 ± 12 mmHg, $P=0.022$) and AHM+SIE (122 ± 12 mmHg, $P=0.013$) in comparison to PLAC (132 ± 16 mmHg). The BP reduction in PLAC+SIE faded out at 4 a.m., whilst in AHM+SIE continued over the complete measurement period (Figure 1). At nighttime BP reduction was larger in AHM+SIE than PLAC+SIE (-5.6 ± 4.0 mmHg, $P=0.006$). **Conclusion:** Our data show that a bout of supramaximal aerobic interval exercise in combination with antihypertensive medication in the morning elicits a sustained blood pressure reduction that lasts at least 21-h. Exercise potentiates the effects of antihypertensive medicine reducing blood pressure longer and at a larger magnitude than exercise alone.

Figure 1



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Cardiorespiratory Fitness & Healthy Vascular Aging

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(No relevant relationships reported)

Healthy Vascular Aging (HVA), defined as carotid femoral pulse wave velocity (cfPWV; arterial stiffness) <7.6 m/s and absence of hypertension in adults ≥ 50 years of age, is associated with lower incidence of cardiovascular disease (CVD). Higher cardiorespiratory fitness (CRF) is associated with lower CVD mortality; however, the relation between HVA and CRF has not been examined. **PURPOSE:** To determine the relation between HVA and CRF in an apparently healthy adult population.

METHODS: One hundred and one individuals (54M/47F) with a mean age of 63.5 ± 0.8 years and body mass index (BMI) of 28.3 ± 0.5 kg/m² underwent measures of vascular hemodynamics (cfPWV; resting blood pressure, BP), CRF (VO_{2max}), and traditional CVD risk factors. Participants were divided into either the HVA or no-HVA groups based on the resting cfPWV and BP values and medication status. Data were analyzed with unpaired t-tests and Pearson correlations. **RESULTS:** HVA was present in 25% ($n=25$) of the subjects, while 75% ($n=76$) had no-HVA. Compared to no-HVA, HVA were younger (59.7 ± 1.8 vs. 64.7 ± 0.9 years, $p<0.05$), had lower cfPWV (6.7 ± 0.1 vs. 8.5 ± 0.1 m/s, $p<0.05$) and systolic BP (111.2 ± 2.5 vs. 117.6 ± 1.5 mmHg, $p<0.05$). CRF was not different between groups (27.2 ± 1.4 vs. 25.2 ± 0.8 ml/kg/min, $p>0.05$), but age and sex adjusted CRF percentiles according to the Fitness Registry and Importance of Exercise National Database (FRIEND) demonstrated greater CRF in HVA vs. no-HVA ($62\% \pm 5.7$ vs. $47\% \pm 3.0$, $p<0.05$). HVA compared with no-HVA had lower ($p<0.05$) BMI (26.3 ± 1.1 vs. 29.0 ± 0.6 kg/m², $p<0.05$), waist circumference (88.9 ± 2.8 vs. 98.5 ± 1.6 cm, $p<0.05$), and blood glucose (91.8 ± 2.1 vs. $103.4 \pm$

2.6 mg/dL, $p<0.05$). cfPWV ($r=-0.3406$) and bSBP ($r=-0.3202$) were both inversely correlated with the FRIEND percentiles ($p<0.05$, both). **CONCLUSIONS:** Our findings indicate HVA is associated with greater CRF. These data support the notion for lower CVD-related mortality with higher levels of CRF may be attributable, in part, to HVA.

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The Differential Effects Of Amount, Intensity, And Mode Of Exercise Training On A Novel Lipoprotein Multimarker Of Insulin ResistanceLeanna M. Ross¹, Cris A. Slentz¹, Irina Shalaurova², Margery A. Connelly², James D. Otvos², Connie W. Bales¹, Joseph A. Houmard, FACSM³, William E. Kraus, FACSM¹. ¹Duke University Medical Center, Durham, NC. ²Laboratory Corporation of America Holdings (LabCorp), Morrisville, NC. ³East Carolina University, Greenville, NC.

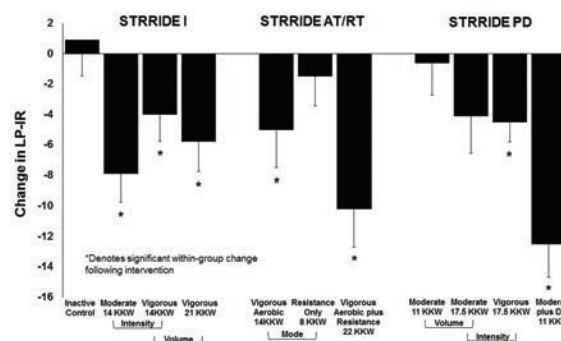
(No relevant relationships reported)

Purpose To examine the effects of amount, intensity, and mode of exercise training on Lipoprotein Insulin Resistance Index (LP-IR; a relatively new spectroscopic multimarker of insulin resistance) across 10 exercise interventions from the STRIDE studies.

Methods A total of 531 men and women with dyslipidemia [STRIDE I ($n=222$) and STRIDE AT/RT ($n=142$)] or prediabetes [STRIDE-PD ($n=167$)] were randomized to either control group or one of 10 exercise interventions, which ranged from doses of 8-22 kcal/kg/week (KKW); intensities of 50-75% VO_{2peak} ; and durations of 6-9 months. Two groups included resistance training and one group included dietary intervention (weight loss goal of 7%). Fasting blood samples were obtained at both baseline and 16-24 hr after the final exercise bout. NMR spectroscopy was performed at LabCorp to determine LP-IR score, which is comprised of six lipoprotein subclass and size parameters. LP-IR score ranges from 0 (most insulin sensitive) to 100 (most insulin resistant). Paired t-tests determined post- minus pre-intervention change score significance within groups ($p<0.05$). Study-specific ANCOVA determined differences between groups.

Results The inactive control group did not significantly change LP-IR. After training, seven of the 10 exercise groups significantly improved LP-IR, ranging from -4.0 ± 7.6 to -12.5 ± 14.2 . The figure displays change scores across all groups. The Aerobic plus Resistance group resulted in significantly greater change than the Resistance only group in STRIDE AT/RT. The Moderate plus Diet group had significantly greater LP-IR change than all other groups in STRIDE-PD.

Conclusion On average, STRIDE interventions improved LP-IR. Our results provide compelling evidence that adding resistance to aerobic training elicits a synergistic training effect on LP-IR. In individuals with prediabetes, incorporating dietary intervention with aerobic training results in the most robust LP-IR improvement.



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May 29 4:30 PM - 4:45 PM

Effect of Aerobic Exercise on Blood Glucose and CVD Risk in Glucose Metabolism Disorders People

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(Sponsor: Zhengzhen Wang, FACSM)

(No relevant relationships reported)

It's essential for glucose metabolism disorders people to monitor the change of blood glucose, heart rate (HR), systolic blood pressure (SBP) during and after exercise in order to prevent hypoglycemia and CVD risks. **PURPOSE:** To determine blood glucose after aerobic exercise in glucose metabolism disorders people, and to monitor recovery of HR and SBP. **METHODS:** By PAR-Q and OGTT, 58 subjects were divided

into : normal glucose metabolism group (N,n=18), impaired fasting glucose (IFG) group (PD,n=20), and diabetes group (D,n=20). Everyone completed 30-minute cycle ergometer at 45%-55%HRR. According to assessment standard of HR recovery and abnormal standard of SBP increasing during exercise, the CVD risk was judged. All subjects were provided the same amount diet, and exercise began just after one hour of the meal. All wrote consent, and the study was approved by the ethical committee of BSU. **RESULTS:** (1) Compared with blood glucose at the beginning of the exercise, the decreased amount of PD and D were bigger than N's (At the moment of finishing exercise, blood glucose of N, PD and D decreased respectively 2.19 ± 1.25 mmol/L, 3.59 ± 1.47 , 3.19 ± 2.02 ; at 1h-point after exercise, 1.31 ± 1.25 , 2.29 ± 2.63 , 2.66 ± 2.57 ; at 2h, 2.11 ± 1.31 , 3.72 ± 1.77 , 4.66 ± 2.47 , $P < 0.05$.) (2) The fluctuation of blood glucose in PD and D were much sharper than N's when the data of seven time-point samples were calculated (1.62 ± 0.53 , 1.96 ± 0.73 , 1.11 ± 0.44 , $P < 0.05$ and $P < 0.01$), and the seven time-points followed as fasting glucose, 1h after meal, the moment just finishing exercise, 15min, 30min, 1h, 2h in turn. (3) As to N, PD, D's HR, the incidences of abnormal recovery at the 1st minute after exercise were 6.7%, 13.3%, 13.3% respectively, and the incidences of SBP abnormal increase during exercise were 20%, 33.3%, 60%. **CONCLUSIONS:** (1) The study found blood glucose of healthy or glucose metabolism disorders people after aerobic exercise changed regularly: decreased remarkably at the end of exercise, and then increased gradually with its peak at 30min, recovering almost entirely at 2h-point. (2) IFG subjects benefited more in blood glucose from 30min aerobic exercise than diabetes. (3) The CVD risk of exercise for diabetes patients was higher than that for IGR people and healthy ones. Supported by Research on Prevention and Control of Major CNCD (2016YFC1300202).

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Differences in Daytime vs. Night-time Travel Stress and Recovery as Measured by Heart Rate Variability

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(No relevant relationships reported)

Purpose: Air travel over several time zones causes disruption of circadian rhythms resulting in disorientation, nausea, gastrointestinal distress and difficulty concentrating. This may compromise health and decrease performance in travelling athletes. Heart rate variability (HRV) used to assess autonomic cardiac control may be an indicator of jetlag. This case study investigated trans-meridian travelling effects on the autonomic nervous system (ANS) by measuring time domain (RMSSD), high frequency domain (HF) and autonomic balance (LF/HF) indicators. **Methods:** A recreational athlete was monitored on tour from South Africa (SA) to New Zealand (NZ) for 28 days. HRV measurements were averaged over 3 days/nights and reported as means (SD): a) after a 18 hour flight from SA, b) after 1 week in NZ, c) after 2 weeks in NZ, d) upon return to SA. **Results:** Active daytime vagal cardiac influence showed a return to normal/higher values measured after 2 weeks of arrival in Auckland, with a marked decline directly upon return to SA; RMSSD (ms): a) 45.63 (23.88), b) 62.90 (32.20), c) 67.00 (40.06) and upon return to SA d) 43.50 (25.75); HF (ms²): a) 613.33 (366.11), b) 1164.00 (632.90), c) 1324.50 (795.30) and upon return to SA d) 834.33 (849.58). However, night time measurements indicated a decrease of the vagal control set point. RMSSD (ms): a) 52.37 (26.93), b) 50.55 (29.29), c) 46.80 (27.02) and upon return to SA d) 36.07 (18.12); HF (ms²): a) 829.33 (471.39), b) 772.50 (451.86), c) 530.00 (309.22) and upon return to SA d) 336.00 (179.77). Daytime autonomic balance (LF/HF) followed the same pattern, returning to lower/normal values after 2 weeks in NZ, and upon homecoming values reversed, signalling a new stress response due to the return flight: a) 3.66 (1.97), b) 2.83 (1.66), c) 2.71 (1.59) and finally d) 7.64 (4.50). Night time LF/HF values had small increases during the first 2 weeks with a stress response upon return to SA: a) 2.81 (1.62), b) 2.83 (1.66), c) 3.25 (1.88) and d) 6.40 (3.39). **Conclusion:** Reduced daytime vagal control improved with time (i.e. ANS adaptation) following international travel, illustrating the potential for HRV quantification as a jetlag marker. A novel finding is that during periods of travel it appears if autonomic cardiac control, as measured by HRV during daytime, differs to the nocturnal response.

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May 29 5:00 PM - 5:15 PM

Autonomic Modulation Adjustments In Two Different Ergometric Tests In Young Adults

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(No relevant relationships reported)

An inadequate position while performing an ergometric test (ET), specifically by grasping tightly the front or side rails, can lead to a misinterpretation of a person's physical capacity and hemodynamic responses. **PURPOSE:** This study has compared heart rate variability (HRV) kinetics throughout an ET executed in two different positions. Wherefore, was tested the hypothesis of an overestimated autonomic dynamic in ET while performed in an incorrect position. **METHODS:** Thirty-five undergraduates (21.08 ± 2.98 years old) of both sexes, volunteered to undertake two treadmill ET on *Ellestad* protocol, in non-consecutive days. The first test (T1) was performed in an inadequate position and, after seven days, the second test (T2) without holding the front or side rails of the treadmill. Autonomic function was measured by HRV during both tests and resting. Repeated comparisons of HRV variables on each stage of *Ellestad* protocol on ET were performed with *two way* ANOVA and multivariate linear regression, considering *P* values of < 0.05 . **RESULTS:** Estimated value of peak oxygen uptake ($\dot{V}O_2$) was 22.4% higher in T1 ($P < 0.0001$) when compared to T2. Overall, parasympathetic pathway was deactivated earlier in T2 than in T1, showed by NNxx ($P < 0.005$) and HF ($P < 0.05$). In stage two, mean values of HF in T2 corresponded to 32% of values in T1 ($P < 0.048$). Stage three presented a difference of 60% ($P < 0.014$) in LF between means reached in T1 and T2. An association of LF and $\dot{V}O_2$ was verified in early stages of both ET's. Each increase of one ms² in LF added up 0.013 ml.kg.min in $\dot{V}O_2$ mean. **CONCLUSION:** When performed on the right positioning, the duration of the test is closer to real effort undertaken. Parasympathetic component stays activated for a longer period when the person grasps the rails of the treadmill because maximum effort is reached later.

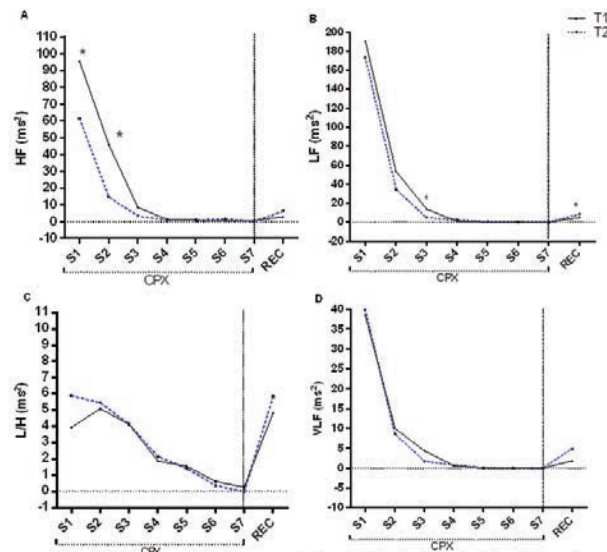


Figure 1. HRV frequency domain components dynamic during both ETs. Graphic analysis in each stage of T1 and T2 for: (A) high frequency component (HF), (B) low frequency component, (C) LF/HF and (D) very low frequency component (VLF). Values are expressed in means in each stage for both tests. CPX is cardiopulmonary exercise, without recovery, REC is recovery time of 3 minutes; S1: stage one; S2: stage two; S3: stage three; S4: stage four; S5: stage five; S6: stage six; S7: stage seven. * $P < 0.05$

B-42 Clinical Case Slide - Hip and Thigh I

Wednesday, May 29, 2019, 3:15 PM - 5:15 PM
Room: CC-304E

727 Chair: Aaron Rubin, FACSM. Kaiser Permanente, Fontana, CA.

(No relevant relationships reported)

728 Discussant

Peter Gerbino, FACSM. *Monterey Sports Medicine, Monterey, CA.*

(No relevant relationships reported)

729 Discussant

Melody Hrubes. *UIC Sports Medicine, Chicago, IL.*

(No relevant relationships reported)

730 May 29 3:15 PM - 3:35 PM**Buttock Pain - Cross Country Skier**

Jake H. Reisner, Elena J. Jelsing. *Mayo Clinic, Rochester, MN.*
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(No relevant relationships reported)

HISTORY: A 32 year old male cross country skier presented with a multi-year history of right posterior “deep” buttock pain. He endorsed associated radiation down his posterior right thigh, leg and into the plantar foot. He described “burning” and “tingling” that increased with prolonged sitting and standing. Surgical history was significant for bilateral hip arthroscopic surgeries for femoral acetabular impingement. He denied any significant weakness or change in bowel/bladder function.

PHYSICAL EXAMINATION: Exam revealed right toe flexor weakness. Straight leg raise reproduced his right lower limb and buttock pain. Reflexes were physiologic and symmetric. Hip range of motion was full and pain free. Intraarticular provocative maneuvers were negative. He had tenderness to palpation of his deep hip external rotators. FABER’s test and passive piriformis stretch reproduced his right buttock and lower limb symptoms.

DIFFERENTIAL DIAGNOSIS:

S1 Radiculopathy
Sacroiliac Joint Dysfunction
Piriformis Syndrome
Hip Osteoarthritis
Proximal Hamstrings Tendinopathy
Ischiofemoral Impingement Syndrome

TEST AND RESULTS: Lumbar spine x-rays showed anterolisthesis of L5 on S1 with associated disc space narrowing and MRI showed paracentral disc protrusion at L5-S1 effacing the right S1 nerve root. Electromyogram showed evidence of a chronic, inactive right S1 radiculopathy. Ultrasound of the right hip identified a small nerve fascicle, separate from the sciatic nerve, appearing to pierce the piriformis muscle. MRI of the pelvis with lumbosacral plexus protocol demonstrated the sciatic nerve coursing deep to the right piriformis muscle and identified the right S2 nerve root coursing through the piriformis muscle.

FINAL WORKING DIAGNOSIS:

Piriformis syndrome resulting in active, compressive, right S2 neuritis
Superimposed, chronic, inactive right S1 radiculopathy

TREATMENT AND OUTCOMES:

Extensive PT with plateau in improvement.
No relief with right S1 selective nerve root block.
Ultrasound guided piriformis corticosteroid injection provided temporary relief of buttock pain.
Ultrasound guided sciatic nerve hydrodissection coupled with neural flossing provided several months of relief and allowed the patient to return to cross country skiing.
Surgical referral for consideration of piriformis release.

731 May 29 3:35 PM - 3:55 PM**A Simple Leg Injury? - World Champion Super-Heavyweight Weightlifter**

David Cole¹, Ryan Rompolo², Mark E. Lavallee, FACSM¹. ¹York Hospital - WellSpan Health, York, PA. ²Franciscan Health Sports Medicine, Lafayette, IN. (Sponsor: Mark E. Lavallee, FACSM)
(No relevant relationships reported)

HISTORY: A 41-year-old male Bulgarian was lifting in a Masters Championship in Barcelona in the 105+kg weight class. The first series was the snatch with his first attempt at 115 kg (254 lbs) going well and without pain. On his second attempt at 121 kg (267 lbs) he experienced some anterior left thigh pain. He attempted the third at 126 kg (278 lbs) unsuccessfully. After a short break he attempted the clean and jerk series first at 145 kg (320 lbs) and had a good lift. He attempted his second clean and jerk at 150 kg (331 lbs) at which point his pain increased and he forfeited the last attempt. Overnight at his hotel his pain intensified, and he sought care at a local ER. He was subsequently discharged with no imaging, intervention, or treatment plan. The following morning, he presented to the event medical tent with worsening pain, swelling and difficulty with bearing weight on his left lower extremity. **PHYSICAL EXAMINATION:** Appreciable difference in thigh size, no erythema with mild lacey bruising over left knee and distal to the knee joint. Right thigh measuring 65cm and left thigh measuring 72cm. Marked tenderness to palpation over the superior quad tendon and over the bodies of the rectus femoris and vastus lateralis. Limited hip and knee flexion, with endorsed pain in anterior thigh and superior aspect of patella. Sensation intact, Palpable femoral, DP, PT pulses. **DIFFERENTIAL DIAGNOSIS:** 1. Quadriceps hematoma 2. Superior patella avulsion fracture 3. Quadriceps tendon tear 4. Morel-Lavallee Lesion 5. Evolving thigh compartment syndrome **TEST AND RESULTS:** Plain film showed superior pole avulsion fracture of the left patella and soft tissue swelling suggestive of hematoma. MRI obtained 4 days following evaluation indicated significant diffuse edematous changes of muscle and fascia with interstitial hematoma and evidence of muscle body rupture of the vastus lateralis **FINAL/WORKING DIAGNOSIS:** Left vastus lateralis rupture with avulsion fracture of the superior pole of the patella **TREATMENT/OUTCOMES:** Sent back to ER, radiograph obtained, placement in a long leg splint and LMWH given. Inability to obtain better imaging in Spain due to cost. Orthopedic evaluation upon return to Bulgaria within 4 days of injury with subsequent MRI. Patient treated conservatively with rehab and no surgical intervention.

732 May 29 3:55 PM - 4:15 PM**Left Anterior Hip and Groin Pain-Rowing**

Jeffrey Smith, Kentaro Onishi. *UPMC, Pittsburgh, PA.* (Sponsor: Brian Davis, FACSM)
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(No relevant relationships reported)

HISTORY

21 year old female division I rower with history of left L5 radiculopathy s/p L5-S1 microdiscectomy and foraminotomy presented with a 3 month history of dull, deep, aching anterior hip pain radiating into the groin, provoked by hip flexion, prolonged sitting, and rowing. Her symptoms started after a 15 mile row. She complained of quadriceps weakness worsening over the past month. She tried NSAIDs, heat, ice, and stretching without success. A separate provider ordered EMG/NCS for radiculopathy workup, which showed an L5 radiculopathy, but did not investigate the rectus femoris, medial femoral cutaneous nerve or saphenous nerve.

PHYSICAL EXAMINATION

Atrophy of the quad musculature. No gait abnormalities. She was nontender to palpation at the greater trochanter, ischial tuberosity, piriformis, and quadratus femoris. Active and passive ROM of hip was full and not painful. Strength was 5/5 except knee extension was 4/5. Sensation intact in all dermatomes of lower extremity. Negative log roll test. Positive Stinchfield, femoral nerve stretch and Tinel’s over anterior hip reproducing pain. Straight leg raise produced posterior leg and back pain. FABER and FADIR produced anterior hip pain.

DIFFERENTIAL DIAGNOSIS

1. Acetabular labral injury
2. Femoral neuropathy
3. High lumbar spinal stenosis
4. High lumbar disc herniation
5. External Iliac artery fibrosis

TEST AND RESULTS

Lumbar MRI: no abnormalities at L1-L4, scar tissue at L5-S1 causing mild flattening of the S1 nerve root and a shallow disc bulge at L4-L5 with no canal or foraminal stenosis

Pelvic MRI: no compressive lesions in the lumbosacral plexus and no labral injury
Diagnostic ultrasound of the anterior hip: negative based on a complete ultrasound following AIUM protocol

FINAL/WORKING DIAGNOSIS

Labral injury vs femoral neuropathy, chronic L5 radiculopathy

TREATMENT AND OUTCOME

Initial treatment was a diagnostic ultrasound guided (USG) intraarticular hip injection with local anesthetic with no response. This was followed by an USG femoral nerve diagnostic hydrodissection with lidocaine that provided short term relief. 1 week later, she received an USG femoral nerve hydrodissection with 15cc of D5W and sent for femoral nerve focused therapy. At 3 month follow up she had relief of her symptoms. She is now assistant coach for the rowing team with no symptoms.

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Acute Proximal Posterior Thigh Pain in a Division 1 Women's Soccer Player

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(No relevant relationships reported)

HISTORY: A 22-year-old female soccer player for a Division 1 College team with a previous history of contralateral hamstring injury a year ago presents to the training room with acute onset left posterior thigh pain. She was seen in the training room 5 days prior with an ache in the posterior thigh. Sideline ultrasound was unremarkable for any abnormality at that time. Pain worsened while performing a drill during practice so she presents for re-evaluation. **PHYSICAL EXAMINATION:** No obvious gait abnormalities. No ecchymosis over posterior thigh. Tender to palpation at left proximal semitendinosus muscle belly but no palpable defect noted. Resisted knee flexion/hamstring activation and reverse plank reproduced pain. Strength was full and symmetric and sensation intact in bilateral lower extremities. **DIFFERENTIAL DIAGNOSIS:** 1. Acute medial hamstring strain/tear 2. Proximal medial hamstring tendinitis 3. Ischial bursitis 4. Adductor strain **TEST AND RESULTS:** Limited training room ultrasound reveals separation in the layers of investing fascia of semitendinosus/biceps femoris interval with sonopalpation tenderness reproducing her concordant symptom at the proximal hamstring region. There were no signs of muscular injuries on ultrasound. **FINAL WORKING DIAGNOSIS:** Acute left proximal semitendinosus/biceps femoris fascia tear without sonographic evidence of muscle strain in a senior soccer player with 3 games left of her career. **TREATMENT AND OUTCOMES:** Using sonographic guidance, 4 cc of autologous conditioned plasma (ACP/PRP) was injected at the site of fascial abnormality. Patient remained prone for 5 minutes following the injection followed by application of ACE wrap for the next 2 hours and use of thigh compression until she was pain free. She was instructed to rest completely for 24 hours with a progressive rehabilitation program to return to play. At 6 days post procedure, she progressed to jogging and warm up exercises with minimal residual pain but was advised to continue to refrain from soccer. At 1-week post procedure she was completely pain free and was cleared to return to play in the game the following day. She then returned as a starter in the last game of the season, 11 days post injection, and even assisted a goal that led to her team's win. She is now 22 days post injury and remains pain free.

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Right Lateral Hip Injury - Squash

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(No relevant relationships reported)

HISTORY

55 year old elite male squash player felt a sudden onset of hip pain mid match. As he lunged to his left to return a ball, his left leg was in the stance phase and his right leg was in the swing phase, crossing over his body towards his left side. While mid-swing of the right leg, he heard a pop in his right hip and could not bear weight on his right leg. The next day, he began to ambulate with a hiking stick for assistance. He reported to the outpatient sports medicine clinic 10 days after the injury presenting with lateral hip pain described as focal, dull and rated 1/10.

PHYSICAL EXAMINATION

5/5 strength in hip flexors, knee flexors and extensors. Tenderness to palpation of the anterior rim of the right iliac crest. No tenderness to palpation of the right PSIS, buttock, or greater trochanter. No pain with passive hip flexion, internal or external rotation. Pain with hip abduction in the side-lying position on the right, worse with the hip extended and with clamshells. Pain with single leg hop on the right. No sign of an antalgic gait.

DIFFERENTIAL DIAGNOSIS

Hip osteoarthritis
Iliopsoas tendinitis
Trochanter bursitis
Tear of gluteus medius muscle
Lumbar paraspinal muscle sprain

TESTS AND RESULTS

Right hip radiographs: No acute fracture, mal-alignment or osseous findings. Mild degenerative disease of the visualized lower lumbar space.

Ultrasound focused on the right lateral hip at the iliac crest: Appeared to be a 2 cm x 2 cm partial tear of the right gluteus medius muscle off of the iliac crest.

FINAL WORKING DIAGNOSIS

Right gluteus medius partial muscle tear at the attachment to the iliac crest

TREATMENT AND OUTCOMES

A non-load bearing mechanism of injury is unusual in this case, which could mean the patient had underlying degenerative changes to the gluteus medius prior to the injury. Physical Therapy (weeks 1-2 after evaluation) - progressive strengthening of hip girdle muscles with no direct gluteus medius muscle activation.

Repeat focused ultrasound at week 4 showed healing of the partial gluteus medius muscle tear.

Physical Therapy (weeks 4-8) - progressive strengthening exercises focusing on dynamic movements of the lower musculoskeletal extremity with a low-intensity return to squash program.

Return to squash matches starting at week 8 and painless hip abduction, extension and dynamic movements required for competitive squash.

735 May 29 4:55 PM - 5:15 PM

A Typically Female Hip Issue in a Male Basketball Coach

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(No relevant relationships reported)

HISTORY: 34 year-old male basketball player/coach with left hip pain. Pain anteriolateral for the last month with hip rotation and lying on left. No preceding injury or trauma. No pain at rest. Improves with sitting. No fever, chills, numbness, tingling, radiation, other joint involvement, swelling, erythema, catching, locking. No pertinent medical, surgical, or family history. No medications other than ibuprofen above. Works as a teacher and basketball coach, recreational basketball player. Denies tobacco, alcohol, or drugs.

PHYSICAL EXAMINATION: BMI 27. Trendelenburg gait, uncompensated and positive trendelenburg test on left leg standing. Internal rotation of the hip of 15 degrees with mild pain. External rotation of the hip unremarkable. Neurovascularly intact. Mild pain with passive, bent knee internal rotation. No pain with passive, bent knee external rotation. 5/5 strength with resisted straight knee hip flexion with + pain. 5/5 strength with resisted bent knee hip flexion, adduction, and abduction without pain. Negative FABER test for pain but decreased ROM, slightly worse than contralateral. Positive FADIR. Tender only at ASIS and along IT band. Positive Ober's test.

DIFFERENTIAL DIAGNOSIS: Osteoarthritis, Inflammatory arthritis, femoroacetabular impingement/labral pathology, fracture, lateral hip pain/gluteus medius tendinopathy and weakness, IT band syndrome, lumbar radiculopathy, infiltrative process/mass.

TEST AND RESULTS: X-ray: Decreased bone density within the left femoral head without fracture or mass. This could recommend transient osteoporosis of the hip.

MR arthrogram: Subchondral insufficiency fracture in the superior aspect of the left femoral head with significant bone marrow edema in the left femoral head and neck. Small left anterior superior labral tear.

FINAL WORKING DIAGNOSIS: Transient osteoporosis of the left femoral head with subchondral insufficiency fracture and anterior, superior labral tear.

TREATMENT AND OUTCOMES: Crutches for pain-free guided weight-bearing and pain-free water exercise. 6 weeks after diagnosis, doing pain-free ADLs without difficulty. Physical therapy started. 6 months after diagnosis: x-ray with no fracture seen and improved bone density. Cleared for all activity without restrictions.

B-43 Clinical Case Slide - Spine I

Wednesday, May 29, 2019, 3:15 PM - 4:35 PM
Room: CC-306

736 Chair: Joseph Ihm, FACSM. *Shirley Ryan AbilityLab, Chicago, IL.*

(No relevant relationships reported)

737 Discussant

Oluseun A. Olufade. *Emory University, Johns Creek, GA.*

(No relevant relationships reported)

738 Discussant

Prakash Jayabalan. *Shirley Ryan AbilityLab/Northwestern University, Chicago, IL.*

(No relevant relationships reported)

739 May 29 3:15 PM - 3:35 PM

Bilateral Upper Extremity Weakness in a Wrestler

Kimberly S. Casten, Adam Lewno. *University of Michigan, Ann Arbor, MI.* (Sponsor: Robert Kiningham, FACSM)

(No relevant relationships reported)

HISTORY: A 19-year-old male college Wrestler with a history of right labral repair presented with 4-month insidious 10/10 neck pain and band-like pain over his shoulders. In the last month he developed bilateral dorsal hand paresthesias with shoulder fatigue while wrestling. After a month off, symptoms would emerge after 2.5 minutes of wrestling and progressively longer. No illness, increase in activity, color changes, temperature differences, loss of dexterity.

PHYSICAL EXAMINATION:

General: Well-developed male

Skin: No rashes or lesions

Vascular: Normal pulse and capillary refill

Neuromuscular: Normal muscle bulk and tone. Normal range of motion, strength, deep tendon reflexes, and sensation to light touch and pinprick in the bilateral upper extremities. Positive Tromner reflex bilaterally, otherwise negative special testing of the cervical spine, shoulder, scapula, and neurovascular bundle.

DIFFERENTIAL DIAGNOSIS:

1. Cervical Radiculopathy
2. Transient quadriplegia
3. Suprascapular or Axillary Mononeuropathy
4. Brachial Plexopathy
5. Thoracic Outlet Syndrome
6. Myopathy
7. Quadrilateral Space Syndrome
8. Spinal cord injury
9. Cervical facet pathology

TEST AND RESULTS:

Cervical MRI identified absent right C5 pedicle with no spinal cord signal abnormality.

C5 and C6 spinal nerve roots were separate with no dural extension

Cervical CT showed no fracture of the right C5 pedicle; likely congenital absence.

Anterior and posterior columns were normal

Cervical radiographs revealed no dynamic instability

Bilateral upper extremity electrodiagnostics were normal with no axillary or suprascapular mononeuropathy, upper trunk plexopathy, or radiculopathy.

FINAL WORKING DIAGNOSIS: Congenital absent right C5 pedicle with C6 subluxation

TREATMENT AND OUTCOMES:

1. Neurosurgical consultation which confirmed spinal stability with no restriction on sporting activities
2. Progressed from limited sporting activities including aerobic activities without upper body utilization and non-Olympic lower body weight lifting without barbell utilization, to stabilization exercises aimed at cervical musculature, trapezius, deltoids, and rhomboids.
3. Return to sport in process, focusing on Folk style wrestling given less submission and upper extremity rapid force transmission.

740 May 29 3:35 PM - 3:55 PM

Back Injury - Crossfit

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(No relevant relationships reported)

HISTORY: A 31 year old female with obesity s/p gastric sleeve presents with left shoulder pain after an injury sustained performing a power clean during a crossfit session 2 months prior. At the top of the lift she felt a tearing pain between her scapula and spine that radiated all the way down her left arm and felt like numbness and tingling in her small three fingers. She has tried ibuprofen, ice, heat, and cyclobenzaprine which have only mildly improved her pain over the past 2 months. **PHYSICAL EXAMINATION:** Examination revealed a normal appearance to the left shoulder. Palpation noted for tenderness over the left rhomboid, trapezius. Tenderness over spinous process with tenderness at C6-C7 spinous processes. ROM of left shoulder intact with pain elicited on extension, abduction and external rotation. Strength 3/5 with forward flexion, abduction and external rotation. Positive Lift Off test.

DIFFERENTIAL DIAGNOSIS: 1. Cervical Radiculopathy 2. Rotator Cuff tear 3. Brachial plexopathy

TEST AND RESULTS: Left Shoulder x-ray- No acute findings. Spinal Survey AP/ Lat- Small ossific fragment along posterior aspect of C6 spinous process. Large ossific fragment between the C7 and T1 spinous processes. MRI Thoracic Spine w/ out Contrast- Old 50% compression deformity of T4. Syrinx in the lower thoracic spinal cord centered at T9 level measuring 4cm craniocaudally and 5mm in maximal transverse dimension. NM Bone Scan SPECT- Increased bone uptake at the spinous process of C7 extending between C7 and T1. 15mm well corticated fragment most compatible with healing fracture. C7 spinous process excisional biopsy pathology- Bone and dense peri-osseous soft tissue without significant histological abnormality. **FINAL WORKING DIAGNOSIS:** C7 vertebral fracture with C7 spinous process ossicle

TREATMENT AND OUTCOMES: 1. Surgical Excision of the ossicle complicated by wound dehiscence and surgical site infection necessitating debridement and antibiotic therapy. 2. Cervical collar for 2 weeks weaned out of over the third week. 3. Lifting restriction of less than 10 pounds for 6 weeks. 4. Neck extension exercises out of the collar and isometric exercises. 5. Returned to activities as tolerated 3 months post op from original excision surgery with improvement in strength, range of motion and numbness symptoms.

741 May 29 3:55 PM - 4:15 PM

Perplexing Presentation- Preserving Function

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(No relevant relationships reported)

HISTORY:

A 60-year-old female with uncontrolled DM II, HTN, hyperthyroidism, tobacco abuse and depression arrived to physical therapy for evaluation of chronic left leg pain and weakness of sudden onset eight months prior. She reported constant pain including unremitting night pain, changes in bowel habits and a twenty five pound weight loss within the last six months. She denied urinary incontinence, night sweats, chills and fevers. She reported left knee buckling, falls, difficulty working as a bartender and completing daily activities. She endorsed non-adherence with medications and marijuana and non-prescription opiate use.

Physical Examination:

Examination revealed gross atrophy of the left thigh and left foot drop during gait. Sensation was decreased to light touch and deep pressure along L2-4 dermatomes in the left leg and was normal on the right. Reflexes were absent in L4/5 and S1 bilaterally; she had a negative Hoffman and Babinski bilaterally. Myotomes were 2-/5 proximal and 3+/5 distal to the knee on the left and 4/5 throughout on the right. There was flaccidity throughout the left leg. All other tests of the hip and spine including slump and straight leg raise tests were unremarkable.

Differential Diagnosis:

* Lower motor lesion with systemic etiology

* Malignancy

Tests and Results:

The physical therapist referred the patient back to the primary care physician (PCP) who ordered an abdominal CT and a spinal MRI. The patient was referred back to physical therapy. At re-evaluation one month later the patient presented with progressive motor loss scoring 3-/5 grossly on the right and 2-/5 grossly on the left leg. Sensory deficits extended to both lower extremities. Falls increased to thrice a week forcing patient to discontinue work. The patient was referred back to the PCP who admitted the patient to hospital for further workup. A brain MRI, myositis panel, aldolase, ANA and inflammatory markers were all unremarkable. EMG results revealed lumbosacral polyradiculopathy without evidence of myopathy.

Final/Working Diagnosis:

Diabetic Lumbosacral radiculoplexus neuropathy

Treatment and Outcomes:

* Glycemic and pain control were achieved and, after three weeks at an inpatient rehab facility, patient walked with a walker without falls. She returned to work without the walker despite an increase in falls.

742 May 29 4:15 PM - 4:35 PM

Osteomyelitis After Deadlifting Injury- A Rare Case Of A Burst Abscess

Edmund M. Qiao, Kenneth Vitale. *UCSD School of Medicine, La Jolla, CA.*

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(No relevant relationships reported)

HISTORY: 68-yr old male weightlifter presented with 1 mo. L buttock pain, acute onset of popping mid-lift during a deadlift, with radiating vague pain in L buttock. He continued to exercise through pain and 1 wk later pain progressed to severe deep buttock pain and difficulty ambulating. Denied low back pain, radiating thigh/leg symptoms, numbness/tingling, weakness, or bowel/bladder changes. Past hx positive for melanoma (treated in remote past), social hx negative for smoking, drug/alcohol abuse. He initially went to outside facility (only lumbar x-rays taken) without improvement, came in for another opinion with progressive symptoms.

PHYSICAL EXAMINATION: Skin normal without warmth, erythema. Vague tenderness in region of L buttock and SI joint. Full lumbar spine and hip ROM. Negative SLR. Mild nonspecific back discomfort with FABER. Normal lower limb neurovascular exam.

DIFFERENTIAL DIAGNOSIS: 1. SI Joint Dysfunction 2. Lumbar Radiculopathy 3. Piriformis Syndrome 4. Lumbar or Sacral Compression Fracture 5. Metastatic Cancer 6. Sacroiliitis

TEST AND RESULTS: Outside lumbar x-rays negative for fracture, showed minimal degenerative disc changes. We obtained hip/pelvis radiographs showing significant erosions and destructive changes of L SI joint. An urgent MRI showed fluid-filled and widened SI joint, severe inflammatory sacroiliitis with extensive erosions and bone marrow edema, widespread reactive muscle edema (iliacus showing fluid collection/early abscess at SI joint); SI joint aspirate was obtained.

FINAL WORKING DIAGNOSIS: septic sacroiliac arthritis with iliatus abscess and secondary osteomyelitis; aspirate grew staphylococcus aureus (MSSA).

TREATMENT AND OUTCOMES: The patient had a unique etiology of osteomyelitis not commonly reported. Orthopedics and ID determined he had pre-existing asymptomatic abscess that ruptured. Under the extreme abdominal pressures of deadlifting, they felt abscess burst leading to local spread and secondary osteomyelitis. This case highlights the rapidity and widespread destruction of infectious arthritis and need for awareness and prompt workup. Patient was treated with 6 wks of oxacillin and responded well. He returned to baseline physical activity at follow up; repeat x-rays showed SI joint sclerosis and patient was counseled on SI joint arthritis.

B-44 Rapid Fire Platform - Distance Running

Wednesday, May 29, 2019, 3:15 PM - 4:35 PM

Room: CC-Hall WA2

743 Chair: Clare E. Milner, FACSM. *Drexel University, Philadelphia, PA.*

(No relevant relationships reported)

744 May 29 3:15 PM - 3:25 PM

Changes in Shock Absorption and Kinematics during a Half Marathon as Measured with Inertial Sensors

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(No relevant relationships reported)

The repetitive impacts of the foot with the ground are hypothesized to be related to overuse injuries in running. Shocks caused by these impacts can be absorbed actively (i.e. muscle contractions) or passively (i.e. bones, tendons and ligaments). When fatigued, shock absorption is expected to shift from active to passive structures, increasing the risk of overuse injuries. Inertial sensors were used previously to quantify running mechanics in a real-world setting.

PURPOSE: To investigate shock absorption mechanisms between the tibia and sacrum in trained athletes during different phases of a Half Marathon, using inertial magnetic measurement units (IMUs).

METHODS: 8 trained athletes (5M 3F, 32.1±9.2 years, 177.4±8.1 cm, 67.8±7.5 kg) performed a Half Marathon during competition. A total of 8 IMU's (240 Hz) were placed at the feet, tibia, upper legs, sacrum and sternum. Parameters of interest included two indicators of impact; peak tibial acceleration (PTA) and peak sacral acceleration (PSA), and the knee angle at midstance (MS). Mean values over 100 strides were calculated bilaterally during three periods in the Half Marathon (1st km, halfway and 20th km). Paired sample t-tests were used to test for statistical differences in the parameters between the three periods.

RESULTS:

Both PTA and PSA increased significantly during a Half Marathon, despite a unilateral increase in knee angle at MS.

CONCLUSIONS:

In the first part of the Half Marathon, an increase in PTA did not increase PSA, probably due to an increase in shock absorption by active structures (i.e. unilateral increase in knee angle at MS). During the last part of the Half Marathon shock absorption decreased, resulting in an increased PSA. We speculate that fatigue caused the shock absorption mechanism to shift from active to more passive structures during the last part of the Half Marathon. Future research should determine if shock absorption by passive structures is sufficient to prevent overuse injuries.

Table 1. Mean values ± standard deviation for the selected outcome parameters during different phases of a Half Marathon during competition. PTA = peak tibial acceleration; PSA = peak sacral acceleration; MS = midstance.

	PTA (m/s ²)		PSA (m/s ²)		Knee angle at MS (°)	
	Left	Right	Left	Right	Left	Right
1 st km	198.6±181.3	145.1±74.3	43.7±34.2	58.1±46.5	44.2±5.3	41.9±4.7
Halfway	264.5±172.5	220.4±104.9	53.3±28.9	66.5±42.5	43.5±8.1	44.0±4.4
20 th km	264.7±127.9	233.6±88.9	61.1±38.9	74.5±44.8	44.7±8.3	44.4±4.2
Sign. diff.						
1 st km – Halfway	p<0.05	p<0.01	n.s.	n.s.	n.s.	p<0.05
Halfway – 20 th km	n.s.	n.s.	n.s.	p<0.05	n.s.	n.s.
1 st – 20 th km	p<0.05	p<0.01	p<0.05	p<0.05	n.s.	p<0.05

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May 29 3:25 PM - 3:35 PM

Differences in Lower Extremity Kinematic Variability between Healthy Runners Classified as Low or High Mileage

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(No relevant relationships reported)

Evidence suggests that running mechanics may differ between runners based on their weekly mileage; greater weekly mileage (WM) may act as a protective mechanism against injury. While the interaction between coordination patterns and WM has been investigated, interaction between lower extremity (LE) kinematic variability and WM has not. **PURPOSE:** To compare changes in LE kinematic variability between low (LM) and high mileage (HM) healthy runners after a prolonged run. **METHODS:** 23 healthy participants (27.4±7.7 yrs., 1.70±0.11 m, 67.9±15.4 kg, 16.3±5.6 km/week) were included in the LM group, while 12 participants (25.1±6.3 years, 1.71±0.1 m, 65.8±9.4 kg, 46.9±14.5 km/week) were included in the HM group. Participants ran on a treadmill for 30 minutes at a self-selected training pace. 3D kinematic data were collected after 5 minutes of running and again at the end of run at 200Hz using reflective markers placed on the lower body with 6 infrared cameras. Variables of interest included ankle, knee and hip sagittal and frontal plane angles. Standard deviation (SD) and coefficient of variation (CV) were calculated for each dependent variable (DV) at the beginning and end of the run. Approximate entropy (ApEn) was also calculated for each DV at both time intervals. Two repeated measures ANOVAs with time and joint as the within-subject factors and group as the between-subject factor, were used to compare kinematic variability. Post-hoc analyses were conducted for significant interactions. Alpha level was set at 0.05. **RESULTS:** Average running speed for the LM and HM group were 2.5±.3 m/s and 2.9±.4 m/s, respectively. In the sagittal plane, a significant interaction was found between joint and group ($F_{2,42}=5.5$, $p=.006$). Specifically, the HM group demonstrated greater amounts of variability (SD) than the LM group (LM=25.7±3.0; HM=29.5±3.7). No other statistically significant differences were attained.

CONCLUSIONS: Kinematic variability differed between the LM and HM groups, but only for the knee in the sagittal plane. Ankle and hip sagittal plane movement was comparable between the LM and HM groups. This may suggest that movement of the ankle and the hip do not differ in response to having to control variability at the knee. When assessing kinematic variability, it is important to consider the weekly mileage of each runner.

746 May 29 3:35 PM - 3:45 PM

Are Joint Kinetics Proximally Redistributed Following A Long Run In Well-trained Runners?

Max R. Paquette, Victoria A. White, Jake A. Melaro, Douglas W. Powell, FACSM. *University of Memphis, Memphis, TN.*
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(No relevant relationships reported)

Proximal redistribution of joint work to the hip occurs following intensive running in novice runners [1] and might explain the reduced running economy following prolonged running [2]. These findings in novice might be different in well-trained runners due to their training status. **PURPOSE:** The purpose of this study was to assess if proximal redistribution of joint kinetics following a running bout is observed in well-trained runners. **METHODS:** 14 well-trained male runners with habitual rearfoot strike patterns (76±22km/week) completed 5 running trials at a speed equivalent to ±5% of their long run pace while 3D kinematic and ground reaction force data were collected before and after a treadmill run equal to 25% of weekly mileage (19±6km). Joint powers and work were calculated from these data using Visual3D. Percent contribution of each joint work relative to total lower limb joint work was computed. Paired samples t-tests were used to compare joint kinetics before and after the run ($p < 0.05$). Cohen's d effect sizes were computed to assess mean difference magnitudes. **RESULTS:** Peak ankle negative power (Table 1) and hip negative relative work contribution (pre: 14.3±3.6%, post: 15.6±4.5%, $p=0.041$; $d=0.33$) showed significant pre- to post-run effects. Positive ankle (pre: 50.6±6.8%, post: 49.5±7.3%, $p=0.35$; $d=0.16$) and hip relative work (pre: 26.2±10.1%, post: 27.1±8.8%, $p=0.53$; $d=0.10$) were unaffected by the long run in these well-trained male runners. **CONCLUSIONS:** These findings suggest that previously reported distal-to-proximal shift in positive joint work in novice runners following a running bout [1] is not observed in well-trained male runners. This might be the result of chronic training exposure in these trained runners and suggest a preservation of mechanical joint output despite prolonged running exposure. Differences in run type (intense vs steady prolonged run), foot strike, and gender might also be responsible for these differences between studies.

Table 1. Peak negative and positive joint powers ($W \cdot kg^{-1}$) before and after the prolonged run (mean±SD).

Joint Kinetic Variables	Pre-Run	Post-Run	p-value	d
Ankle negative power	-8.4±2.0	-7.8±2.1	0.005	0.33
Ankle positive power	10.2±2.8	9.7±2.8	0.12	0.34
Knee negative power	-13.5±2.6	-12.8±2.3	0.16	0.39
Knee positive power	4.4±1.2	4.4±1.1	0.99	0.00
Hip negative power	-3.3±1.9	-3.4±2.1	0.73	0.05
Hip positive power	4.3±1.9	4.5±2.3	0.57	0.10

Notes: %: percent of total lower limb joint negative or positive work.

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Pelvic Motion Differences in Three Different Techniques of Jogging Stroller Propulsion

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(No relevant relationships reported)

Running with a jogging stroller has become a viable option for exercise in individuals serving as caregivers. Previous research has shown that stroller running leads to altered kinematics, but for many studies, running velocity was not constant between conditions. Some studies have reported altered trunk and pelvic motion during two-handed stroller running. **PURPOSE:** This study compared pelvic motion in all three planes of motion using various methods of pushing a stroller while running. **METHODS:** 13 recreational runners ran behind a Thule Urban Glide 2 jogging stroller suspended over an instrumented treadmill (Bertec, Inc, Columbus, OH). The study measured running in four different conditions: one with the participant's right hand on the handlebar (RH), another with left hand on the handlebar (LH), one with both hands on handlebar (BH), and running without the stroller (CON). The first three conditions were randomized between participants, but the final condition was always performed without the stroller. Biomechanical data were collected with Vicon Nexus 2.3 (Vicon, Inc., Oxford, UK) and processed through Visual 3D (5.0, C-Motion, Inc., Germantown, MD, USA). A repeated measures ANOVA was utilized to compare peak angles of the pelvis in all three planes of motion. **RESULTS:** The pelvis was more anteriorly tilted in the BH condition (25 ± 1.9°) compared to CON (23 ± 1.7°, $p=0.01$), RH (22 ± 2.0°, $p<0.01$) and the LH conditions (24 ± 1.9°, $p=0.04$). In the transverse plane only the LH (5.2 ± 0.75) and CON (5.6 ± 0.83°) conditions were similar. There was more right to left rotation of the pelvis in the BH condition (7.8 ± 0.7°) compared to the CON ($p=0.02$), RH (3.1 ± 0.88°, $p<0.01$) and the LH conditions ($p=0.02$). The RH was different from all other conditions for left to right rotation ($p<0.01$). There were no difference between conditions for pelvic obliquity, motion in the frontal plane, for any

of the four conditions. **CONCLUSIONS:** Running while behind a stroller alters some aspects of pelvic motion when compared with regular running. This is true for both one and two-handed stroller running. Pelvic motion plays a role in many aspects of running and altered mechanics in this region may lead to increased risk for injuries of the low back or lower extremity.

748 May 29 3:55 PM - 4:05 PM

Immediate Effects of a Textured Insole on Running Biomechanics in Rearfoot Strikers

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(No relevant relationships reported)

Running biomechanics are influenced by footwear and insole properties. The sensorimotor system, specifically subcutaneous plantar receptors, play a role in initiating adaptive gait mechanics. Designed to increase afferent signaling via plantar surface deformation, an insole inlaid with a textured heel-plate (TI) is proposed to precipitate gait changes during running. **PURPOSE:** To compare biomechanical patterns during over-ground running between the TI and a non-textured insole (NI). **METHODS:** Nineteen rearfoot strike runners (24.9 ± 5.7 yo; 6 M, 13 F) performed twenty, 35-meter running trials under TI and NI conditions. Insole conditions were counter-balanced, and velocity was controlled (±5%). Plantar sensation was assessed using a 3.61g monofilament applied to seven standardized sites. Thirty-six reflective markers (dia.=16-20 cm), affixed bilaterally to lower extremity bony landmarks, were tracked via a 10-camera motion analysis system (120 Hz), and ground reaction forces were collected (1200 Hz). Visual3D and a custom Matlab script were used to determine lower extremity kinematics and kinetic variables. Perceived insole comfort was scored with a visual analogue scale. Dependent variables were analyzed using paired-samples t-tests; for data that violated assumptions, a Wilcoxon signed-rank test was utilized. **RESULTS:** Kinetic measures did not differ significantly between insole conditions; impact peak (NI=1.46±0.58 BW, TI=1.50±0.44 BW, $p=.74$), active peak (NI=2.37±0.16 BW, TI=2.35±0.15 BW, $p=.28$), loading rate (NI=35.9±12.2 BW/s, TI=34.0±13.2 BW/s, $p=.26$), peak braking (NI=-.31±0.03 BW, TI=-.32±0.06 BW, $p=.69$) and peak propulsion (NI=.27±0.05 BW, TI=.27±0.04 BW, $p=.28$). A significant increase in ankle internal rotation angle at initial contact was observed in the TI versus NI (NI=5.9 ± 5.9°; TI=7.3 ± 5.9°; $p=.01$, $d=.24$), however, no other significant kinematic differences were detected. NI (mdn=9.0) was rated as significantly more comfortable than TI (mdn=8.0) ($\chi^2=2.026$ $p=.04$). **CONCLUSION:** Because kinematic and kinetic variables did not vary significantly between the TI and NI, the efficacy of the TI as a method of immediately altering running mechanics in a population of rear foot strikers should be further investigated. Insoles provided by: ShoeCue Inc (ShoeCue, Orleans, MA)

749 May 29 4:05 PM - 4:15 PM

Comparison of Running Gait Kinematics Among College Students With and Without ASD

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(No relevant relationships reported)

BACKGROUND: Autism Spectrum Disorder (ASD) is a developmental disability associated with difficulties in social communication and the presence of repetitive behaviors. Along with social impairments, motor deficits can be identified as another characteristic associated with ASD. Although gait deviations have been looked at in children with ASD, not much is known about how gait deviations may persist in college students with ASD. **PURPOSE:** To compare running gait deviations between college students with and without ASD. **METHODS:** Ten college students participated in this study. Five participants had a diagnosis of ASD (age 21.5±2.9 years) and 5 participants did not have an ASD diagnosis and comprised a healthy control (CON) group (age 24±3.5 years). Each participant performed 3 running trials over a 7.62 meter distance. Kinematic data were collected using a 12-camera 3D motion capture system. Stance and swing phase time, and hip, knee, and ankle angles at initial contact and at toe off were extracted for further analysis. Variables were compared between groups using independent t-tests. As this is a preliminary analysis with a small sample size, significance was set at $\alpha<0.10$. **RESULTS:** Individuals with and without ASD had similar lower extremity joint angles at initial contact (hip 60.21±13.13° ASD, 53.60±16.07° CON, $p=0.53$; knee 37.10±12.40° ASD, 43.48±3.30° CON, $p=0.36$; ankle 17.66±4.89° ASD, 18.18±6.47° CON, $p=0.90$). The two groups also demonstrated similar knee and ankle angles at toe off (knee 24.51±3.86° ASD, 19.36±4.28° CON, $p=0.11$; ankle -15.74± 6.45° ASD, -13.22±10.32° CON, $p=0.69$), but the ASD group demonstrated less hip extension at toe off (2.97±1.07° ASD, -2.02±4.60° CON, $p=0.07$). The ASD group also demonstrated longer stance phases (0.29±0.03s ASD, 0.23±0.02s CON, $p=0.02$) and shorter swing phases (0.40±0.05s ASD, 0.47±0.05s CON, $p=0.10$) compared to the control group. **CONCLUSION:** The

control group demonstrated more hip extension at toe off, which could suggest greater forward propulsion of the body. Greater propulsion is also associated with shorter ground contact times, and requires greater stability. The ASD group exhibited greater time in stance phase, and less time in swing phase, which could suggest potential balance deficits and less effective running patterns in college students with ASD.

750 May 29 4:15 PM - 4:25 PM

Stride Frequency Manipulation: Physiological And Perceptual Responses During Backward Running With Body Weight Support

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(No relevant relationships reported)

Manipulation of stride frequency (SF) influences gait mechanics of forward running, regardless of body weight support (BWS). Nevertheless, no research has investigated the influence of a change in SF on physiological and perceptual responses during backward running with BWS.

PURPOSE: To investigate influence of a change in SF on physiological and perceptual responses during backward running at different levels of BWS. **METHODS:** Nine participants (33.2 ± 12.1 years) ran forward and backward at 0%BWS, 20%BWS, and 50%BWS conditions on a lower body positive pressure treadmill. The SF conditions consisted of forward and backward running at preferred stride frequency (PSF), PSF+10%, and PSF-10%. Oxygen uptake (VO_2), heart rate (HR), rating of perceived exertion (RPE), and muscle activity from the rectus femoris, biceps femoris, tibialis anterior, and gastrocnemius were measured. VO_2 , HR, RPE, and muscle activity from lower extremity were analyzed using a 2 (running direction) \times 3 (BWS) \times 3 (SF) repeated measures analysis of variance ($\alpha = 0.05$). **RESULTS:** VO_2 , HR, RPE, and muscle activity from the rectus femoris, tibialis anterior, and gastrocnemius were not influenced by the interaction of running direction, BWS, and SF ($P > 0.05$). VO_2 , HR, and muscle activity from the rectus femoris were significantly different between SF conditions ($P < 0.05$). For example, VO_2 and HR during running at PSF+10% were significantly higher than when running at PSF, regardless of running direction and BWS (e.g., 27.4 ± 5.7 ml/kg/min and 24.9 ± 4.3 ml/kg/min in VO_2 for PSF+10% and PSF during forward running at 50%BWS, respectively: $P < 0.05$). However, RPE was not different between SF conditions ($P > 0.05$). **CONCLUSION:** These observations suggest that manipulation of SF (i.e., a 10% change in SF from the PSF) during running may have greater impact on physiological responses than on perceptual responses, regardless of running direction and BWS. Supported by JSPS Grant Number 16K01663.

751 May 29 4:25 PM - 4:35 PM

Non-Linear Relationship between Footstrike Angle and Vertical Loading Rate during Running

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(No relevant relationships reported)

Footstrike is considered a primary determinant of lower limb mechanics during running. Indeed, vertical loading rates, often a focus of investigations into running-related injuries, are typically found to be lower in forefoot compared to rearfoot strikers fostering the belief that forefoot strike is desirable. However, prior work has shown that foot angle relative to the ground (foot inclination angle (FIA)) is a poor predictor of vertical loading rate when using a linear model, suggesting a more complex relationship is present. **PURPOSE:** To determine if a non-linear model improves the ability to estimate average vertical loading rate (AVLR) from FIA compared to a linear model.

METHODS: Whole body kinematics and vertical ground reaction forces (VGRF) were collected for 169 NCAA Division I athletes (96 males) during treadmill running at 2.68, 3.35, and 4.47 m/s. Athletes were healthy at testing, had no history of lower limb surgery, and no bone stress injury within 3 months prior to testing. FIA and AVLR were calculated for 15 strides and averaged across strides for each limb. FIA at initial contact was calculated, with positive and negative FIA indicating a more rearfoot and forefoot position, respectively. AVLR was the VGRF slope over 20-80% of the force from initial contact to impact peak or, when an impact peak was absent, to the force at 30.79% of time to peak VGRF. The relationship between FIA and AVLR was evaluated using linear and non-linear models at each speed.

RESULTS: AVLRs were lowest at the extremes of FIA (i.e., -15° , 20°), while greater AVLRs were observed between $5-10^\circ$. The non-linear model to estimate AVLR from FIA resulted in an approximate increase in R^2 values of 0.30 above the linear model at all speeds (linear: 0.13, 0.14, 0.12; non-linear: 0.46, 0.39, 0.44, for 2.68, 3.35, and 4.47 m/s, respectively). Model error was reduced in the non-linear models by 30-60 N/kg/s (linear: 165.2, 202.6, 293.4 N/kg/s; non-linear: 130.7, 170.9, 234.9 N/kg/s for 2.68, 3.35, 4.47 m/s, respectively).

CONCLUSIONS: AVLR among FIA reflective of forefoot strike was low, but AVLR varied considerably among FIA associated with rearfoot striking, indicating a distinct non-linear relationship. This supports that dichotomous treatment of FIA does not appropriately estimate AVLR and may bias models utilizing AVLR to assess injury risk.

B-53 Free Communication/Poster - High Intensity Training

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM

Room: CC-Hall WA2

767 Board #1

May 29 2:00 PM - 3:30 PM

Effects Of High-intensity Interval Training Vs Sprint Interval Training On Body Composition And Aerobic Power In Healthy Young Women

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(No relevant relationships reported)

PURPOSE: To compare the effects of two types of interval training, High-Intensity Interval Training (HIIT) and Sprint Interval Training (SIT), on anthropometric measures and cardiorespiratory fitness in healthy young women.

METHODS: A randomized clinical trial in which 49 young active women (age, 30.4 ± 6.1 years; body mass index, 24.8 ± 3.1 kg.m⁻²; peak oxygen consumption ($\text{VO}_{2\text{peak}}$), 34.9 ± 7.5 mL.kg⁻¹.min⁻¹) were randomly allocated into a SIT or HIIT group. The SIT group performed four bouts of 30 s all-out cycling efforts interspersed with four minutes of recovery (passive or light cycling with no load). The HIIT group performed four bouts of four-minute efforts at 90-95% of peak heart rate (HR_{peak}) interspersed with three minutes of active recovery at 50-60% of HR_{peak} . The protocols were performed three times per week (Monday, Wednesday, and Friday) for eight weeks. At baseline and after eight weeks of intervention, waist circumference, skinfolds (triceps, subscapular, suprailiac, abdominal and thigh), body mass and BMI were measured by standard procedures and cardiorespiratory fitness was assessed by cardiorespiratory graded exertion test on an electromagnetically braked cycle ergometer. **RESULTS:** The HIIT and SIT groups improved, respectively, $14.5 \pm 22.9\%$ ($P < 0.001$) and $16.9 \pm 23.4\%$ ($P < 0.001$) in $\text{VO}_{2\text{peak}}$ after intervention, with no significant difference between groups. Sum of skinfolds reduced $15.8 \pm 7.9\%$ and $22.2 \pm 6.4\%$ from baseline ($P < 0.001$) for HIIT and SIT groups, respectively, with greater reduction for SIT compared to HIIT ($P < 0.05$). There were statistically significant decreases in waist circumference ($P < 0.001$) for the HIIT ($-3.1 \pm 1.1\%$) and SIT ($-3.3 \pm 1.8\%$) groups, with no significant difference between groups. Only SIT showed significant reductions in body weight and BMI ($p < 0.05$). No significant difference ($P > 0.05$) was found in dietary intake between the HIIT and SIT groups at baseline and after eight weeks of training.

CONCLUSIONS: Eight weeks of HIIT and SIT resulted in improvements in anthropometric measures and cardiorespiratory fitness, even in the absence of changes in dietary intake. In addition, the SIT protocol induced greater reductions than the HIIT protocol in the sum of skinfolds.

768 Board #2

May 29 2:00 PM - 3:30 PM

Application of High-intensity Interval Training Program of Increased Intensity and Decreased Volume: A Pre-competition Case

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(No relevant relationships reported)

The training effect of track-sprinted cycling largely depends on the completed riding intensity on track or ergometers. Especially before the big events, coaches normally arrange a training plan of gradually decreased volume. Meanwhile, the training intensity should be kept or increased, which is difficult to be achieved.

PURPOSE: To investigate the effect of seven high-intensity interval training (HIT) sessions with increased intensity for an elite female track-sprinted cyclist before the Hong Kong track cycling world cup in January 2015. **METHODS:** Seven sessions of HIT on Wattbike Pro cycle ergometer (UK) were completed in continuous three weeks (2 or 3 days interval). Each session included four groups' HIT of 20 s riding and 10 s active recovery with the different group times. The pedalling cadence of 20 s should be kept around 120 rpm, and there were 30 min rest between four groups. The total training volume of sessions declined gradually through the decreased riding

times (40, 32, 32, 32, 28, 24, 24). But the total gear meters of sessions were set to be increased gradually (26m, 27.2m, 27.2m, 27.2m, 27.8m, 28.4m, 28.4m) by adjusting the air brake gear of Wattbike. The power, work and HR were recorded with the sampling rate of 200 Hz. Blood lactate was tested at one and three minutes after each group. **RESULTS:** Except the average cadence (Cavg) of the first session was closed to 120 rpm, other six sessions' Cavg were only around 117 rpm. Although the total work of HIIT sessions were decreased from 266.8 kJ of the first session to the last session's 201.0 kJ. But the average power of each session were increased gradually by 341.2±10.2 W, 369.0±9.2 W, 383.0±18.8 W, 377.1±9.8 W, 408.4±26.9 W, 416.3±9.3 W and 418.1±9.5 W respectively. The average HR only decreased by 6.1% in the second session than the first, and rised to the same level in the next five sessions. Although the post-group BLA increased obviously from the third session, the degree of BLA recovery between 3 min and 1 min increased significantly in the sixth and seventh session. **CONCLUSIONS:** A specific pre-competition training phase with obviously increased intensity should improve the lactate buffer and transportation capacity of blood significantly. The achieved intensity in HIT should be the decisive factor for the improvement of anaerobic exercise capacity.

769 Board #3 May 29 2:00 PM - 3:30 PM
Effects Of High-intensity Interval Training On Aerobic Capacity And Sleep Quality In Middle-aged Women

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Middle-aged women often have a tendency to gain weight due to decreased basal metabolic rate and physical activity. In order to make women's elderly life more quality, women's physical fitness in middle age is an issue that needs attention. **PURPOSE:** To investigate the effects of different percentages of critical velocity (CV) training on cardio-pulmonary fitness, body composition, and sleep quality in middle-aged women. **METHODS:** Twenty-four middle-aged women (age: 45.0±7.2 yrs, height: 160.3±5.0 cm, weight: 61.6±7.1 kg, body fat percentage: 38.3±7.1%) participated in the study who were paired by CV to perform high-intensity interval training (HIIT, 130% CV, running 2 minutes with 1 minute recovery, repeated 7 times) or moderate-intensity continuous training (MICT, 90% CV, running 20 minutes) 3 times a week for 12 weeks. Participants were asked to wear the Mi band II 3 weeks before and during the intervention period to record the number of steps and sleep status. **RESULTS:** The body fat percentage (HIIT group: 39.7±4.5% to 38.5±4.7%, MICT group: 36.9±3.2% to 35.7±3.3) and maximal oxygen uptake (HIIT group: 30.7±5.3 to 33.8±5.3 ml/min/kg, MICT group: 30.8±3.5 to 33.3±5.0 ml/min/kg) were significantly improved in both groups ($p < .05$), and there was no difference between the groups ($p > .05$). However, the HIIT group significantly improved the ventilation threshold (26.3±5.6 to 29.5±4.2 ml/min/kg) and increased the proportion of deep sleep (31.1±8.0% to 33.2±9.2%) ($p < .05$). **CONCLUSIONS:** When training time was the same, both HIIT and MICT have significant improvement on body composition and cardio-respiratory fitness, but HIIT can also improve high-intensity exercise ability and sleep quality.

770 Board #4 May 29 2:00 PM - 3:30 PM
Examining Work-to-Rest Ratios to Optimize Upper Body Sprint Interval Training

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PURPOSE: The primary purpose of this study was evaluate the effectiveness of upper body sprint interval training (SIT) protocols with varying work-to-rest ratios on both aerobic and anaerobic performance. The secondary purpose was to investigate the changes in metabolic and neuromuscular fatigue thresholds from two weeks of SIT in recreationally active men. **METHODS:** Forty-two recreationally trained men were randomized into one of three training groups [10s work bouts with two minutes of rest (10:2) or four minutes of rest (10:4), or 30s work bouts with four minutes of rest (30:4)] or a control group (CON). Participants underwent six training sessions over two weeks with four to six 'all-out' sprints. During pre- and post-intervention visits, participants underwent a graded exercise test to determine maximal oxygen consumption ($\dot{V}O_{2peak}$) and peak power output (PPO), four constant-work rate trials to determine critical power (CP), anaerobic working capacity (W'), and electromyographic fatigue threshold (EMGFT), and an upper body Wingate test to determine peak power (PP), mean power (MP), and total work (TW). An analysis of covariance was performed on all testing measurements collected at post with the associated pre-values used as covariates.

RESULTS: There were significant between group differences in post-test absolute $\dot{V}O_{2peak}$, with an adjusted pre-test mean of $2.44L \cdot min^{-1}$, and PPO, with an adjusted pre-test mean of $130.9W$. Absolute $\dot{V}O_{2peak}$ was greater in 30:4 ($2.36 \pm 0.26L \cdot min^{-1}$, $p = .007$) and 10:2 ($2.53 \pm 0.38L \cdot min^{-1}$, $p = .036$) than CON ($2.17 \pm 0.34L \cdot min^{-1}$), and PPO was greater in 30:4 than CON (136 ± 14 vs. $127 \pm 22W$, $p = .007$, respectively). No differences were observed between groups in CP ($p = .530$), W' ($p = .900$), EMGFT ($p = .692$), PP ($p = .692$), MP ($p = .290$), or TW ($p = .291$).

CONCLUSION: SIT protocols with larger work-to-rest ratios appears to have enhanced $\dot{V}O_{2peak}$ in the upper body over a short-term two-week intervention.

771 Board #5 May 29 2:00 PM - 3:30 PM
Four Weeks of Low Volume High-Intensity Interval Training Has No Effect On VO_{2max}

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Previous works assessing the impact of high intensity interval training on VO_{2max} have offered varying results

PURPOSE: To determine the meaningful effects of a short-term high-intensity interval training (HIIT) or continuous training (CET) intervention on VO_{2max} and the anaerobic capacity through quantification of both the respiratory and haemodynamic responses. **METHOD:** Following local institutional ethical approval, 37 physically active participants undertook 4-weeks of either cycling-based HIIT (age, 17.0 ± 0.5 yrs; height, 173.1 ± 9.2 cm; mass, 62.4 ± 6.9 kg), (8×20 s at $170\% p\dot{V}O_{2max}$ with 10 s recovery) or CET (age, 17.0 ± 0 yrs; height, 173.6 ± 8.7 cm; mass, 69.3 ± 17.0 kg) (30 min at $70\% \dot{V}O_{2max}$) 3 times per week. VO_{2max} , anaerobic capacity as determined through the maximally accumulated oxygen deficit (MAOD), blood-based markers and haemodynamic responses were assessed pre and post the intervention period. VO_{2max} and MAOD were evaluated using breath-by-breath open circuit spirometry while haemodynamic responses were monitored using thoracic impedance cardiography. Analysis conducted using both inferential analysis as well as magnitude-based inferences (MBI) and effects sizes (ES). **RESULTS:** VO_{2max} exhibited a non-significant 4.1% increase ($P > 0.05$) ($ES = 0.24$) for HIIT with 7.0% $p = 0.007$ ($ES = 0.40$, MBI= likely trivial) increase for CET. Haemodynamic responses (Q_{max} , SV_{max}) displayed non-significant responses for CET and HIIT ($P > 0.05$) while $a-vO_{2diff-max}$ increased from 15.8 ± 4.8 to 18.3 ± 2.9 ml/100 ml⁻¹) ($p = 0.02$) ($ES = 0.63$, MBI= possibly beneficial) following HIIT. MAOD increased by 7.3 ml/kg⁻¹ for HIIT ($p = 0.001$) ($ES = 0.72$, MBI= likely beneficial), with CET showing no change ($p > 0.05$). **CONCLUSIONS:** VO_{2max} is a function of Q_{max} and $a-vO_{2diff-max}$, so for a meaningful change to occur in cardiorespiratory fitness there must be a concomitant increase in O_2 delivery. This study demonstrates that a short-term HIIT intervention evokes peripherally mediated responses ($a-vO_{2diff}$) and anaerobic substrate utilisation rather than O_2 delivery components. The increase in VO_{2max} for CET in the absence of haemodynamic responses lends further support to the need for valid quantification of VO_{2max} .

772 Board #6 May 29 2:00 PM - 3:30 PM
High-intensity Interval Training In The Heat: A "hotter" Alternative For Promoting Cardiovascular Health And Performance?

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Chronic heat exposure during exercise, exercise heat acclimation (EHA), and high-intensity interval training (HIIT) both promote positive physiological and performance adaptations; however, it remains unknown if HIIT acts synergistically with EHA compounding the performance benefit of HIIT. **PURPOSE:** To investigate the effects of HIIT and EHA (HIIT+Heat) on cardiovascular function (CV), endurance running performance, and muscle function vs. HIIT alone. **METHODS:** Using a randomized controlled parallel-design, 10 young healthy males and females completed 6 sessions of HIIT (8×30 s on, 90 s off) performed either in the heat (HIIT+Heat, $30^\circ C$, 50% RH) or thermoneutral (HIIT, $\sim 20^\circ C$, 15% RH) condition. Measures of cardiovascular and muscle function, running performance and economy were measured prior to, and >72 hr post, training in a thermoneutral environment. A 5 km time-trial and graded treadmill protocol were conducted to assess for running performance and economy, while power and velocity during maximal vertical jump were used to assess muscle function. CV function was assessed via, heart rate (HR), HR variability (HRV; root mean square of successive differences; RMSSD, and standard deviation of N-N intervals; SDNN), central (cBP), peripheral blood pressure (pBP), and pulse wave velocity (PWV). **RESULTS:** No baseline differences were observed between groups.

No differences in performance improvement (-4 ± 2 vs. $-4 \pm 4\%$ in 5km time) or running economy were observed between groups ($p > 0.05$). Resting HR (-2 ± 3 vs. $-2 \pm 2\%$) and HRV (SDNN 5 ± 2 vs. $11 \pm 4\%$) were improved in both groups but were not different between conditions (HIIT vs. HIIT+Heat, $p > 0.05$). However, cSBP (1 ± 2 vs. $-7 \pm 3\%$), pSBP (-2 ± 2 vs. $-8 \pm 2\%$), and PWV (0 ± 1 vs. $-6 \pm 3\%$) only decreased in the HIIT+Heat (HIIT vs. HIIT+heat, respectively, all $p < 0.05$). Improvements in jump velocity (-3 ± 5 vs. $8 \pm 5\%$) and power (-2 ± 5 vs. $9 \pm 6\%$) tended to be greater in HIIT+heat ($p = 0.08-0.10$). **CONCLUSION:** Short term HIIT combined with heat stress did not improve running performance or economy more than HIIT alone, but did significantly improve blood pressure, vascular stiffness, and tended to improve muscle function in thermoneutral conditions. Further work exploring longer training and/or greater heat stress in larger populations, or those with vascular dysfunction, is warranted.

773 Board #7 May 29 2:00 PM - 3:30 PM
Effectiveness Of HIIT And MICT On Body Weight And Fat% Of Overweight Adults: A Meta-analysis

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PURPOSE: To determine the effectiveness of high-intensity interval training (HIIT) and medium-intensity continuous training (MICT) on body weight and fat% of overweight adults.

METHODS: A comprehensive bibliographic search was conducted on the intervention studies of HIIT and MICT on body weight and fat% published in peer-reviewed journals between January 1, 2013 and January 1, 2017. Databases searched included Pubmed, WebScience, Embase and CNKI (Chinese database). Identified studies were analyzed using a meta-analysis so that the effect size of HIIT and MICT interventions can be determined. Risk bias evaluation was used to evaluate the quality of each included study and STATA 13.1 software was used for the analysis.

RESULTS: A total of 10 studies involving 233 subjects (100 males, age = 32.3 ± 5.9 yr.) were included in the final analysis. Intervention durations averaged 10.3 ± 2.7 weeks with a mean sample size of 23.3 ± 6.5 . The reduction of body weight by HIIT and MICT was 1.56% and 1.53%, respectively and the reduction of fat% was 4.05% and 4.06%, respectively. Thus HIIT had no better effect in reducing weight (effect size = -0.18, 95% CI: -1.03 ~ 0.66, $P = 0.67$) or fat% (effect size = -0.38, 95% CI: -1.02 ~ 0.27, $P = 0.25$) than MICT. The further subgroup analysis showed that, the more times of HIIT, the larger of the training effect; e.g., the subgroup had "greater than or equal to 48 times" training led a significant difference in reducing body weight (effect size = -1.51, 95% CI: -2.73 ~ -0.29, $P = 0.016$). For fat%, it was found that the longer training period, the more significant effect of HIIT, e.g., in the period of "12 weeks" subgroup, there was a significant marginal significance (effect size = -0.73, 95% CI: -1.49 ~ 0.03, $P = 0.061$).

CONCLUSION: While both HIIT and MICT led reduction in body weight and fat%, but there was no significant difference between them. Longer and higher frequency HIIT may be needed to lead a more significant weight and fat% reduction.

774 Board #8 May 29 2:00 PM - 3:30 PM
Inter-Individual Adaptive Responses to Sprint Interval Training in Recreationally Active Males

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Sprint interval training (SIT) has emerged as a time efficient alternative to conventional endurance exercise, inducing similar physiological adaptations in both athletic and non-athletic populations. These include both anaerobic adaptations such as those observed during a 30 s Wingate test, and aerobic adaptations such as improved time trial performance. However, the magnitude of such adaptations can vary considerably on an individual level. **PURPOSE:** To investigate the inter-individual variation in response to a 3 week SIT intervention in healthy males.

METHODS: Healthy recreationally active ($\text{VO}_2 \text{ max} < 50 \text{ ml.kg.min}^{-1}$) males ($n=25$) participated in a 3 week SIT intervention, comprising 9 exercise sessions. Each SIT session consisted of 4-6 30 s "all out" cycle sprints at a resistance of 7.5 % body mass, interspersed with 4 min active recovery. Participants completed a 30 s Wingate and a 20 min cycle performance test at baseline and 72-96 h following the final SIT session. (Non-)Responders were identified using twice the typical error (TE) of measurement for Wingate peak power (PP; $2 \times \text{TE} = 1.58 \text{ W.kg}^{-1}$), minimum power (MP; $2 \times \text{TE} = 0.81 \text{ W.kg}^{-1}$) and average power (AP; $2 \times \text{TE} = 0.39 \text{ W.kg}^{-1}$), and for mean power during the cycle performance test (CP; $2 \times \text{TE} = 10.07 \text{ W}$).

RESULTS: Group level (mean \pm SD) increases in PP ($0.9 \pm 1.1 \text{ W.kg}^{-1}$), MP ($0.3 \pm 0.6 \text{ W.kg}^{-1}$), AP ($0.4 \pm 0.4 \text{ W.kg}^{-1}$) and CP ($16.8 \pm 15.6 \text{ W}$) were observed (all $p < 0.05$). Non-responders in PP (17/25, 68 %), MP (19/25, 76 %), AP (9/25, 36 %), and CP (10/25, 40 %) were all identified. Adverse responses in AP and MP (1/25, 4 %) were also observed. Global non-responders to SIT were identified (4/25, 16 %), who did not improve any performance measure. All other participants improved at least one performance measure. Of participants that improved CP a large subset (10/15, 67 %) also improved AP, this is the most common response. Interestingly, $n=4$ participants improved CP in response to SIT without improving any anaerobic variable.

CONCLUSIONS: This study's findings indicate significant heterogeneity in the individual adaptations to SIT in measures of anaerobic and aerobic performance. Subsets of responders to multiple performance variables, as well as those who improved aerobic, but not anaerobic performance, were identified, demonstrating the wide range of adaptive responses to SIT.

775 Board #9 May 29 2:00 PM - 3:30 PM
Six Hit Treadmill Training Sessions Improves Lipid Oxidation and Ventilatory Thresholds Intensities

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The high-intensity interval training (HIT) has been used as alternative to cardiorespiratory training performed continuously with submaximal intensity and prolong time. **PURPOSE:** The aims of this study were to propose a treadmill HIT protocol and verify the influence of six HIT sessions on intensities of ventilatory anaerobic thresholds (VATs) and substrate oxidation rates during submaximal continuous exercise (SCE). **METHODS:** Fifteen irregularly active men performed incremental treadmill exercise testing followed by submaximal work-rate running for 45min to determine VATs, $\text{VO}_{2\text{peak}}$, peak velocity (V_{peak}), and substrate oxidation rates, before and after training period. The training period consisted of six HIT sessions, composed each one of eight sets of 60s running at $100\%V_{\text{peak}}$ interspersed by 75s recovery, every 48h. **RESULTS:** Our results showed increases in VATs intensities of 4.4% for VAT1 and 8.8% for VAT2, reduction of 12.8% for carbohydrate oxidation (CHOox) and increase of 23.7% for lipid oxidation (LIPox); as a result, the relative energy derived from LIPox was 20.3% higher after the training period. V_{peak} was $\sim 15 \text{ km/h}$, which produces the relative intensities of $\sim 84\%V_{\text{O}_{2\text{peak}}}$ e $\sim 91\%FC_{\text{peak}}$ during the training period. **CONCLUSION:** The proposed protocol promoted similar adaptations and intensities which were described by the literature; but unlike others, it can be applied in irregularly active individuals.

776 Board #10 May 29 2:00 PM - 3:30 PM
Effects Of High-intensity Strength Training On Muscle Strength Gain And Muscle Hypertrophy In Males And Females: A Meta-analysis

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High-intensity strength training is known to induce muscle strength gain and muscle hypertrophy. However, there are only few reports on the effects of high-intensity strength training on strength gain and muscle hypertrophy in females. **PURPOSE:** To conduct a systematic review of a meta-analysis to compare changes in strength gain and muscle hypertrophy between males and females after high intensity resistance training.

METHODS: To carry out present review, English-language literature searches on PubMed and SPORTDiscus databases were conducted from all time points up until June 2018. Combinations of the following keywords were used as search terms: "training intensity," "strength training," "resistance training," "strength," "muscle hypertrophy." **RESULTS:** Thirty-five articles were included in the meta-analysis. The standardized mean differences for muscle strength gain were 1.27 (95% confidence interval [CI], 0.99-1.55) and 1.16 (95% CI, 0.45-1.87), in males and females, respectively. The standardized mean differences for muscle hypertrophy were 0.73 (95% CI, 0.41-1.05) and 0.33 (95% CI, 0.07-0.60) in males and females, respectively. **CONCLUSIONS:** Our results suggested that high-intensity strength training induces muscle strength gain and increases muscle hypertrophy in both males and females. However, in the case of muscle hypertrophy, females tend to have lower standardized mean difference than males after high-intensity strength training.

777 Board #11 May 29 2:00 PM - 3:30 PM
Influence Of Combining Aerobic And High Intensity Interval Training on 400m Performance And Post-exercise Responses.

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(No relevant relationships reported)

PURPOSE: To examine the possible influence of combining aerobic and high intensity interval training (HIIT) on post-exercise responses in 400m in young sprinters.

METHODS: Fourteen male sprinters (100-200 m) (18.4 ± 0.3 years old; mean ± SE) performed 400m at maximal effort (400mMax), 400m at 90% (400m-90%), and the Cunningham-Faulkner treadmill test (C-F) (12.8 km·h⁻¹, 20% inclination to fatigue). Afterwards, participants were divided in 2 equivalent groups of 7 persons each and underwent 6 weeks of either HIIT training two times per week (HIIT), or HIIT and supplementary aerobic training two times per week (Comb). After training, 400mMax was repeated, whereas the 400m-90% was performed at pre-training intensity. Saliva samples for the determination of testosterone (TESTO) and Cortisol (CO) were collected before and 30min after the 400mMax and 400m-90%. Pre and post exercise differences between trials were analyzed using 2-way ANOVA and responses over time by 3-way ANOVA. **RESULTS:** Performance improvement with training in 400mMax (HIIT: 2.6 ± 0.4% vs. Comb: 1.9 ± 0.4%, $p=0.23$) and C-F (HIIT: 15.7 ± 1.3% vs. Comb: 13.9 ± 3.9%, $p=0.66$) was similar between groups. In 400m-90% the TESTO/CO ratio increased after training only in Comb (Pre-Training: 7.0 ± 2.2 vs. Post-Training: 13.4 ± 2.2, $p=0.045$), while CO was higher ($p=0.016$) after training in HIIT (13.6 ± 1.5 ng·ml⁻¹) compared to Comb (8.4 ± 1.5 ng·ml⁻¹). Higher hormonal increases ($p<0.05$) with exercise were observed in 400mMax compared to 400m-90% irrespective of training (pre/post training) and type of group (HIIT/Comb). No other hormonal differences were detected between groups. The increase of lactate concentration (post-pre exercise difference) 3 min after 400mMax (Comb: 9.6 ± 0.6 mmol·l⁻¹ vs. HIIT: 12.2 ± 0.6 mmol·l⁻¹; $p=0.04$) and C-F (Comb: 12.1 ± 0.4 mmol·l⁻¹ vs. HIIT: 15.4 ± 0.5 mmol·l⁻¹; $p=0.012$) was lower after training in Comb compared to HIIT. During the 3-min recovery, mean percentage heart rate was lower ($p<0.001$) in Comb (75 ± 1%) compared to HIIT (80 ± 1%) in 400mMax. **CONCLUSIONS:** Comb training possibly attenuated CO response 30min post-exercise in 400m-90%. Also, the Comb training did not further improve performance in 400mMax and C-F compared to HIIT but probably induced adaptations that facilitated the faster blood lactate and heart rate recovery.

778 Board #12 May 29 2:00 PM - 3:30 PM
The Effect Of Varying High-intensity Interval Training Style Warm-ups On Hemodynamic, Power, And Flexibility Responses

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the effectiveness of high-intensity interval training (HIIT) style warm-up on hemodynamic, power, and flexibility responses.

METHODS: Twelve male subjects (age: 24.15 ± 3.1 yr. & weight: 78.78 ± 16.83 kg) completed the study. On the first day, initial screening, anthropometric measures, and familiarization with testing procedures were completed. There was a total of 6 randomized testing sessions (separated by at least 48 hours.). The testing sessions were as follows: 3-min warm-up session with 20 sec work followed by 10 sec (C1), 3-min warm-up session with 30 sec work followed by 10 sec (C2), 5-min warm-up session with 20 sec work followed by 10 sec (C3), 5-min warm-up session with 30 sec work followed by 10 sec (C4), 8-min warm-up session with 20 sec work followed by 10 sec (C5), and 8-min warm-up session with 30 sec work followed by 10 sec (C6). The warm-up sessions included timed interval body weight squats. Hemodynamics (heart rate (HR) and systolic (SBP) and diastolic (DBP) blood pressure), a countermovement jump, and flexibility values were recorded before and after warm-up protocols.

RESULTS: There was a significant duration*time interaction for flexibility ($p<0.01$) and vertical jump ($p=0.02$). Flexibility increased from pre to post for 3-min and 5-min warm-up conditions, however, decreased for 8-min warm-up conditions. Vertical jump increased for 3-min conditions and decreased for 5-min and 8-min conditions. There were significant duration main effects for HR ($p<0.03$); time main effects for HR ($p<0.01$), SBP ($p<0.01$), and DBP ($p<0.01$); duration*time interaction for HR ($p<0.01$) and intensity*time interaction for SBP ($p<0.04$).

CONCLUSIONS: The findings of the study indicate that a 3-min duration of HIIT style warm-up may be enough to physically prepare individuals to improve flexibility and vertical jump. In addition, the data also suggests that the required/recommended duration for a warm-up protocol to prepare the body may be shortened with HIIT style warm-up. Future studies should compare and contrast the efficacy of varying work to rest ratio of HIIT style warm-up with other warm-up protocols to determine the most effective warm-up protocol.

779 Board #13 May 29 2:00 PM - 3:30 PM
Performance Recovery In Army Reserve Officer Training Corps Cadets Following A Bout Of High-Intensity Exercise

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(No relevant relationships reported)

PURPOSE: The aims of this study were to determine the time-course for recovery in Army ROTC cadets following a bout of high-intensity exercise, if sex differences for recovery exist, & examine the use of a countermovement jump (CMJ) as a measure of fatigue & muscle damage.

METHODS: 10 male (M) & 9 female (F) ROTC cadets performed high-intensity interval resistance (HIIR) exercise using their 10RM for 3 sets of 8 resistance exercises (Chest press, leg press, lat pull, etc.) w/60s work:60s rest. Soreness ratings (100mm VAS) & perceived recovery status (PRS) were recorded prior to performing 5 countermovement jumps (CMJ). RPE (CR10 scale) was taken after each round. Immediately post-exercise, subjects performed 5 more CMJs. Thirty-minutes post exercise, subjects provided session RPE (sRPE). This protocol was used at baseline (BL), 24, 48 & 72 hrs post BL.

RESULTS: For M & F subjects, exercise performance was similar w/24, 48, & 72 hrs of recovery & all were > than BL (385.3-419.8 vs. 331.9 reps). CMJ relative peak power was > in M vs. F at all time points (47.2 vs. 33.7 W/kg, respectively) & decreased from pre-to-post at BL only for both M & F cadets (1.1% vs. 1.8%, respectively). Percent change in CMJ performance from pre-to-post did not differ between genders at any time point. Soreness ratings were > at 24H (27.2) versus BL (7.5) and 72H (12.3). Upper body soreness ratings were > than lower body soreness for BL (7.5 c 6.2), 24H (24.3 v 15.1) & 48H (16.8 v 10.1). M & F did not differ in soreness ratings. PRS was moderately correlated ($r = 0.484, 0.682, 0.503, 0.528$) with soreness ratings for BL, 24H, 48H, & 72H; sRPE did not differ between time points for all subjects (overall $\bar{x} = 8.3 \pm 0.7$). RPE increased from set 1 to set 3 (7.5 v 8.8, respectively). M & F did not differ in RPE for all sets.

CONCLUSIONS: ROTC cadets could recover 24H following a bout of HIIR exercise with no differences between M & F cadets. CMJ performance did not match the change in exercise performance. Soreness patterns were similar for M & F cadets for high-intensity exercise. PRS matched the pattern of soreness indicating it is associated with soreness rather than performance. More work is needed to understand the utility of CMJ for recovery monitoring in this population. Lastly, this type of resistance exercise protocol may be useful for improving muscle fitness in entry-level ROTC cadets.

780 Board #14 May 29 2:00 PM - 3:30 PM
Comparing Strength Outcomes Of An 8 Week Hift Intervention Vs 8 Week Traditional Weight Training.

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(No relevant relationships reported)

Jason Sartor¹, Justin A. DeBlauw¹, Brittany S. Hollerbach¹ and Katie M. Heinrich¹ ¹Kansas State University, Manhattan, KS

High-intensity functional training (HIFT) temporally combines aerobic and resistance exercise at relative high intensity levels. Functional workouts include varied exercises that simulate movements of daily living to improve overall fitness. Traditional weight training (TWT) focuses on progressive sets and repetitions of resistance exercise performed both with free weights and machines. Training includes both multi joint (squat) and single joint (arm curls) exercises to improve strength. With comparison Data of these interventions' individuals can obtain a better understanding of expected fitness outcomes for HIFT and TWT.

PURPOSE: To compare effects of HIFT and TWT on power, strength and muscular endurance in college students.

METHODS: Participants (n = 95) were enrolled in 8-week TWT or HIFT fitness classes. Baseline and posttest measures were completed by 83 participants (87.4%; TWT: N = 35, age = 22.6 ± 4.11 years, body mass = 78.3 ± 21.4kg; HIFT: N = 48, age = 21.2 ± 3.1 years; body mass = 77.2 ± 14.6kg). After completing a standardized warm-up, participants completed measures testing lower body muscular power (vertical jump), strength (handgrip dynamometer), and muscular endurance (2-minute timed push-ups and 1-minute body weight squats). Within (paired) and between (independent with change scores) samples t-tests were conducted using SPSS 25.

RESULTS: Significant improvements were seen for squats in both groups (HIIT +3.9 \pm 5.5 reps, $t = 4.86$, $p < .001$; TWT +3.8 \pm 5.3 reps, $t = 4.29$, $p < .001$) and push-ups in TWT (+4.3 \pm 4.5 reps, $t = 5.67$, $p < .001$). No significant changes were found for power or strength. Independent samples t-tests revealed no significant differences between groups.

CONCLUSIONS: After 8-weeks of either HIIT or TWT participants significantly improved muscular endurance, with no significant differences between groups. More direct measures of strength (e.g., 1 rep max testing) should be examined in future research along with longitudinal changes in fitness comparing different training modalities.

781 Board #15 May 29 2:00 PM - 3:30 PM
Effect Of Ethnicity On Change In Vo2max And Substrate Oxidation In Response To HIIT

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 (No relevant relationships reported)

Introduction: About 20% of adults meet the 2008 Physical Activity Guidelines and this lack of physical activity increases individuals' risk of heart disease, stroke, type-2 diabetes, and certain cancers which increases morbidity and all-cause mortality. Typically, moderate intensity continuous training (MICT) is prescribed to clients to improve overall fitness and health status, although a primary barrier to regular physical activity among sedentary individuals is lack of time. An alternative to MICT is high intensity interval training (HIIT) which significantly increases VO₂max and fat oxidation, in turn improving exercise capacity and reducing health risks. One widely ignored aspect of individual response to exercise training is ethnicity, as there are minimal data examining the effect of ethnicity on responses to exercise training. **Purpose:** To determine if ethnicity alters adaptation to low volume HIIT in sedentary women. **Methods:** Inactive, non-obese women (age and VO₂max = 24.3 \pm 4.1 yr and 29.1 \pm 2.1 mL/kg/min) participated in 9 sessions over a 3-week period of cycling-based HIIT (8-10 1-minute bouts at 85% PPO interspersed with 75-sec recovery at 10% PPO). Participants were Caucasian (C) (n=6) or Hispanic (H) (n=4). To assess VO₂max, the initial work rate began at 30 or 40 W for 2-min followed by a 15 or 20 W/min increase in power output until volitional exhaustion. To assess substrate oxidation, a 6-min warm up began at 10% PPO and subsequently work rate increased by 10% PPO every 5-min during 4 remaining stages. These variables were measured pre- and post-training. **Results:** Training elicited a HR equal to 88-94% HRmax. Data showed an increase (p=0.016) in VO₂max in C (30.5 \pm 1.3 vs 32.6 \pm 3.9 mL/kg/min, +7%) and H (27.7 \pm 2.8 vs 31.7 \pm 2.6 mL/kg/min, +14%) with no significant groupXtime interaction (p=0.35). There was a significant trainingXboutXgroup interaction for fat oxidation (p=0.005), carbohydrate oxidation (p=0.009), and RER (p=0.000). Data showed an increase in the rate of fat oxidation and a reduction in carbohydrate oxidation in response to training which differed based on ethnicity. **Conclusion:** These data show HIIT induces significant increases in VO₂max which are slightly higher in H vs C. In addition, ethnicity seems to mediate changes in substrate metabolism after interval-based exercise.

782 Board #16 May 29 2:00 PM - 3:30 PM
High-Intensity Interval Training Does Not Induce Anti-Inflammatory Changes in Healthy Men

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Low-grade inflammation is associated with the risk of various chronic diseases, and the protective effects of a physically active lifestyle may be partially ascribed to the anti-inflammatory effects of exercise. The impact of moderate intensity exercise training on circulating pro-inflammatory molecules has received much attention in recent years. However, there are very few well designed and adequately powered studies on the influence of high-intensity interval training (HIIT) on circulating markers of inflammation. **Purpose:** The purpose of this study was to examine potential changes in plasma concentrations of C-reactive protein (CRP), interleukin-6 (IL6), and soluble interleukin-6 receptor (sIL6r) following four (4w) and eight weeks (8w) of HIIT in healthy men. **Methods:** Healthy, sedentary men participated in a HIIT program three days/week for eight weeks. Training bouts were modeled after the traditional Wingate test, consisting of repeated, 30-second bouts of maximal intensity cycling separated by 4.5 minute rest intervals. Training began with three bouts per day and an additional bout/day was added to the regimen every two weeks, progressing up to six bouts per day in the final two weeks. Plasma concentrations of CRP, IL6, and sIL6r were assessed by ELISA at baseline, 4w, and 8w. Statistical comparisons across the three time points were done using repeated measures ANOVA. Variables that deviated from normality were log transformed prior to analysis. Significance was set to p<0.05. **Results:** 21 men (age: 25 \pm 5 yrs, BMI: 26.7 \pm 6.2 kg/m²) completed the study. No significant changes were observed for CRP during training (baseline: 1.5 \pm 2.3, 4w:

1.0 \pm 1.4, 8w: 2.2 \pm 3.0 mg/L, p>0.05). Likewise, IL6 (baseline: 1.4 \pm 1.6, 4w: 1.6 \pm 1.7, 8w: 1.2 \pm 2.2 pg/ml) and sIL6r (baseline: 36.2 \pm 23.9, 4w: 27.8 \pm 22.0, 8w: 32.6 \pm 22.2 ng/ml) did not change with training (all p>0.05). **Conclusion:** Though it has been suggested that HIIT may reduce inflammation, results of the present study do not indicate HIIT influences specific inflammatory mediators in healthy young men. Future research should explore the potential anti-inflammatory benefits of HIIT in different populations and disease states.

783 Board #17 May 29 2:00 PM - 3:30 PM
Mots-c Plasma Levels Following A Single Session Of MICT And HIIT

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Acute moderate intensity continuous training (MICT) and high-intensity interval training (HIIT) result in increased mitochondrial transcriptional activity. The mitochondrial open reading frame of the 12S rRNA-c (MOTS-C) is a peptide encoded from mitochondrial DNA. This mitochondrial derived peptide can regulate skeletal muscle glucose uptake and fatty acid beta-oxidation. However, it is not known if MOTs-C concentrations are altered following an acute bout of MICT or HIIT. **PURPOSE:** The present study investigated the effects of acute MICT and HIIT on MOTs-C levels in plasma pre- and 3 hours post-exercise. **METHODS:** Ten recreationally active (> 150 min moderate-vigorous intensity aerobic activity per week \geq 1 year) males (n=5; age 25.2 \pm 1.1, VO₂max 48.0 \pm 4.9 mL/kg/min) and females (n=5; age 21.6 \pm 3.6, VO₂max 39.4 \pm 7.7 mL/kg/min) were conveniently recruited for an initial study conducted at the UNM Exercise Physiology Laboratories. The original study, and the current expanded exploration were approved by the institution's Institutional Review Board (IRB). Participants completed a health history, and physical activity history questionnaire. Based on criteria from the American College of Sports Medicine, all participants were considered low-risk. Utilizing a crossover design subjects performed an acute bout of MICT and HIIT exercise on a treadmill. The MICT bout consisted of 60 minutes at 55% of maximum velocity (Vmax) achieved during the VO₂max test and the HIIT trial required two sets of 6 x 1-min bouts at 100% Vmax, with 5 minutes recovery at 3 MPH between sets. Trials were conducted at least 72 hours apart in randomized order and in a fasted state. Plasma samples were collected during a previously conducted study and frozen for future analysis. MOTs-C was measured from the previously collected samples obtained pre- and 3 hours post-exercise using an enzyme-linked immunosorbent assay. **RESULTS:** There were no significant changes in plasma MOTs-C (p = 0.21) from pre to post-exercise for MICT (220.4 \pm 62.9 vs 248.4 \pm 45.2 ng/ml, respectively) or HIIT (p = 0.38) (227.9 \pm 62.4 vs 246.9 \pm 75.9 ng/ml, respectively). **CONCLUSION:** Our findings show plasma MOTs-C does not increase in response to a single session of MICT or HIIT.

784 Board #18 May 29 2:00 PM - 3:30 PM
Effects of Heart Rate Variability Modulation on High Intensity Functional Training Strength Outcomes

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PURPOSE: High Intensity Functional Training (HIFT) involves completing concurrent aerobic and resistance training functional movements at high intensity with the goal of increased fitness. We examined the effectiveness of using daily heart rate variability (HRV) status to modulate training intensity and increase performance outcomes. We hypothesized that HRV modulation for HIFT would facilitate strength improvements. **METHODS:** Participants (N = 55) were healthy, untrained or recreationally trained adults not participating in a structured exercise program. Participants were randomly assigned to either HIFT (n = 29, age = 24.1 \pm 4.1 years, 41.4% male) or HIFT-HRV (n = 26, age = 23.7 \pm 4.5 years, 53.8% male) groups. Both groups underwent an 11-week training protocol which included: 2-weeks baseline HRV collection, baseline, midpoint, and post-intervention anthropometric and fitness assessments, and 6 weeks of HIFT, 5 days/week. All participants recorded their HRV daily via validated mobile app throughout the study. HIFT-HRV participants' exercise was modulated by reducing rate of perceived exertion based on their daily HRV statuses. Maximal strength was tested using the squat, overhead press, and deadlift in kg at baseline, midpoint, and post-intervention. **RESULTS:** There were no differences in intervention fidelity between groups, which included adherence to HIFT (p = .21) and providing daily HRV data (p = .75). The HIFT-HRV group had their training modified 17.12 \pm 6.75 days. Additionally, one-way RM-ANOVAs indicated significant increases in the squat (HIFT = +14.10 \pm 1.63 kg, F = 55.38, p < .001; HIFT-HRV =

+13.25 ± 1.77, $F = 50.87$, $p < .001$), overhead press (HIFT = +3.75 ± .93, $F = 11.82$, $p < .001$; HIFT-HRV = +4.37 ± .87, $F = 10.72$, $p < .001$), and deadlift (HIFT = +15.40 ± 2.51, $F = 28.7$, $p < .001$; HIFT-HRV = +15.62 ± 2.75, $F = 27.7$, $p < .001$) within each group. Independent samples t -tests showed no differences in strength ($p = .41-.99$) between groups. **CONCLUSIONS:** Results suggest that HIFT-HRV produced equal increases in strength while having reduced training intensity for over half of the training days. HRV appears to be an effective means of modulating HIFT to increase strength outcomes.

785 Board #19 May 29 2:00 PM - 3:30 PM

Differences in Physiological Demands Between Common High-Intensity Interval Training Protocols

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PURPOSE: The definition of high-intensity interval training (HIIT) is broad, with no accepted procedure for classifying HIIT protocols with different workloads and work and recovery interval times. Additionally, little is known about the differences in training load and recovery between common HIIT protocols. The purpose of this study was to evaluate the differences in acute physiological demands and perceived difficulty between three common HIIT protocols.

METHODS: Eight participants completed the following training sessions on a cycle ergometer in a randomized order, with at least one week between sessions: 4 x [30-sec all-out, 4-min active recovery], 12 x [1-min 100% $\dot{V}O_{2max}$, 1-min 50% $\dot{V}O_{2max}$], and 4 x [4-min 90% $\dot{V}O_{2max}$, 3-min 60% $\dot{V}O_{2max}$]. Metabolic variables and HR were measured throughout exercise and 30-min of recovery. Training impulse and session-RPE were also determined.

RESULTS: There were significant differences during exercise in total O_2 consumption between the 30-sec and 1-min ($ES = -3.4$, $p < 0.001$), and 30-sec and 4-min ($ES = -3.4$, $p < 0.001$) protocols, average $\dot{V}O_2$ between 30-sec and 1-min ($ES = -2.6$, $p < 0.001$) and 30-sec vs. 4-min ($ES = -1.9$, $p < 0.001$) protocols, average HR between 30-sec and 1-min ($ES = -1.3$, $p = 0.007$) and 30-sec and 4-min ($ES = -1.3$, $p = 0.02$) protocols, and blood lactate between 30-sec and 1-min ($ES = 0.9$, $p < 0.001$) and 30-sec and 4-min ($ES = 1.0$, $p < 0.001$) protocols. There was a difference in training impulse between 30-sec and 4-min protocols ($ES = 1.5$, $p = 0.009$). There were no significant differences in peak $\dot{V}O_2$ or peak HR attained during the protocols, or in session-RPE reported after the protocols. There were no differences in $\dot{V}O_2$ or HR after 5-min or 30-min of recovery. Blood lactate was only significantly higher after 30-min of recovery from the 30-sec compared to the 4-min ($ES = 1.3$, $p = 0.001$) protocol.

CONCLUSIONS: These findings show several differences, but also some similarities, in the acute physiological demands from HIIT protocols. However, differences in total metabolic work, average intensity, and training load did not result in differences in $\dot{V}O_2$ or HR during recovery or in the perceived difficulty of these protocols. These factors should be accounted for when planning training sessions or research studies, or when interpreting past research.

B-54 Free Communication/Poster - Running

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

786 Board #20 May 29 2:00 PM - 3:30 PM

Relationship Between Running Bio-mechanics, Hip Mobility, And Knee Injury Risk In Division III Runners.

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(No relevant relationships reported)

Introduction: Hip mechanics influence foot strike patterns while running (Valenzuela et al., 2015) **Objective:** To observe the relationship between foot strike and sagittal plane passive hip range of motion in runners, as a surrogate for their risk for patellofemoral pain (PFP). **Methods:** Ten participants (20.5 ± 1.75 years) completed FMS testing and were rated by one certified tester. Participants' passive hip flexion and extension ranges of motion (ROM) were measured via goniometry. Then, reflective markers were placed at the lateral knee, lateral malleolus of fibula, and 5th metatarsal to define relative ankle angles. Participants ran at 3 different speeds and were filmed from the sagittal plane on both sides. Angles were analyzed on Dartfish software. **Results:** Hip flexion ($p = 0.08$, $r = 0.57$) and extension ($p = 0.17$, $r = 0.47$) were not significant predictors of dorsiflexion angles. Runners with pain/tightness experienced reduced hip extension ROM by 10.5% and had increased hip flexion ROM by 13.6% than runners without pain/tightness. The deep squat (DS) significantly predicted right hip flexion ($p = 0.02$, $r = -0.71$), but not left ($p = 0.12$, $r = -0.51$). Runners with pain/

tightness scored 1.75 on the DS, which was 12.5% lower than normative values.

Discussion: As passive hip sagittal plane ROM increased, the ankle angles increased, indicating a trend towards a more mid-forefoot strike, decreasing stress on the knee. Anterior hip tightness showed to decrease extension ROM, but not flexion ROM. The DS is sensitive to self-reported pain/tightness. **Conclusion:** For DIII runners, passive hip flexion and extension ROM were not significant predictors of foot strike type, runners with pain/tightness had presented changes in hip ROM and lower scores on the FMS DS.

787 Board #21 May 29 2:00 PM - 3:30 PM

Lower Extremity Stiffness in Collegiate Distance Runners Pre- and Post-Competition

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(No relevant relationships reported)

During running, the lower extremities are compared to a spring due to their ability to store and release energy. Recent evidence suggests a relationship between increased lower extremity stiffness and enhanced athletic performance, specifically in distance running. Current literature lacks information on the influence of fatigue on leg stiffness across multiple days in response to competition. **PURPOSE:** To determine how leg stiffness in runners was influenced in the 24- and 48-hour period following a cross country race. **METHODS** Twenty-two collegiate cross-country runners (13 M, 9 F, 19.5 ± 1.4 y) were recruited and participated. Leg stiffness was assessed 24h before a race and 24h and 48h post-race. Participants performed three static jumps (SJ) and three countermovement jumps (CMJ) on two force plates (AMTI Optima OPT464508; Watertown, MA; 1000 Hz). During each jump, participants held a dowel across the shoulders to prevent arm swing. Participants then performed a hop test (HT) where they completed 10-s of straight leg maximal hopping in sync with a metronome (2.2Hz). Leg stiffness was calculated, in agreement with previously reported methods, from the vertical ground reaction force of the 5th-7th hop of the HT. Repeated measures ANOVA and post-hoc analysis were used to assess significance ($p \leq 0.05$).

RESULTS: A significant main effect was found for SJ height, CMJ height and leg stiffness. Leg stiffness was significantly reduced 24h post-race (pre-race 36.84 ± 4.96 kN · m⁻¹, 24h post 33.11 ± 8.05 kN · m⁻¹, $p = 0.05$) and then increased significantly from 24h post-race to 48h post-race (36.84 ± 6.88 kN · m⁻¹, $p = 0.015$). No significant differences were found in post-hoc analysis for CMJ height (pre-race 30.81 ± 5.79 cm, 24h post-race 29.89 ± 6.06 cm, 48h post-race 31.44 ± 6.47 cm, $p > 0.05$) and eccentric utilization ratio (pre-race 1.24 ± 0.10, 24h post-race 1.20 ± 0.10, 48h post-race 1.22 ± 0.10, $p > 0.05$). SJ height increased significantly from 24h to 48h post-race (24h post-race 25.99 ± 5.65 cm, 48h post-race 27.19 ± 5.63 cm, $p > 0.05$). **CONCLUSION:** Following a cross country race leg stiffness significantly declined in a group of collegiate runners 24 hours post-race but returned to baseline 48 hours post-race. Sport scientists and coaches may be able to monitor leg stiffness as a metric to properly prescribe training regimens.

788 Board #22 May 29 2:00 PM - 3:30 PM

Physiological Correlates With 300 And 1000 M Performance In U14 Athletes

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(No relevant relationships reported)

Physiological correlates with 300 and 1000 m performance in U14 athletes.

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Abstract

PURPOSE: To determine the contribution of selected field tests physiological parameters with running performance in U14 track athletes.

METHODS: Fifteen trained U14 young track and field athletes (12 girls and 3 boys, 12-13 years old) participated in the study. During the first and second visit after anthropometry the athletes performed a 20 m Shuttle Run Test, a RAST (Running Anaerobic Speed Test), a vertical squad jump and a 40 m maximal effort to determine aerobic, anaerobic capabilities and leg explosive strength. The 300 and 1000 m time trial followed. All maximal tests were performed at least three days apart. Pearson's r and Stepwise Multiple Linear Regression were used for the correlation between maximal O_2 uptake ($\dot{V}O_{2max}$), velocity at $\dot{V}O_{2max}$ ($v\dot{V}O_{2max}$), maximal heart rate (HR_{max}), minimal, maximal and mean relative power output values ($P_{min_{RT}}$, $P_{max_{RT}}$ and $P_{mean_{RT}}$, respectively), squat jump (SJ), maximal running speed (V_{max}), body mass (BM), body height (BH), %body fat (%BF) and the time trials 300 (t300m) and 1000 m (t1000m).

RESULTS: Univariate relationships showed significant correlations between t1000m and $\dot{V}O_{2max}$ (-0.866 , $p < 0.01$), $v\dot{V}O_{2max}$ (-0.899 , $p < 0.01$), $P_{min_{RT}}$ (-0.519 , $p < 0.05$), $P_{mean_{RT}}$ (-0.568 , $p < 0.05$), SJ (-0.606 , $p < 0.05$), BM (0.770 , $p < 0.01$) and %BF (0.698 , $p < 0.01$). Furthermore, t300m significantly correlated with $P_{max_{RT}}$ (-0.553 ,

$p < 0.05$), $P_{min_{RT}}$ (-0.579 , $p < 0.05$) and $P_{mean_{RT}}$ (-0.670 , $p < 0.01$). Stepwise Multiple Linear Regression showed that the best predictor variables for t_{1000m} in U14 were vVO_{2max} , $P_{mean_{RT}}$, BM and $P_{max_{RT}}$ ($t_{1000m} = 444.229 - 15.857 \cdot vVO_{2max} - 37.105 \cdot P_{mean_{RT}} + 1.270 \cdot BM + 23.042 \cdot P_{max_{RT}}$, Adjusted $R^2 = 0.948$, $P < 0.001$, $SEE = 6.86$ s), while the single predictor variable for t_{300m} was $P_{mean_{RT}}$ ($t_{300m} = 81.805 - 5.276 \cdot P_{mean_{RT}}$, Adjusted $R^2 = 0.406$, $P = 0.006$, $SEE = 3.97$ s).

CONCLUSIONS: The moderate to high correlations shown in the present study between t_{1000m} and t_{300m} and the selected parameters can predict with acceptable accuracy 1000 m and 300 m in young runners and can be used to estimate performance.

789 Board #23 May 29 2:00 PM - 3:30 PM Effects of Pulsed Electromagnetic Field Application on Aerobic Performance in Runners During Short-Term Altitude Training

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(No relevant relationships reported)

Pulsed Electromagnetic Field (PEMF) application increases microcirculation throughout the body and has been shown to be beneficial in clinical populations. In athletic populations, PEMF is used to improve recovery. Altitude training has long been used by endurance athletes to improve sea-level performance. **PURPOSE:** To determine if recovery with PEMF during altitude performance leads to greater improvements in VO_{2peak} and ventilatory threshold (VT) in cross-country runners. **METHODS:** Fourteen male NCAA cross-country runners (age: 19.07 ± 0.92 y.o.) with initial VO_{2peak} of 73.13 ± 5.65 ml/kg/min participated in the study. Subjects were randomly assigned either to the PEMF intervention (INT) ($n=8$) or to a control group (CON) ($n=6$). VO_{2peak} and VT were evaluated using a metabolic cart at sea-level, pre- and post-training. Runners from sea level traveled to high altitude where they lived at 1322m above sea-level for 6 days. Six training sessions were performed at altitudes ranging from 881.25 ± 148.87 m to 1047.70 ± 237.29 m above sea-level with training sessions averaging a duration of 75.25 ± 7.04 mins, speed of 13.02 ± 1.60 kmph and distance of 16.42 ± 2.95 km. Subjects in INT received PEMF application prior to and after training, while subjects in CON did not. **RESULTS:** There was no significant difference in either absolute or relative VO_{2peak} . A main-effect of time was found for absolute VT ($p < 0.01$), which changed from 3.35 ± 0.52 L/min to 3.89 ± 0.55 L/min, and VT relative to VO_{2peak} ($p < 0.01$), which changed from $73.10 \pm 1.60\%$ of VO_{2peak} to $87.08 \pm 1.82\%$ of VO_{2peak} . There was no significant difference between groups for absolute VT ($p = 0.24$) however, the INT group displayed a positive-trend for VT relative to VO_{2peak} (INT: 18.28% , CON: 9.68% ; group*time $p = 0.07$). Consequently, there was a main effect of time for heart-rate at VT ($p = 0.02$), which changed from 168.10 ± 3.25 bpm to 175.34 ± 3.49 bpm, with no difference between groups (group*time $p = 0.11$). **CONCLUSION:** While altitude training showed some positive adaptations in cross-country runners, the addition of PEMF did not improve these adaptations significantly. This can be attributed to the short duration of application, since a positive-trend was found for VT relative to VO_{2peak} . PEMF could have beneficial effects when combined with a longer duration of altitude training.

790 Board #24 May 29 2:00 PM - 3:30 PM The Effects of Hip Tightness on Running Mechanics and the FMS Deep Squat in DIII Track & Field Runners

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Introduction: Running requires rapid hip movements. Increasing running speeds place increased loads on hip flexor and extensor muscles (Schache et al., 2011). It is unclear whether Division III track and field athletes with self-reported hip tightness would present altered sagittal plane hip mechanics while running and functional limitations when performing the Functional Movement Screen (FMS) deep squat. **Objective:** To investigate the relationship between hip tightness, as measured by the Functional Movement Screen (FMS) deep squat (DS), and running mechanics, as measured by the peak flexion and extension angles in Division III Track & Field athletes. **Methods:** Ten subjects completed the FMS DS and were filmed from both sides while running on a treadmill at 3 different speeds. Reflective markers were placed on the greater trochanter and lateral epicondyle of the femur. Absolute peak flexion and extension angles were obtained using Dartfish software. **Results:** DS was not a significant predictor of running mechanics. There were moderate positive correlations between peak hip flexion angles and DS. DS scores of 1 were associated with increased hip flexion ROM and decreased extension, especially on the left side. Runners who reported hip tightness had higher

average DS scores. **Conclusion:** Self-reported hip tightness group showed earlier toe-off and increased flexion ROM during swing phase. Differences between groups are greater in hip extension.

Findings also suggest asymmetries in the non-affected side for the tightness group. Future studies could investigate these changes in running mechanics in different planes of motion and injury prevalence in runners with self-reported hip tightness.

791 Board #25 May 29 2:00 PM - 3:30 PM Prevalence And Spectrum Of Electrocardiogram Abnormalities In Amateur Marathon Runners

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PURPOSE: The purpose of this study was to assess the prevalence and the spectrum of electrocardiogram (ECG) abnormalities in amateur marathon runners.

METHODS: The participants of this study were contestants who participated in Hangzhou marathon (full marathon or half marathon) in 2015 and 2016. 12-lead ECG data of 24,210 amateur marathon runners aged 18-70 were included for analysis. The prevalence of ECG abnormalities were calculated and Chi square test was applied to compare the prevalence between different gender, age, weight status and sports performance groups. Logistic regression was utilized to determine the odds ratios of having certain ECG abnormalities in runners with good performance as compared with the runners with poor performance.

RESULTS: Sinus bradycardia and sinus arrhythmia were found in approximate 15% and 5% of participants. Prevalence of left ventricular high voltage, T wave change and right axis deviation are also higher than 1%. Runners with better performance had higher odds ratios to have sinus bradycardia, left ventricular high voltage, right ventricular high voltage and atrioventricular block (AVB).

CONCLUSIONS: Sinus bradycardia, sinus arrhythmia and left ventricular high voltage are the most common ECG abnormalities in amateur marathon runners. Sinus bradycardia and ventricular high voltage could be physiological adaptation after long-term marathon training, but ST-T change and axis deviation are not training-related ECG abnormalities.

792 Board #26 May 29 2:00 PM - 3:30 PM Running Economy of Highly-Trained Distance Runners in Marathon Racing Shoes compared to Track Spikes

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(No relevant relationships reported)

Running economy represents a complex interplay of physiological and biomechanical factors that are able to adapt chronically through training or acutely through other interventions such as changes in footwear. The Nike Vaporfly (NVF) shoe was designed for marathon running on the roads and has been shown to improve running economy by ~4% compared to other marathon shoes, however, during track racing distance runners traditionally wear a much lighter shoe with an embedded spike plate around the forefoot. **PURPOSE:** To determine if, and to what extent, the NVF shoes improve running economy compared with established track spikes (SPIKE) and marathon racing shoes (MAR). **METHODS:** 24 highly-trained runners (12 male, 12 female) ran 4x5 min trials on a treadmill while wearing each of the four shoe conditions: NVF, SPIKE, MAR, and the NVF matched in weight to the MAR shoe (NVF+), during three separate visits: (Visit 1) familiarization; (Visit 2) 14 and 18 km·h⁻¹ run for men, 14 and 16 km·h⁻¹ for women; (Visit 3) 16 km·h⁻¹ run for men, 15 km·h⁻¹ for women plus a VO_{2max} test for both genders. We measured rates of oxygen uptake (VO_2), carbon dioxide production (VCO_2) and biomechanical measures (stride rate, contact time, stride length, flight time) were made at each run velocity and shoe condition. Differences in running economy while running in the four shoe conditions over three velocities was assessed using a two-way ANOVA with repeated measures. Multiple regression analyses were used to evaluate potential relationships between changes in biomechanical measures and running economy. **RESULTS:** The NVF shoe improved running economy by $2.6 \pm 1.3\%$ compared to SPIKE, $4.2 \pm 1.2\%$ compared to MAR, and $2.9 \pm 1.3\%$ when matched in weight of the MAR shoe. Among the 24 subjects, the difference in running economy over the four velocities between the NVF and SPIKE shoes ranged from +0.50 to -5.34% and from -1.72 to -7.15% for NVF versus MAR. Correlations between changes in running economy and changes in biomechanical variables were either trivial or small ($r < 0.27$) but unclear. **CONCLUSION:** The NVF enhanced running economy compared to track spikes and marathon shoes and should be considered a viable shoe option for track and road racing.

793 Board #27 May 29 2:00 PM - 3:30 PM
Influence of Body Weight, FMS, & Summer Training on Mile Run Performance in Endurance Runners

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PURPOSE: Anthropometrics, summer training volume, and functional movement including unilateral strength, flexibility and coordination have all previously been linked to athletic performance. The purpose of the current investigation was to determine the best predictor of mile time trial performance in division III cross country runners across the variables of body weight, functional movement screen (FSM), and total volume of miles run in the 14 weeks leading up to the start of the cross country season. **METHODS:** 31 subjects (M=22, F=9) aged (20 +/- 2 yrs) on a division III collegiate cross country team were asked to record and report summer mileage each week for the 14 weeks preceding the start of the season. Additionally, FMS tests were conducted on all subjects, as well as body weight measurement within the first week of the season. All subjects also completed a mile time trial run concomitantly. A multiple regression analysis was utilized to determine if FMS score, pre-season mileage, and/or body weight were significant predictors of mile time trial performance. **RESULTS:** The overall regression analysis revealed that FMS, body weight, and summer mileage were significant predictors of mile time trial performance ($r = .41$; $p < .05$). When covaried out, body weight was not significantly ($p > .05$) correlated with mile time trial performance for males or females ($r = .35$, $r = .27$, respectively). Summer mileage was statistically significant ($p < .05$) to mile time trial results. Lastly, FMS testing was deemed not significant ($p > .05$) towards mile time trial performance. **CONCLUSIONS:** Summer running volume, as recorded in the 14 week period leading up to the cross country season is the best predictor of performance when compared to anthropometric data as well as functional movement screening. Cross country athletes should focus on utilizing the progressive overload principle to gradually increase running volume over the summer months in order to maximize in season performance.

794 Board #28 May 29 2:00 PM - 3:30 PM
The Effect of Plyometric versus Muscular Endurance Training on Cross Country Time Trial Results

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PURPOSE: Traditionally, endurance runners have supplemented aerobic training with muscular endurance training. Recent research has suggested that plyometric training improves running efficiency and endurance performance, and hence may be a more effective option in comparison to muscular endurance training. The purpose of the current investigation was to compare the effect of a plyometric and power intervention to a muscular endurance intervention on running performance in division III male and female cross country runners. **METHODS:** Both plyometric and muscular endurance training groups were assigned using stratified selection based on 2-mile time trial results completed during the first week of cross country practice. Subjects (N=46; M=29, F=17) participated in a 9 week intervention in conjunction with the cross country season. The muscular endurance group participated in exercises with a high repetition, low intensity scheme, while the plyometric/ power group participated in explosive exercises with a low repetition, high intensity scheme. To ensure equal training time, proper technique, and safety, researchers coached both groups during each training session. An unpaired t-test was utilized to determine if significant differences existed in cross country race finish time based on group assignment. **RESULTS:** The unpaired t-test revealed there was no significant difference ($T = 1.68$, $p > .05$) in race time to completion for the plyometric group compared to the muscular endurance group (27:12 +/- 3:08 vs 27:32 +/- 5:40, respectively). **CONCLUSIONS:** The plyometric/ power group was not significantly faster when compared to the muscular endurance group. However, on average the plyometric group was 20 seconds faster when compared to the muscular endurance group. Future interventions may need to be longer than nine weeks in order to elicit significant positive adaptations in endurance running as a result of the supplementation of plyometric training.

795 Board #29 May 29 2:00 PM - 3:30 PM
Relationship Between Hemoglobin Saturation and Performance in Collegiate Cross Country Runners

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PURPOSE: Hemoglobin is essential for proper transportation of oxygen in the blood to muscles within the body. This is of especial importance and focus within endurance athletics as effects on performance can vary based on the level of hemoglobin saturation. Previous research mainly focused on the significance of higher hemoglobin levels improving performance, while the significance of negative effects from low levels is still of equal importance. The purpose of this study was to investigate the relationship between hemoglobin saturation and running performance in collegiate division III cross country runners.

METHODS: Hemoglobin saturation level was measured by capillary puncture and analyzed with a hemoglobin meter and test cartridges of 34 collegiate cross country runners (11 females, 23 males). Endurance performance was measured by two-mile time trial in minutes. A linear regression analysis was utilized to show the relationship between levels of hemoglobin saturation and time trial performance. Further, a one sample t-test was utilized to compare the averages of males classified with low levels of hemoglobin saturation and those in the normal range.

RESULTS: There was no significant correlation between hemoglobin saturation and two-mile time trial performance for both males ($R = .268$; $p > .05$) and females ($R = .282$; $p > .05$). Subjects were also classified as low hemoglobin if values were < 12.0 mg/dL for females, and < 13.0 mg/dL for males. Male subjects classified within the standard levels (mean = $10.4870 \pm .817599$ min) had significantly faster ($t(15) = -3.126$; $p = .007$) two-mile times in comparison to subjects who were below this standard (mean = 11.12586 min) with a mean difference of .638860 min.

CONCLUSIONS: Hemoglobin saturation levels are important in cross country athletes. The relationship, however, is more important and significant when saturation levels go below the normal range compared to those within the range. Runners categorized as low in hemoglobin saturation see significant decreases in performance for two-mile time trials compared to those in the normal range.

796 Board #30 May 29 2:00 PM - 3:30 PM
Functional Movement Screen Scores of Division III Cross-Country and Track and Field Runners

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The functional movement screen (FMS) is a battery of seven fundamental movement patterns that include the Deep squat (DS), hurdle step (HS), in line lunge (ILL), shoulder mobility (SM), active straight leg raise (ASLR), trunk stability push up (TSPU), and rotary stability (RS) (Cook et al., 2006). FMS tests are scored on a 0 to 3 scale, for a composite score of up to 21 points. **PURPOSE:** To describe the FMS scores of DIII cross-country and track and field athletes and compare them to normative values for experienced distance runners, as reported by Agresta (2014).

METHODS: Ten NCAA Division III cross-country and track and field athletes (6 sprinters and 4 distance runners) were screened by one level 1 FMS certified tester. **RESULTS:** Mean DS was 1.9 (SD=0.57), mean HS was 1.7 (SD=0.48), mean ILL was 2.1 (SD=0.57), mean SM was 2.4 (SD = 1.07), mean ASLR was 2.4 (SD=0.84), mean TSPU was 2.6 (SD=0.7), and mean RS was 1.9 (SD =0.32). The mean composite score was 15 (SD = 1.76). When compared to the normative values established by Agresta (2014), DIII runners scored higher on SM by 25%, ASLR by 12.5%, TSPU by 24.2%, RS by 21.1%, and total FMS score by 12.7%. Results were the same for DS and ILL and lower on the HS by 5.9%. **DISCUSSION:** Despite having higher mean scores than the norm, three individuals had composite scores below the suggested threshold of 14 (Kiesel, 2007, Chorbá, 2010, Hotta, 2015) and eight participants had scores of one and zero in individual tests, suggesting that the composite score alone is not sensitive enough to capture these asymmetries/imbbalances. Overall scores were higher than the normative values by Agresta (2014), but similar to mean composite values of 16.4 for young adult runners reported by Loudon et al. (2014). **CONCLUSIONS:** The mean composite score for DIII Cross-country and track and field runners was 12.7% higher than the scores for experienced runners in Agresta (2014). Future studies should continue to establish normative values for NCAA DIII cross-country and track and field runners.

- 797** Board #31 May 29 2:00 PM - 3:30 PM
Can High Intensity Interval Training Effect Division I College 800/1500m Runner's Performance
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HITT is a common training method incorporated for all fitness levels and been shown to improve athlete performance. However, these results were shown in sedentary and recreationally active populations and little research has been done with the Division I collegiate athlete population. **PURPOSE:** This study questioned whether HITT could increase performance within this level of athletes, specifically middle distance runners (800/1500 m).

METHODS: A total of six Division I Collegiate level (800/1500 m) runners completed the study (three males, three female). The participant completed four weeks of HITT, consisting on two HITT workouts per week. The HITT consisted of four 20-s Wingate tests with 4-min recovery between each. Both pre- and post- performance tests were completed, consisting of a run to volitional exhaustion, RPE, HR, which were collected on a treadmill. Stride length and stride frequency, were also measure during a 1500 m time trial on the track.

RESULTS: Significant differences were not found for performance pre- and post-training intervention, with respect to time to completion of the 1500 m time trial (pre-intervention: 5.0 ± 0.7 min; post-intervention: 4.8 ± 0.5 min; $p = 0.23$), and time to volitional exhaustion (pre-intervention: 20.1 ± 1.2 min; post-intervention: 19.7 ± 1.3 min; $p = 0.14$). RPE ($p = 0.64$), HR ($p = 0.09$), stride length ($p = 0.09$), and stride frequency ($p = 0.78$), showed no significant changes pre- and post-intervention.

CONCLUSIONS: HITT did not impact 800/1500 m middle distance runner's performance, suggesting it can maintain performance, providing alternative training methods.

- 798** Board #32 May 29 2:00 PM - 3:30 PM
Telomere Length, Lipid Profile and Body Composition of Master Sprinters and Endurance Runners
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BACKGROUND: Previous studies have shown that middle-aged Master Athletes have better body composition and lipid profile, as well as longer leukocyte telomeres compared to untrained peers. However, no comparisons were made with markers of biological aging, body composition, and metabolic health among athletes who performed different training regimens through life (ie, sprint / strength vs. resistance training).

PURPOSE: The telomere length, lipid profile and body composition were compared in sprinters and endurance runners from Master category.

METHODS: Middle-aged master athletes ($n=23$) with a minimal of 20 yrs of lifelong training in Track and Field were allocated according to their training specificity, being Sprinters ($n=12$; 49.41 ± 9.10 yr-old) and Endurance Runners ($n=11$; 55.45 ± 7.84 yr-old). Blood samples were collected after 8-hour fasting. Relative leukocyte telomere length was determined with qPCR analyses (T/S). The serum lipid profile was analyzed using commercial kits and body composition was predicted through skinfold measures.

RESULTS: Unpaired T-test revealed no differences between Sprinters vs Endurance athletes regarding to Leucocyte Telomere Length (T/S) [1.26 ± 1.01 vs. 1.11 ± 1.13 ($p=0.732$)], Body Fat (%) [12.32 ± 4.51 vs. 13.29 ± 4.49 ($p=0.612$)], Free Fat Mass (kg) [87.68 ± 4.51 vs. 86.70 ± 4.49 ($p=0.612$)], and lipid profile (mg.dL⁻¹) through Triglycerides [79.04 ± 51.28 vs. 120.20 ± 75.81 ($p=0.139$)], HDL [93.21 ± 28.66 vs. 70.41 ± 38.06 ($p=0.116$)], LDL [83.53 ± 76.34 vs. 125.59 ± 58.18 ($p=0.155$)] and Total Cholesterol [192.56 ± 72.85 vs. 220.04 ± 29.02 ($p=0.256$)].

CONCLUSION: For master athletes, regarding of whether they were trained lifelong in sprints or endurance, both training models revealed to be similar for the leukocyte telomere length and equally beneficial for lipids profile and body composition.

- 799** Board #33 May 29 2:00 PM - 3:30 PM
Can Your Face Affect Your Pace? The Impact of Facial Expression on Running Economy
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Running economy (RE) is an important performance metric for runners. It is determined by comparing the oxygen cost of steady state exercise at given running speeds across individuals. A recent study examined the physiological impact that facial expressions (smiling and frowning) had on RE compared to more traditional cognitive relaxation techniques. Smiling while running resulted in a 2.8% improvement in RE among a group of recreational adult runners. **PURPOSE:** The purpose of this study was to determine whether facial expression would impact RE in a group of aerobically trained collegiate athletes. **METHODS:** Twenty-four Division III collegiate athletes (females $n=14$) completed four 6-minute running blocks at 70% of $\dot{V}O_{2\max}$. The order of bouts was determined using a balanced Latin square design with each participant serving as his/her own control. Participants completed running blocks while smiling (Smile), frowning (Frown), relaxing their hands and upper bodies (Relax), and running as they "normally" would (Control). Cardiorespiratory responses were recorded continuously and participants reported perceived effort (RPE), affective valence (FS), and arousal (FAS) after each condition. Blood lactate was measured at the end of each block. Repeated measures analysis of variance was run on all primary variables with a significance level set a priori at 0.05.

RESULTS: There were no significant differences in RE between conditions (Smile 33.72 ± 4.4 , Frown 34.15 ± 4.08 , Relax 34.17 ± 4.12 , Control 34.16 ± 3.91 ml/kg/min, $p > 0.05$). Additionally, unlike previous research, there were no significant differences in RPE during smiling and frowning conditions (11.71 ± 2.56 vs. 11.82 ± 1.97 , $p = 0.71$). There were also no significant differences in affective valence, arousal, or blood lactate between all conditions. **CONCLUSIONS:** Among a group of aerobically trained collegiate athletes running at 70% $\dot{V}O_{2\max}$, smiling does not improve RE. However, future research should be conducted in order to discern what meaningful effect, if any, facial expression could have on psycho-physiological markers associated with running performance across a more diverse population.

- 800** Board #34 May 29 2:00 PM - 3:30 PM
The Changing Relationship Between Performance and Aging as the Duration of an Ultramarathon Increases
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PURPOSE: It is often said that increasing the distance of a race eliminates or reduces the age decline in performance. After, the age of 25 maximal oxygen consumption typically declines by 1% per year. If aging is not associated with impaired performance, it would suggest factors other than aerobic fitness become more important for racing extreme distances. **METHODS:** Data on finishing times, and age of participants was collected from Western States 161 km run (WSER) from 1974 through 2018. Age and mileage completed were collect from Across the Years 6 day race (ATY) from 2011 - 2017. **RESULTS:** From 1974 - 2018, 9310 individual finishes were recorded for the WESR. Mean age was 42.01 ± 8.65 yr with finish times of 25.57 ± 3.44 h. Regression analysis revealed age to be positively associated with finishing times (Finishing Time = $0.134 * \text{Age} + 19.937$), with a significant, weak correlation ($p < 0.001$, $r = 0.337$). From 2011 - 2017 there were 305 performances recorded for the ATY 6 day race. Mean age was 50.44 ± 16.36 yr, and mean distance completed was 332.90 ± 197.12 km. A regression analysis revealed that age was positively associated with distance completed (Distance Completed = $3.03 * \text{Age} + 179.85$), with a significant, but weak correlation ($p < 0.001$, $r = 0.252$). **CONCLUSIONS:** Aging tended to impair performance at the WSER. With every one year increase in age, finishing time tended to increase by 8 min, but it should be noted this association was weak. In contrast, aging was weakly associated with increased performance at ATY 6 day race. For every year increase in age, runners at ATY tended to run an additional 3 miles. This suggests that as the distance or time frame of the race increases beyond some point that age becomes less of a factor in performance. This suggests that that aerobic fitness may play less of a role compared to other factors for performance in a 6 day race, but remains important for a 161 km race.

801 Board #35 May 29 2:00 PM - 3:30 PM
The Isokinetic Muscular Strength Characteristics Of Ultra-endurance Runners

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Descriptive information on strength characteristics of ultra-marathon runners is currently limited.

PURPOSE: To determine the isokinetic (ISO) strength of quadriceps and hamstring muscles for eccentric (ECC) and concentric (CON) muscle actions in ultra-marathon runners in conjunction with the physiological assessment of running economy, fractional utilisation and $\dot{V}O_{2max}$.

METHODS: Following local institutional ethical approval, 46 ultra-endurance runners (27 males, 19 females) gave their written informed consent to volunteer in this study (age, 41 ± 8 yrs; height, 174.3 ± 9.1 cm; mass, 75.8 ± 13.3 kg). Each participant took part in at least one of four multi-stage ultra-marathon events: Rovaniemi150 (Finland), Jungle Ultra (Peru), Al Andalus Ultimate Trail (Spain) and Everest Trail Race (Nepal). ISO knee extension (EXT) and flexion (FLEX) peak torques were measured across three angular speeds ($60^\circ \cdot s^{-1}$, $180^\circ \cdot s^{-1}$, $240^\circ \cdot s^{-1}$) during ECC and CON loading for the left (L) and the right (R) leg. Furthermore, running economy, blood lactate responses and $\dot{V}O_{2max}$ were assessed during an incremental treadmill test.

RESULTS: There were non-significant differences in peak torque for EXT between the L and R leg across all angular speeds for both ECC and CON muscle actions ($p > 0.05$). However, the ECC peak torque was significantly greater in the R FLEX compared to the L for both $240^\circ \cdot s^{-1}$ (114.0 ± 34.1 vs. 105.7 ± 33.5 Nm) and $180^\circ \cdot s^{-1}$ (114.6 ± 37.9 vs. 103.2 ± 37.5 Nm), $t(43) = -2.11$, $p = 0.041$ ($ES = 0.12$) and $t(43) = -2.71$, $p = 0.01$ ($ES = 0.15$), respectively. No other significant differences were observed for peak torque for FLEX. The average ECC peak torques (Nm) across the speeds were R EXT ECC 203.7 ± 54.7 , L EXT ECC 204.7 ± 55.4 , R FLEX ECC 115.0 ± 36.6 , L FLEX ECC 106.7 ± 36.8 . The average CON peak torques (Nm) for both legs at 60, 180 and $240^\circ \cdot s^{-1}$ were R/L EXT CON-60 171.6 ± 43.9 , R/L EXT CON-180 121.7 ± 34.0 , R/L EXT CON-240 101.6 ± 29.4 , R/L FLEX CON-60 88.7 ± 28.6 , R/L FLEX CON-180 60.2 ± 19.3 , R/L FLEX CON-240 50.1 ± 18.3 , respectively.

CONCLUSION: This study provides normative ISO strength data for endurance trained athletes who participate in ultra-marathons offering insight into the balance between EXT and FLEX of the knee. These findings will be of interest to ultra-marathon runners, coaches and exercise physiologists supporting these athletes.

802 Board #36 May 29 2:00 PM - 3:30 PM
Relationship Among Physiological, Perceptual, And Biomechanical Variables During Exercise On A Non-motorized Treadmill In D2 Cross-country Athletes

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the relationship between physiological, perceptual, and biomechanical variables during exercise on a non-motorized treadmill (NMT) in cross-country athletes.

METHODS: Thirteen female cross-country Division II athletes (age, 20.77 ± 3.27 yrs; height, 161.92 ± 5.48 cm; weight, 55.54 ± 6.45 kg) participated in separate familiarization and testing sessions. On day one (familiarization), participants performed a treadmill protocol that consisted of a 5-min warm-up walk, 5-min walk, 5-min run, and 5-min cool-down on the NMT. Participants' velocity was recorded every minute to determine average self-selected pace for walking and running. Day two (testing day) consisted of performing the treadmill protocol with the previously determined velocities. Heart rate (HR), rating of perceived exertion (RPE), oxygen uptake ($\dot{V}O_2$), vertical GRF (GRFv), horizontal GRF (GRFh), power, and velocity was recorded and steady-state minutes were averaged and used for analysis. Separate Pearson's r correlation analyses were used to determine the relationship among HR, RPE, $\dot{V}O_2$, GRFv, GRFh, power, and velocity.

RESULTS: There was a significant strong positive correlation in walking between in HR and velocity ($r = 0.75$; $p = 0.003$), horizontal force ($r = 0.73$; $p = 0.004$), and power ($r = 0.76$; $p = 0.002$). There was a significant positive strong correlation in running between HR and velocity ($r = 0.76$; $p = 0.002$), power ($r = 0.76$; $p = 0.002$). There was a significant positive strong correlation in running between $\dot{V}O_2$ and running velocity ($r = 0.71$; $p = 0.006$), GRFh ($r = 0.69$; $p = 0.008$), and power ($r = 0.72$; $p = 0.005$). There was no significant ($p > 0.05$) correlation for all other variables in walking and running conditions.

CONCLUSIONS: The results indicate that $\dot{V}O_2$ has strong correlations with running velocity, force, and power, and that HR has strong correlations with running velocity and power. $\dot{V}O_2$ and HR are indicators of exertion in running conditions. Since the runners were in a steady-state condition, these results suggest that an increase in exertion—indicated by cardiovascular and metabolic responses—also requires an increase in kinetic measures. Because the NMT requires users to self-propel, the results suggest mechanics of running on a curved-NMT may influence physiological responses.

803 Board #37 May 29 2:00 PM - 3:30 PM
Evaluation of Running Performance in Recreationally Active Individuals at Submaximal Speeds: Shod vs. Barefoot Conditions

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(No relevant relationships reported)

The concept of barefoot running (BFR) is to purposely change foot strike patterns to promote metabolic efficiency, however exposing normally shod runners to BFR may have detrimental effects on overall running performance. **PURPOSE:** The purpose of this study was to evaluate the differences in physiological variables in running performance when individuals were acutely exposed to BFR. **METHODS:** This study consisted of 9 college aged males, (22.67 ± 1.0 y/o, 83.68 ± 9.01 kg, 178.36 ± 4.54 cm, and $14.60 \pm 5.27\%$ body fat), who engaged in aerobic exercise at least twice a week with no prior BFR experience. Subjects were blindly asked during each condition to self-select running speeds that they could maintain for 10 min. Variables collected included speed, $\dot{V}O_2$, HR, RER, VE, LRPE, SRPE, and foot pain. **RESULTS:** Data analysis revealed no statistically significant differences in physiological variables between conditions. However significant differences were seen between selected running speed and foot pain. Results indicated that subjects decreased their running speed by .98mph ($p = 0.004$) and experienced greater amount of foot pain ($+2.11$, $p = 0.02$) when in the BFR condition. **CONCLUSIONS:** The findings of this study suggest that acute exposure to BFR may decrease overall running speed during a workout and subjects may also experience a greater amount of foot pain compared to shod running. Caution should be used when introducing the concept of BFR to athletes or recreational runners.

804 Board #38 May 29 2:00 PM - 3:30 PM
Relationship Between Training Load and Intensity and Next Day Resting Heart Rate in Running.

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(No relevant relationships reported)

Resting heart rate (RHR) is a commonly used indicator used to monitor adaptations in aerobic conditioning. In long distance training, measures such as heart rate and distance covered are used as indicators of intensity and workload to affect changes in aerobic conditioning. However, there appears to be a need for more information on possible interactions between measures of intensity and workload and their effect on RHR as an indicator of adaptation. **PURPOSE:** To examine the relationship between training load (LOAD) and training intensity (INT) on next day RHR. **METHODS:** Seven middle-long distance runners, members of a Division I varsity team participated in the study during a cross country season in the fall. Variables were morning RHR, INT measured using Borg's Ratings of Perceived Exertion 16-point scale and LOAD expressed as miles ran. Variables were recorded by each participant on each training day and were aggregated for a total of 224 data points among the seven participants. Correlation and Multiple Regression analyses were used to examine the relationship between the variables. **RESULTS:** Significant correlations were found between LOAD and INT (.392) and between INT and next day RHR (.200). Multiple Regression found INT contributed significantly to the prediction of RHR yielding the following formula: $RHR = 47183 + 0.483 * (INT)$, $R^2 = 0.055$, $SEE = 4.722$.

CONCLUSIONS: Although a relationship was found between LOAD and INT it seems that each may have a unique contribution to next day's RHR.

B-55 Free Communication/Poster - Soccer

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

805 Board #39 May 29 2:00 PM - 3:30 PM
Number Of Sprints Performed By Players Of Different Playing Positions During A Soccer Match

Mario Norberto Sevilio de Oliveira Junior, Alyson Felipe da Costa Sena, Jefferson Fernando Coelho Rodrigues Júnior, Christian Emmanuel Torres Cabido, Emerson Silami Garcia, Christiano Eduardo Veneroso. *Federal Univeristy of Maranhão, São Luís, Brazil.*
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Soccer is a sport characterized by intermittent efforts and by a variation of intensity between the first and the second half-times of the match. The sprints, actions performed at high speeds and which demand a high energy expenditure, are among the several parameters which can be used to evaluate the performance capacity of the players along a match. **PURPOSE:** To compare the sprints performed by professional players of different playing positions along Soccer matches. **METHODS:** Twenty-two professional Soccer players (weight = 76.4 ± 5.2 kg; height = 179.9 ± 6.2 cm; BMI = 23.7 ± 1.7 kg/m²) participated in the study. The Polar Team Pro® GPS system was used to measure distances and speed of the subjects during the games. The number of sprints at speed above 25 km/h were registered in the first and in the second halves of the matches. Only players who participated during 75% of the total time of each of 10 matches were included in the study. Data normality was tested using the Shapiro-Wilk ($p = .714$). The Friedman test followed by the post-hoc Tukey were used to analyse the sprints ($p < .05$). **RESULTS:** The average number of sprints (> 25 km/h) was 13.3 ± 6.4 sprints per game. There was a difference amongst playing positions (Expected $P = .039$ and Calculated $P = .042$) and there was a difference between the second half and the total match time. The number of sprints of mid-fielders and forwards, but not of full-backs and half-backs, was reduced in the second half-time. **CONCLUSIONS:** There was a difference in the number of sprints between players of different positions and also a difference between the first and the second half-times. This information may be used by coaches in conducting training sessions and in matches.

Average number of sprints in the 10 matches			
Player Position	1st half	2nd half	Total
Full-backs	7	7	14
Half-backs	7	7	14
Midfielders	8	6	14
Forwards	8	7	15

806 Board #40 May 29 2:00 PM - 3:30 PM
Structured Physical Training Program Reduces Injury Risk Factors Unrelated to Performance Improvements in Soccer Players

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(No relevant relationships reported)

Physical training programs are designed to improve sport performance. To augment these programs, specific injury prevention protocols can be included. However, structured physical training programs alone could reduce injury risk.

Purpose: To determine the effects of a structured offseason training program on physical performance and modifiable LE injury risk factors.

Methods: Twenty-three male collegiate soccer players were enrolled (20 ± 1.54 yrs.). Body fat percentage (BF%), aerobic capacity (VO₂max), vertical jump, anaerobic power (Wingate), bench press (1RM), Y-balance (YB) bilaterally and weight bearing lunge ankle dorsiflexion (WBDF) bilaterally were measured pre and post a 12-week physical training program.

Results: Performance measures of BF%, VO₂max, vertical jump, and Wingate were not significantly different after the 12-week program. Bench press 1RM (177.22 ± 31.44 lb.) was the only statistically significant performance measure ($n=9$, $p=0.02$). Right(R) (691.13 ± 81.27 mm) and Left(L) (684.54 ± 85.49 mm) side absolute YB in the anterior-posterior direction ($p=0.03$) and LWBDF ($26.5 \pm 8.47^\circ$, $p=0.05$) were statistically different pre to post assessment ($n=10$). All other YB directions (posterior-medial, posterior-lateral) and RWBDF were not statistically significant. Composite

scores for YB normalized to leg length pre (RYB= $82.84 \pm 9.64\%$, LYB= $80.63 \pm 12.64\%$) and post (RYB= $78.76 \pm 26.88\%$, LYB = $80.53 \pm 19.36\%$) resulted in no significant change.

Conclusion: Participants improved some modifiable injury risk factors at the LE (YB, WBDF) and increased upper extremity strength. However, no other performance measures significantly changed. These results indicate structured physical training programs could positively affect injury risk factors, absent of specific injury prevention programming and unrelated to physical performance improvements. Specific physical training programming and its relationship to reduction of injury risk factors requires further research.

807 Board #41 May 29 2:00 PM - 3:30 PM
Effects of Soccer Kicking Training Using Virtual Reality on Kicking Performance in Boy Soccer Players

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(No relevant relationships reported)

Purpose: Adoption of virtual reality (VR) into sports, games, and educational settings has become popular in recent years, but no evidence regarding VR's effects on athlete's performance has been elucidated. This study evaluated an efficacy of VR soccer kicking training system for kicking performance in young soccer players. **Methods:** A total of 24 experienced boy soccer players enrolling in a elementary school soccer team was recruited for the 6 months study, and divided into two groups; VR training group (VR-G; $n=13$, 11.8 ± 1.0 yrs, 148 ± 7.5 cm, 39.0 ± 7.9 kg) and outdoor training group (OT-G; $n=11$, 11.4 ± 3.4 yrs, 152 ± 9.7 cm, 45.2 ± 10.2 kg). Before (M0) and after (M6) the study, they were tested. For the test, they kicked a ball, in which a sensor was installed, to a curtain screen on which targets were marked by a beam. The VR room was sized 12×8 meter. Using the data of ball speed and target hitting accuracy, a scoring point was calculated for kicking accuracy (Ka) and speed (Ks). They were also tested on a soccer field for measurement of kicking accuracy (Kfa). For the test, they practiced twice and kicked 5 times for measurement. During the study, they were trained for two phases; regular and extra training. For the regular training, the team was trained 4 times/week in a soccer field for 120 min/session. For a total of 15 sessions of extra training, OT-G practiced only kicking on the field, while VR-G did in a VR room. **Results:** For VR-G, Ka, Ks, and Kfa increased from 53.6 ± 9.5 , 26.1 ± 11.8 , and 18.6 ± 14.9 at M0 to 62.9 ± 10.0 ($t=-6.138$, $p<.001$), 38.0 ± 13.2 ($t=-2.396$, $p<.05$), and 31.9 ± 16.0 unit ($t=-2.442$, $p<.05$), respectively. For OT-G, Ka, Ks, and Kfa were not changed from 58.8 ± 8.9 , 35.9 ± 15.5 , and 19.6 ± 13.6 at M0 to 63.1 ± 5.7 , 29.1 ± 10.0 , 22.2 ± 12.8 unit, respectively. No differences were found in 3 kicking variables at M0 and M6 between two groups. **Conclusion:** The regular soccer training and the extra kicking training improved the kicking speed and accuracy in VR-G, while OT-G maintained their performance. VR soccer kicking training program could be a potential substitutional and additional training model for young soccer players. (This research project was supported by the Sports Promotion Fund of Seoul Olympic Sports Promotion Foundation from Ministry of Culture, Sports and Tourism, project # s072016122016)

808 Board #42 May 29 2:00 PM - 3:30 PM
Initial Profiling of Division II Soccer Athletes Revealed Minimal Body Composition Changes Throughout Competitive Season

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(No relevant relationships reported)

Body composition (BC) assessment is a metric utilized in sport performance, yet there is a paucity of BC data profiling NCAA Division II female athletes.

PURPOSE: To measure and compare BC data of Division II female soccer athletes during a competitive season thereby developing an initial profile relative to this sport and division. **METHODS:** Subjects (Age: 19.09 ± 1.15 yrs.) consisted of Division II women's soccer athletes ($n=22$). Body fat percentage (BF%) utilizing air plethysmography [BODPOD, Cosmed] was measured during pre-season and within the penultimate week of the competitive season. Descriptive statistics and dependent t-tests (SPSS version 25.0) were used to analyze data. **RESULTS:** Pre-season data indicated the following team anthropometrics: Height: 165.38 ± 9.05 cm; Weight: 60.02 ± 5.2 kg; BMI: 21.64 ± 1.39 . Team BF% was $19.99 \pm 4.39\%$ with freshman ($n=10$) BF% recorded at $18.73 \pm 5.07\%$ and returners ($n=12$) at $21.0 \pm 3.62\%$. Latter season weight of 59.80 kg \pm 5.09 and BMI of 21.47 ± 1.25 was down slightly. Team BF% increased to $20.27 \pm 4.09\%$ with freshman BF% increasing to $20.55\% \pm 4.90\%$ while returners decreased to $20.02 \pm 3.47\%$. There were no statistically significant differences in team, freshman, or returners BF% or BMI for both time points assessed. **CONCLUSION:** Team BF% was lower at both assessment points than recently

published data on Division I female soccer athletes (Field et al., 2018). Freshman demonstrated lower BF% than returners initially but returners BF% trended downward at the latter part of the season. Future research should continue to explore physical profile changes over time while expanding sport performance testing metrics to obtain a more comprehensive snapshot of the Division II female soccer athlete. Reference: Field, J. et al. (2018). Comparison of body composition variables across a larger sample of national collegiate athletic association women athletes from 6 competitive sports. *Journal of Strength and Conditioning Research*, 32(9), 2452-2457.

809 Board #43 May 29 2:00 PM - 3:30 PM Use Of Muscle Saturation Oxygen As A New Marker Of Fatigue In Female Soccer Players

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According to UEFA, a paucity of relevant studies has led to a significant increased interest in women's soccer research. Additionally, early detection of muscle fatigue could have profound impact on injury prevention and recovery in many sports including soccer. Measurement of muscle oxygen saturation (SmO₂%) with non-invasive near infrared spectroscopy (NIRS) technology has been investigated as a possible indicator of fatigue, however no clear protocol exists regarding interpretation of NIRS data or its application for training assessment or fatigue detection. **PURPOSE:** To evaluate SmO₂% kinetics and relate it to markers of fatigue induced by an official match. **METHODS:** 12 female soccer players (age 19 ± 3 years, weight 59.1 ± 5.7 kg, height 1.61 ± 0.05 m, Fat 18.5 ± 3.5%). They were evaluated pre-match (PRE) and 24 hours after an official match (POST). Blood plasma parameters were measured including Blood Urea Nitrogen (BUN), Glutamate-Pyruvate Transaminase (GOT) Lactate Dehydrogenase (LDH), Creatine phosphokinase (CPK), and total hemoglobin (THb). Additional outcomes were assessed including rate of perceived exertion (CR-10 Borg scale), Visual Analog Scale (VAS-pain 1-10), and "Repeated Ability Sprint Test" (RAST) using a portable "Muscle Oxygen Monitor" (MOXY) placed in the gastrocnemius muscle of the dominant leg to measure SmO₂%. Deoxygenation rate (De-Oxy) and Reoxygenation Rate (Re-Oxy) were calculated. For statistical analysis, T-test, Pearson correlation and mechanical inferential statistics were applied to measure the magnitudes of change. **RESULTS:** Average SmO₂% during test RAST increased after match ((23 ± 8 vs. 29 ± 8 p < 0.05); Δ% = 19.1%), as well minimum SmO₂% values (12 ± 8 vs. 21 ± 8 p < 0.05) and maximum values (31 ± 8 vs. 36 ± 8 p < 0.05). Other fatigue markers increased too after match, LDH (282 ± 45 vs. 341 ± 79 IU/L p < 0.05) and VSA pain (3.2 ± 1.7 vs. 5.1 ± 1.7 p < 0.01). It was also found that a higher Re-Oxy correlated with increases in LDH (r = 0.88 p < 0.01), VSA pain (r = 0.61 p < 0.05) and BUN (r = 0.84 p < 0.01). Taken together, the decrease in SmO₂% was considered as the best performance in the RAST test (r = -0.79 p < 0.01). **CONCLUSIONS:** MOXY monitor can be used as a novel, non-invasive method to identify post-match fatigue in female soccer players through measurement of SmO₂% kinetics and the rate of reoxygenation.

810 Board #44 May 29 2:00 PM - 3:30 PM Effects of Video Feedback on Kicking Performance and Temporal Patterns in U-10 Soccer Players

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Kicking is a crucial motor skill in soccer. Accuracy and velocity are the two primary factors responsible for kicking performance. Coaches and practitioners design programs with practice sessions in which kicking actions are involved. **PURPOSE:** To examine the effects on kicking performance of different types of extrinsic video feedbacks such as slow-motion video feedback (SMVF) or normal video feedback (NVF), with additional velocity feedback, in comparison with no feedback (NF) was studied in U-10 soccer players.

METHODS: Thirty male children soccer players (mean age: 8.9 ± 0.8 years) asked to perform series of dynamic soccer kicks. Their kicking performance was measured in terms of accuracy and velocity, and the motor skill pattern variations were assessed in terms of temporal variables of approach time (ATIME), the last step time (LSTIME) and the foot descent time (DTIME). Players performed 4 blocks of 5 kicks with a 30-second rest period and a retention block of 10 kicks 2 days later.

RESULTS: Results showed significant differences both between the SMVF and NF groups in terms of performance ($F_{2,27} = 3.97, p < 0.05; \eta^2_p = 0.227$). SMVF group

significantly improved performance during the practice phase but not in retention. Significant differences of the coefficient of variation (CV) were found in the main temporal variables of the action ($F_{6,214} = 6.96, p = 0.000; \eta^2_p = 0.44$). Univariate analysis showed a significant effect of group on LSTIME ($F_{2,108} = 4.07, p = 0.015; \eta^2_p = 0.06$) and DTIME ($F_{2,108} = 16.99, p = 0.000; \eta^2_p = 0.16$) but not on ATIME ($F_{2,108} = 1.28, p = 0.30; \eta^2_p = 0.16$).

CONCLUSIONS: The type of multimodal feedback (slow motion video and velocity) significantly affects the acute kicking performance in children and its temporal pattern. The present study suggests possible benefits of using slow-motion video feedback in the learning sessions of children soccer players. The accessibility of such technology using low-cost cameras or mobile phones makes this finding especially relevant. Coaches and practitioners can induce significant changes in kicking performances (and other motor skills) and temporal patterns. This study is inconclusive about the retention of these changes and has not studied the transfer in learning.

811 Board #45 May 29 2:00 PM - 3:30 PM Lower and Upper Body Muscle Characteristics among Collegiate Baseball and Soccer Players

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Increased muscular strength in athletes has shown a prolific effect in the development of sports skills including jumping, throwing, sprinting, and change of direction abilities. Sports, such as soccer and baseball, differ largely in specific characteristics needed for success. To date, few studies have reported differences in sports specific skills between these two sports to measure and quantify the neuromechanical capacity.

PURPOSE: To compare both lower and upper body strength among collegiate baseball (BB) and soccer (SC) players. **METHODS:** In this non-randomized cross-sectional study, 19 baseball and 19 soccer players, age ranges from 18-25 years completed the protocols. Lower body strength and power were assessed by a two-leg press maximal strength test (1RM) and vertical jump test (Just Jump Mat, Tendo Sports Machine), respectively. Upper body strength was assessed by a handgrip (HG) test using handgrip dynamometry (Takei, Japan). **RESULTS:** Independent sample t-test showed BB players (88.05 ± 7.1 kg) were significantly heavier than SC players (72.1 ± 7.2 kg) (p < 0.05). However, weight-adjusted upper body strength and leg power were not significantly different between the two groups. BB players had significantly higher jump height (JH), time in air, and 1RM leg strength compared to SC players (p < 0.05). **CONCLUSIONS:** BB players showed significantly higher lower muscle strength compared to SC players, however no differences were observed for peak power. These results provide a quantitative measure of the performance difference between these two sports, reinforcing the need for further research along with large sample size to assess the possible differences in training effectiveness and inherent characteristics between BB and SC players.

Table 1. Athlete Performance Variables (Adjusted Mean ± SE)

Variables	BB Players (n= 19)	SC Players (n=19)
Time in air (s)**	0.72 ± 0.01	0.64 ± 0.01
Jump Height (inches)**	25.99 ± 0.79	20.10 ± 0.79
Velocity (m/s)	1.42 ± 0.02	1.39 ± 0.02
Power (Watts)	1125.99 ± 25.62	1075.14 ± 25.62
Relative Power (Watts/kg)	13.99 ± 0.31	13.31 ± 0.31
1 RM (Kg)*	355.54 ± 14.88	300.43 ± 14.88
Rt HG (Kg)	44.91 ± 2.36	41.15 ± 2.36
Lt HG (Kg)	42.51 ± 2.20	42.20 ± 2.20

*Significant p < 0.05; **Significant p < 0.01; Rt, Right; Lt, Left

812 Board #46 May 29 2:00 PM - 3:30 PM Performance Implications of Arousal State in Female Collegiate Soccer Players

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(No relevant relationships reported)

Arousal, defined as a blend of physiological activation and psychological awareness, prior to collegiate soccer matches may have important implications on performance. How various arousal states are related to measures of sport-specific performance and

the hormone cortisol in and around matches in female collegiate soccer players is largely unknown. **PURPOSE:** To investigate the effect of arousal state on passing performance and salivary cortisol in female collegiate soccer players.

METHODS: Eighteen NCAA Division I female soccer athletes (20.2 ± 1.1 y) participated in this study during the spring season. One hour before five competitive matches, the Activation-Deactivation Adjective Checklist (AD-ACL) was administered to assess tension arousal (TA) and energy arousal (EA) using tiredness (Ti), energetic (E), tension (Te), and calmness (C) subscale scores. Salivary samples were collected via synthetic swab placed under the tongue 1 hour before, and 30 minutes after each match. Enzyme-linked immunosorbent assay (ELISA) was used to analyze salivary samples for cortisol. Passing performance was defined as percentage of total attempted passes received by a teammate.

RESULTS: Pre-match subscale scores (out of 4, [mean, \pm SD]) for the five competitions were: Ti: 1.9 ± 0.8 , 1.7 ± 0.9 , 1.6 ± 0.6 , 1.6 ± 0.8 , 1.4 ± 0.5 , respectively; E: 2.9 ± 0.6 , 3.1 ± 0.7 , 3.2 ± 0.4 , 3.0 ± 0.6 , 3.0 ± 0.6 , resp.; Te: 1.7 ± 0.5 , 2.1 ± 0.5 , 1.9 ± 0.4 , 1.7 ± 0.5 , 1.7 ± 0.5 , resp.; C: 2.1 ± 0.5 , 2.0 ± 0.5 , 2.0 ± 0.4 , 2.0 ± 0.5 , 1.8 ± 0.6 , resp. Passing performance for the five competitions was $73.6 \pm 14.1\%$, $81.6 \pm 9.6\%$, $79.1 \pm 8.6\%$, $74.6 \pm 8.8\%$, $76.6 \pm 12.1\%$, resp. ($p > 0.05$). Collapsed across matches, Ti and C scores demonstrated negative associations approaching significance with passing performance (both $p = 0.06$, $r = -0.28$); E score was positively associated with passing performance ($p = 0.04$, $r = 0.30$). Collapsed across matches, post-match cortisol was significantly greater than baseline-predicted-values ($p = 0.03$). Percent change in cortisol pre- to post-match in the first match was associated with E score ($p = 0.04$, $r = 0.72$).

CONCLUSIONS: Higher energy-arousal states were associated with improvements in passing performance. Cortisol response may be mediated by energy arousal. Future investigations should examine mediating factors of pre-match arousal states.

813 Board #47 May 29 2:00 PM - 3:30 PM Relative Age Effects In Men's Collegiate Soccer Are Influenced By Nationality, Position, Class, And Success

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(No relevant relationships reported)

Relative age effects (RAEs) refer to an unequal birth-date distribution within cohort of individuals, typically due to selection bias. RAEs have been shown to exist in sports, specifically youth soccer and elite professional soccer. However, no study has assessed the prevalence of RAEs at the collegiate level. **PURPOSE:** To evaluate the existence of RAEs in Division I Men's collegiate soccer. Additionally, the study assessed the impact of nationality, position, class, and post-season tournament qualification on the prevalence of RAEs. **METHODS:** Birth-dates from Division I Men's collegiate soccer athletes ($n=4,082$) from the 2017-2018 season were categorized into calendar quarters (CQ1: January-March; CQ2: April-June; CQ3: July-September; and CQ4: October-December) and scholastic quarters (SQ1: September-November; SQ2: December-February; SQ3: March-May; and SQ4: June-August). All athlete birth-date distributions were compared with the expected birth-date distributions for the United States. All data were assessed using χ^2 goodness of fit tests. **RESULTS:** International-born athletes (INT) displayed a significant ($p < 0.001$) difference in birth-date distribution when assessed with calendar quarters, with an over-representation in CQ1 ($31.2 \pm 2.8\%$) and an under-representation in CQ4 ($20.0 \pm 2.4\%$). However, American-born athletes (USA) showed a significant difference ($p < 0.001$) in birth-date distribution when assessed with scholastic quarters, with over-representation in SQ1 ($27.6 \pm 1.6\%$) and an under-representation in SQ4 ($23.0 \pm 1.5\%$). Furthermore, INT showed significant ($p < 0.001$) RAEs for midfielders and defenders, while USA showed significant RAEs midfielders ($p = 0.009$) and goalkeepers ($p = 0.004$). In terms of class, INT had significant ($p < 0.045$) RAEs for all classes, while USA had significant RAEs only for freshmen ($p = 0.001$) and sophomores ($p = 0.007$). All INT had significant ($p < 0.003$) RAEs regardless of tournament qualification; however, USA had significant RAEs only for non-tournament teams ($p < 0.001$). **CONCLUSION:** Significant RAEs exist in Division I Men's collegiate soccer; however, the presence of RAEs are influenced by nationality, position, class, and on-field team success. Coaches should be aware of RAEs during the recruitment process to avoid potential selection bias.

814 Board #48 May 29 2:00 PM - 3:30 PM Influence of Thresholds on GPS Speed Zones and Sprint Determination in Female Collegiate Soccer Players

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Use of team sport global positioning system (GPS) to track player movements and determine training load has expanded recently. Following training sessions or games, player velocity is categorized into discrete zones utilizing velocity thresholds (VT).

VT are typically pre-determined by the software provider or modified from previous reports. Currently there is no universally accepted standard for VT in collegiate women's soccer players.

PURPOSE: To determine the influence that VT individualization based on maximum speed testing (MST) has on distance covered in speed zones and sprint determination. **METHODS:** Twelve collegiate female soccer players (19.6 ± 0.9 yo, 61.0 ± 6.5 kg, 1.63 ± 0.05 m) were recruited and participated. Maximal velocity (MV) was determined via MST on a 37-meter runway with electronic timing gates. GPS data (10Hz) from five games was processed in a custom written Matlab script to determine distance covered in five velocity zones (Z1-5) and total number of sprints completed. The following two sets of VTs were implemented: (1) manufacturer supplied (MS) (0.83 , 1.94 , 3.06 , 4.17 , and 5.28 m/s), (2) player specific (PS) (11.8 , 27.7 , 43.6 , 59.4 , 75.2 %MV). Paired samples t-tests were conducted to determine significance ($p \leq 0.05$).

RESULTS: There were no significant differences for distance covered in any of the five velocity zones when using either MS or PS velocity thresholds (Z1: MS 234.1 ± 95.6 m, PS 235.0 ± 103.7 m, $p = 0.88$) (Z2: MS 1509.4 ± 442.8 m, PS 1490.2 ± 472.2 m, $p = 0.18$) (Z3: MS 1572.3 ± 410.9 m, PS 1557.7 ± 379.1 m, $p = 0.56$) (Z4: MS 1373.2 ± 343.6 m, PS 1380.0 ± 367.7 m, $p = 0.58$) (Z5: MS 260.4 ± 141.1 m, PS 274.7 ± 156.6 m, $p = 0.42$). Number of sprints determined from MS (32.2 ± 14.6) was not significantly different from PS (35.05 ± 17.9) ($p = 0.18$).

CONCLUSIONS: Distance covered in speed zones and sprint determination from GPS data was not significantly different when using an absolute scale (MS) versus a relative scale (PS) determined from MST. Although aggregate team data did not significantly differ between methods, sport scientists should remain cautious when utilizing an absolute scale. Analysis of individual player differences between methods yielded overestimations >250 m for Z5 and an overestimation in the number of sprints completed by >30 for the fastest player when using an absolute scale.

815 Board #49 May 29 2:00 PM - 3:30 PM Comparison of Performance Measures Between Starters Vs Non-starters in a Division III Women's Soccer Team

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INTRODUCTION: It is widely known that there are physical and physiological differences between members of a collegiate soccer team but less is known regarding the magnitude of those differences between starters (S) and non-starters (NS). Previous research between S and NS players at the NCAA Division I level did not elucidate any differences (Risso et al., 2017), however this might not be the case at other NCAA competition levels. **PURPOSE:** To compare performance measures of S and NS of a NCAA Division III female soccer team. **METHODS:** Performance measures between S and NS of a Division III female collegiate soccer team ($n=22$) were assessed. Data was collected pre-season and consisted of descriptive physical measures (age, height, weight, body fat percentage, fat mass, lean mass) and performance measures (vertical jump, standing broad jump, triple hop, 30-m sprint). All data were analyzed utilizing independent t-tests with significance set at $p < 0.05$. **RESULTS:** Findings show that there were no statistical differences between S and NS in any of the descriptive physical measures. Performance measures demonstrated statistically significant differences in vertical jump (S 0.38 ± 0.06 m vs NS 0.31 ± 0.05 m ($p = 0.01$)); standing broad jump (S 1.78 ± 0.16 m vs NS 1.58 ± 0.17 m ($p = 0.00$)); standing broad jump right foot (S 1.46 ± 0.14 m vs NS 1.23 ± 0.17 m ($p = 0.00$)); triple hop left foot (S 4.79 ± 0.45 m vs NS 4.37 ± 0.48 m ($p = 0.04$)); triple hop right foot (S 4.94 ± 0.48 m vs NS 4.25 ± 0.41 m ($p = 0.00$)); and change of direction left foot (S 2.64 ± 0.14 sec vs NS 2.77 ± 0.11 sec ($p = 0.04$)). There were no differences observed in the 30-m sprint times or any of the intervals (0-5, 0-10, or 0-30 m). **CONCLUSION:** In the current study, S and NS did display significant differences in a number of performance measures. Due to these differences, substitutions could have a major impact on team performance; therefore, training considerations may be warranted between S and NS.

816 Board #50 May 29 2:00 PM - 3:30 PM Correlation between Sprint Tests and Agility 505 Test and Ktest in Elite Young Soccer Players

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Agility, acceleration, change of direction (COD), deceleration, and sprinting are critical technical skills in soccer. The ability to sprint and quickly change direction are determinants of performance in a soccer game. Sprint performance relative to a new Agility K-test and 505 tests were examined. **PURPOSE:** To examine the relationship between the sprint and agility tests in elite young soccer players. **METHODS:** Elite

Czech young male soccer players ($n=29$, age= 19.5 ± 0.4 yrs) volunteered for this study. The KT consisted of the subjects running at maximum speed between cones positioned in a "K" pattern on a field with non-slip running surface. The subjects started and ended running at the intersection of the "K" pattern with two conditions: touching a photocell with the foot (KT_foot) or a contact switch placed on the top of each cone with the hand (KT_hand). The 505 COD test allowed subjects a "flying start" with a 10 m run-up before crossing the timing gates, a five-meter sprint, turn 180° either right or left and a final five-meter sprint. Linear sprinting was also tested with subjects sprinting 5 m (S5) and 10 m (S10) from a static position. The subjects performed two trials of each test, and the time of test execution was measured in seconds. Pearson correlation coefficient test was used to correlate two dependent variables, and independent t-test was used to test differences between KT_hand and KT_foot. $P<.05$. **RESULTS:** The correlation tests between dependent variables showed weak to moderate correlations. Specifically, 505_R vs $S5=.45$, $p<.05$; 505_R vs $S10=.49$, $p<.01$; 505_L vs $S5=.11$, NS; 505_L vs $S10=.11$, NS; KT_foot vs $S5=.34$, NS; KT_foot vs $S10=.32$, NS; KT_hand vs $S5=.30$, NS; KT_hand vs $S10=.41$, $p<.05$. The association between KT_foot and KT_hand=.18. NS. T-test showed the significance, $t(56)=17.48$, $p<.01$. **CONCLUSION:** Specific "movement strategy" may exist in 505 COD tests due to asymmetries that may exist from the one-side dominant nature of the participants. However, due to multiple direction tested, KT-hand coordination "eye-hand" is faster and a more natural motor pattern than KT-foot. The speed variables exhibited significant heterogeneity. Speed and agility are not dependent; therefore, each component of speed must be considered independently when designing training programs for young soccer athletes.

817 Board #51 May 29 2:00 PM - 3:30 PM
Tensiomyographic And Sprint Assessments Following Different Warmup Protocols In Collegiate Male Soccer Athletes

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(No relevant relationships reported)

Tensiomyography (TMG) has been shown to be a non-invasive technique to assess the contractile properties of skeletal muscle which may have application in assessing the effectiveness of warm-up procedures prior to training and athletic competition. **Purpose:** The purpose of this study was to evaluate the effects of three different warm-up protocols on TMG variables and sprint performance in collegiate male soccer athletes. **Methods:** Fifteen collegiate male soccer athletes (age = 20.1 ± 1.3 y, height = 176.6 ± 6.9 cm, body mass = 78.2 ± 7.8 kg, body fat percentage = 12.9 ± 3.6) participated in the study. The three testing days consisted of: pre- and post-TMG assessments; warm-up protocol [dynamic (DYN); plyometrics (PLY); and passing patterns (SOC)]; and two 20-m sprints. Pre- and post-TMG assessments were completed for the biceps femoris (BF) and rectus femoris (RF) of both legs for all participants. The DYN warm-up protocol consisted of a six-minute jog followed by nine minutes of dynamic stretching. The PLY warm-up protocol consisted of a six-minute jog followed by nine minutes of plyometric exercises. The PAS consisted of a five-minute jog followed by a passing pattern drill typically used in advanced soccer athletes termed the "Rondo." Repeated measures ANOVAs (condition x leg x time) were used to evaluate muscle displacement (Dm) and contraction time (Tc) in the BF and RF. A repeated measures ANOVA was used to evaluate the fastest of the two 20-m sprint times between conditions. **Results:** Results showed no significant interactions for Dm (BF: 2.851 to 3.508 mm; RF: 6.793 to 8.253 mm) or Tc (BF: 20.04 to 24.00 ms; RF: 26.87 to 29.36 ms); however, a main effect for time ($p=0.035$) was found for BF Tc with a significant decrease from pre- (22.24 ± 9.09 ms) to post-warmup (20.47 ± 5.01 ms). Significant differences ($p<0.05$) between conditions for 20-m sprint performance were also noted (DYN: 2.76 ± 0.27 s; PLY: 2.64 ± 0.13 s; SOC: 2.62 ± 0.15 s). **Conclusion:** In collegiate male athletes, the warm-up protocols did not appear to have differential effects on specific TMG variables, while differences in sprint performance were seen. The warm-up procedures decreased Tc as evaluated by TMG; however, further research is needed to examine the influence of this change on performance.

818 Board #52 May 29 2:00 PM - 3:30 PM
Effect Of Excentric Training On Balance And Explosive Strength In Women University Soccer Players

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PURPOSE: Women's football has begun to be considered as a potential sport thanks to the performance of sportswomen. For the prevention of injury, the eccentric training appears as part of sports training programs. However, preventive programs do not recognize the characteristics of women, this being the object of this study. Objective.

Determine the effects of an eccentric training on the balance and explosive strength in female soccer players from two universities in Bogotá, Colombia. **METHODS:** Randomized controlled trial, which evaluated the explosive force with the Sargent test and the balance with the Star Excursion Balance Test (SEBT) with the participation of 19 university athletes. The players were randomly distributed among the control group ($n=9$) that made the protocol FIFA 11+ and experimental group ($n=10$) that made the eccentric exercise protocol. Statistical analysis was performed with SPSS, using comparative statistics between groups like the Student's T test for related samples. **RESULTS:** Significant changes are shown for the balance variables ($p\leq0.05$), in 15 of the 16 directions, and significant changes in the explosive force ($p\leq0.05$; $p=0.000$) of athletes who carried out the training eccentric after 4 weeks of intervention. For the FIFA 11+ group only significant changes were observed ($p\leq0.05$) in 3 of the 16 directions of the SEBT and there were no changes in the Sargent test ($p\geq0.05$, $p=0.141$). Therefore, it is verified that the intervention protocol of eccentric training has significant effects on the explosive force, in four weeks of intervention. **CONCLUSIONS:** This study provides evidence on the use of eccentric protocols in amateur soccer players, showing significant changes in the balance and explosive strength, after 4 weeks of training, giving sustenance to introduce eccentric exercises in warm-up programs and injury prevention.

B-56 Exercise is Medicine®/Poster - EIM - The Elderly and Their Health Problems

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

819 Board #53 May 29 3:30 PM - 5:00 PM
Physical, Cognitive and Dietary Characteristics of Older Women with Declines in Balance and Walking Ability

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In 2006, new category of motor disorders was established: musculoskeletal ambulation disability symptom complex (MADS). MADS is defined as an increased rise of falls and isolation due to an age-related decline in balance and walking ability. **PURPOSE:** To examine physical, mental and dietary functions of older community-dwellers using balance assessment, physical, and cognitive function tools, and eating habit questionnaire and understand the MADS in older women.

METHODS: Eighty-six women aged 65 years and over (mean age 71.3 yrs.) participated in this study. The participants completed a demographic questionnaire, one-leg standing time with eyes open (OLS) and timed up-and-go test (TUG). Then, they were divided into two groups according to OLS: G1) longer than 15 sec. ($n=61$), and G2) less than 15 sec. ($n=25$). Following items were measured: hand-grip strength, chair-stand, functional reach, gait speed as physical function, Mini-Mental State Examination (MMSE) and Trail Making Test-A (TMT-A) as cognitive function, and brief-type self-administered diet history questionnaire (BDHQ) as examining eating habits.

RESULTS: The average time of OLS was significantly different in G1 and G2 (72.7 ± 58.0 and 7.6 ± 3.9 sec., $p<0.01$). Age was significantly different in G1 and G2 (70.2 ± 2.5 vs. 73.2 ± 4.4 yrs., $p<0.05$). The results show that maximal gait speed and TUG was significantly lower in G1 than G2 (1.73 ± 0.24 vs. 1.87 ± 0.28 m/sec., $p<0.01$) and (6.8 ± 1.1 vs. 7.5 ± 1.5 sec., $p<0.01$). BDHQ revealed that the consumption of marine products (34.4 ± 43.3 vs. 5.0 ± 2.5 g, $p<0.01$) and cooked fish (25.7 ± 30.4 vs. 5.6 ± 3.5 g, $p<0.01$) were significantly higher in G1 than G2. Older adults without MADS consumed more marine products and cooked fish. In ANCOVA adjusting for the age, only TMT-A was significantly different in G1 (86.2 ± 25.2 sec) and G2 (98.4 ± 28.5 sec.), $p<0.01$. MADS may affect the TMT-A in the older women living in Japan.

CONCLUSIONS: These results suggest that decline in physical, dietary and cognitive functions may be associated with MADS in older women.

820 Board #54 May 29 3:30 PM - 5:00 PM

The Effects Of Exercise Training To Frailty Patient During Post-acute Care HospitalizationYu-Tsai Tu¹, Mu- Jung Kao¹, Chin-Shan Ho². ¹TAIPEI CITY HOSPITAL, TAIPEI, Taiwan. ²National Taiwan Sport University, Taoyuan, Taiwan.

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In Taiwan, frailty patient can receive post-acute rehabilitative care in hospital after they leave acute care hospital. The post-acute care program is proposed by the Ministry of Health and Welfare in Taiwan for functional recovery of the frailty patient. The post-acute care program including strengthening, flexibility, cardiopulmonary, and balance exercise. **PURPOSE:** To evaluate the functional recovery of the frailty patient in in Taiwan with a two-weeks of regular exercise training. **METHODS:** Twelve frailty elderly (Age: 83.25±5.5 years of age) just leave acute medical care were included in this study. The patient must have one of the underlying diseases include dementia, chronic kidney disease, parkinsonism, and Chronic Obstructive Pulmonary Disease. The therapeutic interventions were regular exercise training including strengthening, flexibility, cardiopulmonary, and balance exercise for two weeks. Before and after intervention, Functional outcome were evaluated. Data collection from multiple variables was conducted using questionnaire and examination including Barthel index, IADL, Clinical Frailty scale, Confusion Assessment Method, and Mini Nutritional Assessment-Short Form. **RESULTS:** The result shows significant improvement in Barthel index, Clinical Frailty scale, and Mini Nutritional Assessment-Short Form ($p < .05$). Among other tests, there is no significant difference. **CONCLUSION:** Two-week exercise training program can improve functional outcome of frailty patient during post-acute care.

821 Board #55 May 29 3:30 PM - 5:00 PM

Self-reported Exercise Behaviour Can Differentiate Cardio-metabolic Risks In Young, Middle-aged And Older Healthy AdultsChin L. Lim¹, Kenneth K.C. Ng², Frankie H.Y. Tan³, David J. Stensel⁴, Margaret M.C. Yap¹, Shuen Y. Lee¹, Kai D. Fam¹, Kar L. Chia¹, Liang Zhong⁵, Stephen F. Burns⁶. ¹Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore, Singapore. ²Novena Heart Centre, Singapore, Singapore. ³Singapore Sports Institute, Singapore, Singapore. ⁴Loughborough University, Loughborough, United Kingdom. ⁵National Heart Research Institute of Singapore, Singapore, Singapore. ⁶National Institute of Education, Nanyang Technological University, Singapore, Singapore.

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Purpose. The study aimed to elucidate the effects of age and self-reported exercise behaviour on metabolic risks in clinically healthy participants according to age and exercise behaviour groups (Table 1). The participants were from the Exercise for Life Across Asia (ELIXA) cohort. Active participants reported $\geq 3 \times 45$ min of moderate to high intensity exercise weekly and sedentary participants reported $< 1 \times 30$ min of moderate intensity exercise weekly in the last 5 years. **Methods.** The participants performed an oral glucose tolerance test (OGTT), with fasted blood (13 mL) collected at baseline, followed by ingesting 75 g of glucose in a solution, and blood collections at 0.5 h intervals until 2 h. **Results.** Age and exercise behaviour had no significant effects on body mass index, blood pressure, and waist-hip ratio, and fasted blood glucose and lipids (total cholesterol, triglycerides, and high- and low-density lipoproteins), and plasma insulin and non-fasted plasma pro-inflammatory cytokine concentrations. However, the magnitude of increases in plasma insulin and blood glucose concentrations after glucose ingestion were significantly higher in the sedentary than in the active groups over the 2 h OGTT, when all the age groups were combined and in the “Young” group (Table 2). **Conclusion.** In a clinically healthy population, regular exercise can lower metabolic risks, which can increase from young age due to sedentary lifestyle.

Table 1 Sample sizes in age and exercise behaviour groups

	Young (18 – 39 Yr old)	Middle-aged (40 – 59 Yr Old)	Older-aged (≥ 60 Yr Old)
Active	YA, n = 33	MA, n = 36	OA, n = 14
Sedentary	YS, n = 28	MS, n = 25	OS, n = 11

Table 2 Mean (SEM) for blood glucose and plasma insulin concentrations at 2-hour time point of the oral glucose tolerance test

Groups	Blood Glucose (mmol/L)	Plasma Insulin (mu/L)
Combined (Sedentary)	6.0 (0.2)**	48.8 (4.6)***
Combined (Active)	5.3 (0.1)	26.8 (2.8)
YS	5.7 (0.3)*	45.6 (5.7)*
YA	4.7 (0.2)	25.5 (4.1)
MS	6.0 (0.4)	38.1 (8.8)
MA	5.6 (0.2)	22.6 (4.0)
OS	7.5 (1.0)	60.9 (11.6)
OA	5.9 (0.4)	43.2 (8.0)

Note: * = $p < 0.05$, ** = $p < 0.01$, and *** = $p < 0.001$ between Active and Sedentary groups

822 Board #56 May 29 3:30 PM - 5:00 PM

Walking People - Aruku-hito, Community-based Group Exercise Program For Older Adults: Expanding The ReachTatuo Doi¹, Kazuhira Onishi², Shinji Sato³, Atuko Fujii⁴, Nobuko Hongu, FACSM⁵. ¹Dynamic Sport Medicine Research Institute, Osaka, Japan. ²Oval Heart, Japan, Tokyo, Japan. ³Osaka Sangyo University, Daito-shi, Japan. ⁴Izumisano City Office, Izumisano, Japan. ⁵The University of Arizona, Tucson, AZ.

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PURPOSE: Regular physical activity helps older adults improve their health and enhances overall quality of life. The aim of this study was to determine how the community-based, group exercise program, “Walking People – Aruku-hito” has offered and continues to expand its reach through training health educators for the program in various cities in Japan. **MEHOTDS:** This presentation highlights “Walking People – Aruku-hito” program that was started helping older adults who were the victims of Tohoku earthquake and tsunami that created over 300,000 refugees in Tohoku/Northeast region, Japan in 2011. The contents and resources for reaching older adults, maintaining and expanding the “Walking People – Aruku-hito” program will be presented. **RESULTS:** The “Walking People – Aruku-hito” program started helping sedentary older adults who had limited social activities in a living temporary apartment complex after the loss of their houses. The program teams visited about 400 community-gathering centers, where people who had deeply affected by the Tohoku earthquake and tsunami met regularly. From April 2012 to April 2018, more than 10,000 older adults (65 to 96 years) participated in a supervised workshop. The workshop emphasized 1) benefits of walking, 2) stress-free walking, 3) basic conditionings (strength training, flexibility, balance) for walking, and 4) benefits of habitual daily walking. This tailored physical activity workshop was developed by the joint efforts of community agencies and academic partners. Because of the popularity of the “Walking People – Aruku-hito” program, the workshops have been offered in several regions of Japan with the support of Japan Medical Association and Ministry of Health, Labor and Welfare. Originally, instructors for the program were either certified exercise instructors, nurse practitioners, or physical therapists. Now, the number of instructors is increasing using the Train-the-Trainer approach; the instructors of the program train well-fit older participants who have been helping other participants in the program. **CONCLUSIONS:** The “Walking People – Aruku-hito” program started a community-based program designed for older adults’ specific needs and challenges. With the new supports and existing community resources, the program will be disseminated widely in Japan.

823 Board #57 May 29 3:30 PM - 5:00 PM

Effects Of Social Network Incentives And Financial Incentives On Physical Activity Among Elderly WomenRyo Yamashita¹, Shinji Sato², Ryoichi Akase³, Tatsuo Doi⁴, Shigeki Tsuzuku⁵, Toyohiko Yokoi⁶, Shingo Otsuki², Eisaku Harada¹. ¹Kumamoto Institute of Total Fitness, Kumamoto, Japan. ²Osaka Sangyo University, Osaka, Japan. ³Kumamoto Kinoh Hospital, Kumamoto, Japan. ⁴Dynamic Sports Medicine Institute, Osaka, Japan. ⁵Kumamoto University, Kumamoto, Japan.

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We know that an increase in physical activity improves health. To achieve a behavior change of physical activity, previous studies have used financial incentives. However,

the benefit of the incentive is lost when the intervention ends. Thus, we focused on social network incentives that leveraging the power of peer pressure to regulate behavior.

PURPOSE: The main goal is to ascertain whether combining financial incentives with social network incentives can lead to changes in physical activity (steps/day) during and after the intervention.

METHODS: We conducted a three month, randomized controlled study using pedometers. The effects of incentives on physical activity maintenance were measured six months post-intervention. The subjects were 39 elderly women over 65 years of age, residing in Kumamoto, Japan. The financial incentive (FI) group received a payment ranging from US\$4.40 to US\$6.20 per month depending on the number of steps taken during the intervention. For the other group, we provided a social network incentive (SNI) in addition to the financial incentive. The SNI+FI group walked in three people to use the power of peer pressure.

RESULTS: A two-way ANOVA revealed that in terms of physical activity, there was a statistically significant interaction between group and time ($p=0.017$). The FI group showed no statistically significant improvement in physical activity during the observation period.

CONCLUSIONS: Our results suggest that combining financial incentives and social network incentives is more effective than financial incentives alone. Especially, the effect can continue in post-intervention.

824 Board #58 May 29 3:30 PM - 5:00 PM
Does High-Cadence Cycling Improve Emotional Recognition in Individuals With Parkinson's Disease?

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(No relevant relationships reported)

Parkinson's disease (PD) is a progressive neurodegenerative disease that can lead to cognitive dysfunction including deficits in emotional recognition, which is the ability to identify different facial expressions. This deficit has been shown to lead to difficulties in social interaction and communication. High cadence cycling is a unique rehabilitation modality that has been shown to improve motor function in PD, but it is not known how this modality alters cognition. **PURPOSE:** To examine if three bouts of high-cadence cycling improved emotional recognition in individuals with PD. **METHODS:** Individuals with PD ($N=20$) completed three sessions of high cadence cycling (48 hours apart), on a custom motorized stationary cycle, consisting of a 5-minute warm-up at 50 revolutions per minute (rpm), 30 minutes of high cadence cycling between 75-85 rpm, and a 5-minute cool down. Emotional recognition was assessed using a computerized cognitive assessment battery at baseline and after the three cycling sessions. Individuals with PD in the control group ($N=15$) did not cycle and just underwent baseline and post testing. The percentage of accurately identified emotions and the average reaction time to correctly select an emotion (emotion bias) was used for the analysis of the overall emotion domain. Z-scores were used for the analysis. Independent samples t-tests were run for the change scores between the intervention and control group. **RESULTS:** Both groups displayed negative z-scores representing an emotional recognition deficit. There was no significant difference between the cycling and control group in the overall emotion domain ($p=0.76$). Cycling resulted in a z-score improvement in the emotion domain by 0.22 while the control group improved 0.14. Cycling did significantly improve "disgust" emotion accuracy compared to the control group ($p=0.03$). **CONCLUSIONS:** Three bouts of high-cadence cycling specifically improved "disgust" emotional recognition compared to the control. However, there was no significant difference between groups in the overall emotion domain. While high-cadence cycling might be a valuable rehabilitation modality for improving motor function in individuals with PD, the efficacy for improving emotional recognition and potentially social interaction is unclear.

825 Board #59 May 29 3:30 PM - 5:00 PM
Functional Capability, Flexibility, Strength And Quality Of Life In Sedentary Or Trained Elderly Women

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Throughout the last decades the elderly population has been increasing around the world. During the aging process, all physiological systems undergo significant functional changes and sedentary lifestyle has an elevated correlation with this unbalance. The inactivity increases the rate of chronic diseases development. Although any type or amount of physical exercise may discontinue the cellular aging processes,

regular physical exercise can attenuate the decline in physical and functional capabilities observed in elderly. Currently, some of the most encouraged activities in gyms are resistance exercise, weight-bearing training, and hydrogymnastics.

PURPOSE: The main objective of this study was to compare the effects of the above-mentioned exercises regarding muscle strength, flexibility, functional capability and quality of life in elderly women. **METHODS:** We evaluated 36 elderly women (age 70.17 ± 5.18 years) separated in four groups in agreement with their physical activity practice: 9 Sedentary (S); 9 Hydrogymnastics (H); 9 Weight-bearing Training (WB); 9 Resistance Training (RT). This was a transversal study, and all exercise practitioners had at least 3 months with 3 days a week of frequency. **RESULTS:** All exercised groups showed a significant difference ($p<0.05$) in relation to S in all measured variables. Among the exercises groups, the RT had greater strength and better functional capability. **CONCLUSION:** Regular physical exercise is important to reduce the deleterious effects of sedentary lifestyle in muscle strength, flexibility, functional capability and quality of life and among the exercises evaluated, RT showed to be a key component of a training program for elderly women.

826 Board #60 May 29 3:30 PM - 5:00 PM
Effect Of Acute Specific Exercise And Wuqinxi On Hand Function Of Patients With Parkinson's Disease

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(No relevant relationships reported)

PURPOSE: The aim of the study was to study the improvement of hand movement speed and flexibility in patients with Parkinson's Disease (PD) by an acute exercise of specific exercise and WuQinXi.

METHODS: This study selected 45 patients with PD (22 males and 23 females) from the PD patients Training Camp of Shanghai University of Sport, and randomly divided 22 patients (11 males and 11 females), age 67.17 ± 5.88 into Wu Qin Xi intervention group and 23 patients in the specific exercise intervention group (11 males, 12 females), age 65.52 ± 5.18 . According to the patient's Hoehn-Yahr stage, Wu Qin Xi and specific exercise were divided into three groups: 1-1.5 group, 2-2.5 group, and ≥ 3 group. Two groups of subjects were given 60 minutes' specific exercise and Wu Qin Xi intervention training. The specific exercise is consisted with several different health-care Qigong, which specifically target at the patients with Parkinson's Disease. The Purdue pegboard test, which has good predictive and concurrent validity. The test data were analyzed by SPSS 24.0. The paired sample t test was used for the pre- test and post-test in the group. p value of <0.05 was adopted.

RESULTS: After the intervention, the specific exercise group had significantly improved the three scores of Dominant hand, the Both hand and the assembly subtest ($P<0.05$), especially for the patients whose Hoehn-Yahr stage from 1-1.5, these three scores were improved. The patients whose Hoehn-Yahr stage from 2-2.5 only improved in the assembly subtest, and the patients whose Hoehn-Yahr stage ≥ 3 phase did not significantly increase in either four scores ($P>0.05$). After the intervention, the Wu Qin Xi group showed significant improvement in the Dominant hand, Nondominant hand and assembly subtest ($P<0.05$), especially for the patients whose Hoehn-Yahr stage from 1-1.5, these three scores were improved. There was no significant increase in the four scores in patients whose Hoehn-Yahr stage from 2-2.5 and ≥ 3 ($P>0.05$).

CONCLUSIONS: The acute exercise intervention of specific exercise and Wu Qin Xi can improve the speed and flexibility of hand movement in Parkinson's patients. The effect of specific exercise is more obvious for patients whose Hoehn-Yahr stage from 1-1.5.

827 Board #61 May 29 3:30 PM - 5:00 PM
The Role of 'Exercise Is Medicine' in Asia: Perspectives for the Older Adult Population

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Asia is home to the largest older adult population in the world, and the proportion of people aged 65 and over is projected to rapidly grow in all Asian countries. Many chronic diseases and conditions are prevalent in older adults, and regular exercise and physical activity can help prevent and manage many of these conditions. A significant component of Asian cultures is the promotion of active lifestyles, where many older adults would have the opportunity to practice exercise for free or at low cost. However, if seniors have a chronic condition and no previous experience with exercise, it is not always easy to start an exercise routine without specialized information and appropriate instruction. Exercise is Medicine (EIM) was created to help seniors with

chronic diseases to incorporate exercise into their everyday lives. **PURPOSE:** Due to the initial development of EIM within Western cultures and traditions, the purpose of our work was to examine how best to adapt, implement, and disseminate EIM for the older adult population in Asia. **METHODS:** From April, 2017 to September, 2018 numerous discussions were held between researchers and practitioners from Asian countries who had between 15 to 30 years of experience in the area of aging and physical activity. Additionally, research articles, reports, and web-sites related to EIM were reviewed and analyzed. Finally, interviews were conducted among EIM personnel in Asia. **RESULTS:** The results have been divided into three sections. The first section provides a historical overview of EIM development in Asia. The second presents an assessment of the potential role of EIM for older adults in Asia. The final section provides a blueprint for the development of an extended concept of EIM as a stimulus for further conversations and discussions among the medical, exercise, and health related communities. **CONCLUSION:** EIM has the potential to play an important role in the prevention and management of chronic diseases in Asia, and improving quality of life among Asian seniors.

828 Board #62 May 29 3:30 PM - 5:00 PM
Effect Of Wu Qi Xin Exercise On The Quality Of Life Of Parkinson's Patients

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PURPOSE: To determine the effect of 12-wk Wu Qin Xi exercise intervention on the quality of life of Parkinson's patients.

METHODS: 23 Parkinson (PD) patients (12 men and 11 women; age in 65.65±4.82 yr.) were recruited to participate in a 12 wk Wu Qin Xi, a traditional Chinese exercise, intervention in the Pai Training Camp of Shanghai University of Sport, China. Patients' clinical status was assessed with Unified Parkinson's Disease Rating Scale (UPDRS) parts I-III, and Quality of Life's Disease Questionnaire (PDQ-39). The assessments were conducted before and after the intervention group, which included 120-minute Wu Qin Xi exercises, twice a week for 12-wk. The paired sample t test was used for the pre- and post-test difference. **RESULTS:** A statistically significant pre- and post-test difference were found after the 12-wk Wu Qin Xi intervention: UPDRS score decreased by 23% (p=0.01); UPDRS part I score decreased by 28% (p=0.003); part II decreased by 20% (p=0.004); part III decreased by 24% (p=0.036) and PDQ-39 score decreased by 30% (p<0.001). **CONCLUSIONS:** Wu Qin Xi exercise could improve the quality of life of PD patients.

829 Board #63 May 29 3:30 PM - 5:00 PM
Significant Improvement In Dxa Scores Is Observed With Osteoporotic Patients When High Force, Short Duration Stimulus Is Created

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PURPOSE: Determine if high intensity short duration forces applied to bone results in improved DXA measures.

The relationship between bone geometry and mechanical influences on bone suggests that when significant forces are applied to bone, the compression will stimulate an adaptive response, commonly known as Wolff's Law. However traditional exercise as a treatment for osteoporosis has generally not been able to create the forces needed to stimulate bone growth in a safe and effective manner. **METHODS:** Twenty-six women X age 63 with diagnosis of osteoporosis participated in a one-year study using a novel exercise device that allows bone to adapt to significant forces. A subset (9 individuals) were followed for one additional year after the study concluded. Three independent clinics had identical equipment and protocol. Subjects completed a minimum of 48 sessions once a week over the year. DEXA scans were conducted at the same testing location for both pre-and post-assessments. Subjects self-reported weight, weekly minutes of exercise, diet and prescription medications. **RESULTS:** Of the 26 subjects, 16 individuals demonstrated a significant reduction p<.05 (improvement in bone) in their mean DEXA score, while 6 had no significant change and 4 individuals showed a further degradation. Forces required to significantly improve bone were 2 - 10x multiples of body weight. Of those who continued for an additional year, 6 demonstrated additional improvements p<.05 while 3 were not significantly different. **CONCLUSIONS:** These data suggest that a non-pharmacologic exercise solution is available to individuals diagnosed with osteoporosis. Further study is required with larger sample sizes and more diverse demographics. Additional research is needed to validate this approach as a viable and safe strategy for bone reformation.

B-57 Free Communication/Poster - Aging and Older Adults

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

830 Board #64 May 29 3:30 PM - 5:00 PM
Improving Functional Capacity And Physical Activity Through Education: Four-year Follow-up Of Parqve Study

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PURPOSE: The objective of the present study was to analyze what changes the long-term recommendation of regular physical exercises could cause in individuals with knee osteoarthritis (KOA) during 4 years of follow-up.

METHODS: Individuals undergoing care for primary KOA (N = 153; age = 67 ± 2) in the public health system were randomly assigned to either an educational (GI; n = 83) or control group (CG; n = 70). The volunteers were asked to respond to the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC™) for the assessment of pain, function, and quality of life. The short version of the International Physical Activity Questionnaire (IPAQ) (validated in the Brazilian population) was used to assess the level of daily physical activity in all volunteers. Functional capacity was evaluated at baseline (pre), and at 24 and 48 months follow-up, and included the sit-and-reach test, 6-min walk test (6MWT), timed up and down stairs test (TUDST), Timed Up and go test (TUGT), and sit and lift five times test (FTSST).

RESULTS: The Body mass index (BMI) significantly decreased (3.5%) after 24 and 48 months of follow-up in the GI (P < 0.05), while a slight increase was observed in the GC. The GI group presented improved (P < 0.001) TUGT (27%) and FTSST (36.5%) performance after 48 months of follow-up. The GC did not change during the same period. In the GI, the total WOMAC score fell by 8.0 points, WOMAC pain decreased by 2.5 points, and WOMAC stiffness decreased by 0.5 point, while being higher in the GC (P < 0.001). There was also an increase (P < 0.001) in the prevalence of "active" (26.6%) and "very active" (30%), as well as a reduction in sedentary prevalence (12.5%) in the GI during follow-up. No significant improvements were observed in the sit-and-reach, TUDST, and TC6 tests in either group.

CONCLUSIONS: The results suggest that a program promoting regular physical exercise could be an effective tool to improve physical fitness, functional capacity, quality of life, and level of daily physical activity in individuals with KOA, even over a long period.

831 Board #65 May 29 3:30 PM - 5:00 PM
Intergenerational Multicomponent Training Strategy to Improve Cardiovascular Risk Factors and Quality of Life in Elderly

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 (No relevant relationships reported)

With the aging process, there are several changes in the body composition, a reduction of the lean mass and a progressive increase of the fat mass (FAT%). The percentage of fat mass (FAT%) and arterial stiffness (cPWV) are shown to be risk factors for the development of cardiovascular diseases, but the association between both is not established, especially during aging. Research shows the main benefits of intergenerational programs in the elderly population reflects a better perception of quality-of-life and prevention of cardiovascular diseases. Purpose: The objective of this study was to analyse the effects of a 6-month intergenerational exercise program on body composition, arterial stiffness and quality of life of elderly users of day-care centers. Methods: This is a randomized clinical study with a sample of 37 individuals (27 intervention group- IG and 10 control group-CG) with a mean age of 76.68±9.96 years attending day centers in Porto. Body composition (FAT%) was evaluated by double-energy bone densitometry (DEXA); Arterial stiffness was measured as carotid-femoral pulse wave velocity (cPWV) using the SphygmoCor device (AtCor Medical, Australia). In brief, sequential and consecutive carotid and femoral pressure waves

were registered with parallel electrocardiogram recording and the quality of life was self-reported in the SF-36 questionnaire, with a scale of 0-100, where a higher score indicates a better quality of life. The pre and post intervention differences were analysed using the Kruskal Wallis test Results: The %FAT had a decrease of $1.83 \pm 2.33\%$ with in GI (before = $38.70 \pm 7.62\%$; after = $36.87 \pm 6.92\%$) in relation to CG (before = 39.92 ± 7.82 ; after $41.48 \pm 5\%$), ($p = 0.952$). The values of cPWPV increased 7.34 ± 3.79 in IG (before = 39.50 ± 13.42 after 46.84 ± 12.74) in relation to GC (before 42.82 ± 12.96 ; after 45.35 ± 11.14), ($p = 0.042$) Regarding the self-reported quality of life, there were no significant differences ($p = 0.176$) between GI (before = 39.50 ± 13.52 after = 46.84 ± 12.74) and the CG (42.82 ± 12.96 after 45.35 ± 11.14). Conclusion: The results show that an integrational exercise program can reduce arterial stiffness in the elderly when compared to older people not involved in an exercise program.

832 Board #66 May 29 3:30 PM - 5:00 PM
Barriers of Being Active: Differences Between Two Generations

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(No relevant relationships reported)

PURPOSE: Physical inactivity and sedentary behaviors are nowadays included among principal risk factors for cardiovascular disease and mortality and have the highest Population Attributable Fraction, especially for women. Regular exercise reduces the risk of cardiovascular events; these evidences led to new guidelines where 150 min/week of moderate physical activity or 75 min/week of intense physical activity (or a combination of both) are recommended. Physical activity is also included in the seven metrics of AHA's definition of Ideal Health. Furthermore, the worldwide prevalence of childhood obesity has increased over the past three decades with a simultaneous decrease of physical activity. The study aimed to investigate the principal perceived barriers to exercise in young and adult populations.

METHODS: "Why Not" was a cross-sectional study conducted in 2018 in a high school (87 students, 19.1 ± 0.4 years old) and in the Rectorate of University of Florence (106 adults, 48.4 ± 12.2 years old). Personal anamnesis and information about the amount of weekly physical activity were collected. Barriers to Being Active Quiz (BBAQ), and Mediterranean Diet Score questionnaires were administered. Weight and height were measured according to standardize protocols.

RESULTS: Sedentary habits were present in the 35% of adults and 24% of all students enrolled. Lack of time for exercise was the most frequently reported barrier for adults, followed by lack of energy and laziness. These barriers were well represented in young population too, especially in girls (48% lack of energy and laziness, 39% lack of time) compared with boys (25% lack of energy, 14% laziness, 23% lack of time). Surprisingly, fear for injuries was reported only by man. Prevalence of overweight ($BMI > 25 \text{ kg/m}^2$) was 17% and 42% in adults and 4% and 3.9% among students (woman and men respectively). Mean adherence score of Mediterranean diet was 34 ± 3 among adults and 32 ± 5 among students (score range 0-55) without sex differences.

CONCLUSIONS: Sport medicine physicians should be aware of the barriers that patients face during exercise prescription and be able to contrast them with useful individual strategies. Analysis of young people life-style habits can help finding social strategies to promote healthy behaviors.

833 Board #67 May 29 3:30 PM - 5:00 PM
Optimal Loads for Power in Young and Old Men and Women Using Plate-Loaded Resistance Machines

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PURPOSE: Power affects quality of life and sports performance across age. Plate-loaded machines are the most common equipment used by recreational lifters; however, no studies have determined the optimal loads that maximize power outputs using this equipment. **METHODS:** Fourteen older men (69.4 ± 6.7 y), 21 older women (69.8 ± 7.9 y), 24 young men (21.0 ± 2.2 y) and 22 young women (20.7 ± 1.5 y) participated in two sessions of strength and power testing. They performed ten different plate-loaded exercises to determine their maximum dynamic strength (1RM) and peak power output (PP). Power was tested at 40, 50, 60, 70 and 80% 1RM using a linear position transducer. PP was expressed relative to the highest power produced (PP_{REL}). **RESULTS:** Significant sex x load interactions were seen for all upper body lifts ($p < .05$). Post hoc analyses showed that for multi-joint upper body exercises, men reached their highest PP_{REL} at the low end of the loading spectrum (chest press and seated row: 40-60%1RM; shoulder press: 40-70%1RM), while women's highest PP_{REL} was at higher loads (50-70%1RM). For single joint upper body exercises, the biceps curl and triceps extension showed no differences in PP_{REL} across loads for men, while women's optimal loads were at 50-80%1RM for both exercises. For shoulder press and

biceps curl there were also age x load interactions ($p < .05$). Younger persons reached PP_{REL} at 40%1RM and 50-60%1RM, respectively and older persons at 60-70%1RM and 50-80%1RM, respectively. For lower body exercises, leg press, leg curl and hip abduction showed a significant main effect for load ($p < .033$) with optimal load at 60-70%1RM, 50-70%1RM, and 50-60%1RM, respectively. Hip adduction produced significant age x load ($p < .031$) and sex x load ($p < .034$) interactions. 50-70%1RM was optimal for both age groups, but older persons produced significantly higher PP_{REL} at 40%1RM. For load x sex, optimal load was 50-70%1RM for both sexes; however, PP_{REL} occurred at 70%1RM for men and 50%1RM for women. Analysis for the calf raise showed a significant age x load interaction ($p < .001$) where PP_{REL} was 40-70%1RM for young and 50-80%1RM for older participants. **CONCLUSIONS:** Different optimal load ranges are required for individual plate-loaded exercises depending on age and sex. Younger persons and men optimize power at lower loads than older persons and women.

834 Board #68 May 29 3:30 PM - 5:00 PM
Evidence-based Fall Prevention Program. A 5-year Evaluation.

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(No relevant relationships reported)

Falls among older adults are common, costly, and preventable. Stay Active and Independent for Life (SAIL) is a public-domain evidence-based program that emphasizes on strength and balance to prevent falls in older adults. **PURPOSE:** To evaluate the physical function of older adults participating in the SAIL program over multiple years.

METHODS: Data were collected from multiple locations in Washington State that offer the SAIL program. Physical functioning was assessed using the 8-foot up and go test, the 30-second bicep curl test, and the 30-second chair stand test. A total of one hundred and forty-nine participants completed the baseline assessment. One hundred and forty-three individuals completed the test a year after the baseline assessment, but declined in subsequent years. A paired-sample *t*-test was used to evaluate differences in mobility and strength between baseline and the first year of participation in the SAIL program. A repeated-measures ANOVA was used to evaluate differences in functional assessments among years 1 through 5. Significance was set at $p < 0.05$.

RESULTS: After one year of participation, all functional assessments were significantly different ($p < 0.01$) compared to the baseline measurements. The 8-foot up and go test improved by 8.3% (7.2 ± 2.9 vs. 6.6 ± 2.3), the 30-second bicep curl test increased by 7% (17.1 ± 4.9 vs. 18.3 ± 4.9), and the 30-second chair stand test improved by 12.2% (13.9 ± 5.2 vs. 15.6 ± 5.6). During the five years post baseline, the average time to complete the 8-foot up and go test was less than 7 seconds, but there were no significant ($p > 0.05$) differences among years. The average upper body strength for SAIL participants increased for four years. There was a significant ($p = 0.04$) difference on the number of repetitions completed in 30 seconds between year 3 and year 1 (19.8 ± 5.2 vs. 17.8 ± 4.9). Finally, the average number of chair stands in 30 seconds increased for four years. There was a significantly higher number of repetitions in year 3 compared to year 1 (19.1 ± 7.5 vs. 17.1 ± 6.3 ; $p < 0.01$) and to year 2 (19.1 ± 7.5 vs. 17.6 ± 7.6 ; $p < 0.01$).

CONCLUSIONS: These results indicate that the SAIL program was successful at maintaining mobility and increasing upper and lower body strength of individuals over 5 years. These results suggest a potential decline in the risk of falling for SAIL participants.

835 Board #69 May 29 3:30 PM - 5:00 PM
Effects Of Exercise Classes And Subsequent Independent Exercise Practice On Physical Fitness In Older Adults

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(No relevant relationships reported)

PURPOSE: This study aimed to clarify the effects of instructor-led exercise classes and subsequent independent exercise practice on older adults' physical fitness levels. **METHODS:** The participants were 19 community-dwelling elderly adults (7 males, 12 females, 69.4 ± 3.5 yrs) who took part in exercise classes under the leadership of an expert instructor, held once a week over 10 weeks. They subsequently performed independent exercise practice following the same schedule for 1 year. The exercise program emphasized aerobic exercises such as walking, muscle strength training for the trunk and limbs, and recreational activities. All the participants completed physical fitness assessments before and after the 10-week instructor-led exercise classes and at the 1-year follow-up. This assessment comprised 12 items designed to evaluate physical fitness levels, including hand-grip strength, sit-up, sitting trunk flexion, standing on one leg with the eyes open, 10-m walking time, 10-m obstacle walk, functional reach, the 30-s chair sit to stand test, the timed up and go test, the 5-second stepping test, whole body reaction time, and the 6-minute walk test. The participants

were instructed to wear the accelerometer on their waistline all day. **RESULTS:** The participation rate of exercise classes and exercise practice was $90.0 \pm 11.0\%$ and $76.5 \pm 14.6\%$, respectively. Significant changes were observed in the 10-m walking time (pre: 5.80 ± 1.48 sec and post: 4.93 ± 0.57 sec, $p < .05$), 10-m obstacle walk (pre: 4.56 ± 0.82 sec and post: 3.88 ± 0.66 sec, $p < .05$), and timed up and go test (pre: 4.83 ± 0.59 sec and post: 4.33 ± 0.53 sec, $p < .05$) performance after completion of the 10-week program. Furthermore, these changes were maintained at the 1-year follow-up. Although no significant change was observed in the 6-minute walk test after the 10-week exercise classes, a significant change was apparent at the follow-up (pre: 629.9 ± 51.8 m and follow-up: 677.1 ± 54.7 m, $p < .05$). **CONCLUSIONS:** Our results clearly indicated that even low-frequency, continuous exercise can help improve and maintain physical fitness. However, probably because the independent exercise practice simply continued the activities of the 10-week exercise program, we observed no further effects by the 1-year follow-up.

836 Board #70 May 29 3:30 PM - 5:00 PM
Acceptance And Feasibility Of Using A Seated Elliptical During Sedentary Behaviors In Older Adults

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Older adults aged 60+ years are particularly vulnerable to the exposure and negative health consequences related to sedentary behavior (SB). There is limited evidence for the feasibility and effectiveness of SB interventions in older adults. **PURPOSE:** The purpose of this study is to explore the feasibility and acceptability of using a seated elliptical device (SED) to replace SB with a light-intensity physical activity (LPA) in the homes of older adults. **METHODS:** Twenty older adults (mean \pm SD, 71.9 ± 5.3 years) participated in this feasibility study. Each participant was outfitted with hip-mounted activity monitor and SED in the home for seven days. Participants were randomly assigned to one of four pedaling duration groups (15, 30, 45, and 60 minutes/day) and instructed to accumulate SED pedaling at a self-selected light-intensity during typical SB activities for a minimum of three of the next seven days. A Fisher's exact test was used to test for group differences in pedaling goal adherence and a one-way ANOVA was used to test for linear trends in accumulated pedaling durations across groups. Cohen's d was performed to estimate effect sizes for displacing SB with SED-based LPA for each group. **RESULTS:** There was 100% adherence across all four pedaling duration groups with no significant difference in total pedaling days completed ($p = .241$) and a significant linear group trend ($p < .001$) for minutes pedaled per day. The 45 and 60 min group accumulated greater minutes per day of pedaling than the 15 and 30 min groups ($p < .005$) with no significant differences between the 45 and 60 min groups or the 15 and 30 min groups. Across groups there was a 4.3% to 11.3% reduction in daily SB (Cohen's d : 0.72 to 1.57) and 8.3% to 23.6% increase in LPA (Cohen's d : 0.41 to 1.2) on pedaling days. Participants' perceptions of using the SED were positive. **CONCLUSIONS:** Older adults were successfully able to exceed 60 minutes of daily pedaling without altering or interrupting their typical daily behaviors. The long term impact of these daily changes in LPA on health and function in aging populations are to be determined.

837 Board #71 May 29 3:30 PM - 5:00 PM
Cadence (steps/min) Thresholds For Relative Intensity Indicators In Older Adults

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 (No relevant relationships reported)

In young adults, a cadence (steps/min) of 100 steps/min has been associated with absolutely-defined moderate intensity, measured in metabolic equivalents (METs; 1 MET = 3.5 mL/kg/min). However, less is known about how cadence is associated with relative intensity indicators in older adults.

PURPOSE: To investigate cadence thresholds associated with ACSM-defined indicators of moderate relative intensity (40-59% of heart rate reserve [%HRR], 64-76% of maximum heart rate [%HRmax] percentage, and a Borg scale rating of perceived exertion [RPE] of 12-13). **METHODS:** Thirty-seven older adults (mean \pm SD; age = 68.5 ± 4.7 years, BMI = $26.3 \pm 3.9 \text{ kg/m}^2$) completed a progressive treadmill walking protocol that consisted of 5-minute bouts increasing by 0.5 mph from 0.5 to 6.0 mph. The protocol ended following the

bout where the participant naturally selected to jog or run, $> 75\%$ HRmax, or reported a Borg scale RPE > 13 . Intensity indicators were analyzed using Receiver Operating Characteristic curves. Optimal cadence thresholds associated with moderate intensity were determined using Youden's index.

RESULTS: Four participants did not reach moderate intensity based on %HRR, and three did not reach moderate intensity based on %HRmax. %HRR and %HRmax were both associated with moderate intensity cadence thresholds of 111 steps/min. %HRR had a sensitivity of 76%, a specificity of 87%, and an area under the curve (AUC) of 0.76. %HRmax had a sensitivity of 75%, a specificity of 87% and an AUC of 0.75. Additionally, RPE was associated with a moderate intensity threshold of 104 steps/min, with 78% sensitivity, 80% specificity, and an AUC of 0.83.

CONCLUSION: Cadence thresholds associated with relative indicators of moderate intensity were consistently higher (4-11 steps/min) than the commonly reported heuristic value of 100 steps/min, although still within an obtainable cadence for ambulatory, healthy older adults. Relative indicators provide an opportunity to individualize cadence-based intensity prescription.
 Supported by NIH/NIA Grant 5R01AG049024 – CADENCE-Adults study

838 Board #72 May 29 3:30 PM - 5:00 PM
Less Is More: A Pilot Study Assessing The Benefit Of Exercise Frequency For Older Adults

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 (No relevant relationships reported)

There are countless benefits of exercising for older adults including a maintenance of bone density, muscle mass, and the preservation of muscular strength and endurance. Although older adults benefit from exercising it may be more convenient, more accessible, and less of a burden to exercise less times per week. **PURPOSE:** The purpose of this pilot study is to quantify if there are any added benefits to exercising three days a week compared to two days a week. **METHODS:** Participants included community dwelling adults ($N = 36$, $M = 74.34 \pm 7.91$ years) who self-selected exercise frequency by joining a multi-component fitness class offered in their local community. Classes were held either two or three days per week depending on the location. The Functional Fitness Test and Short Physical Performance Battery were conducted two times 6 months apart at all locations. Results were analyzed using repeated measures ANOVA. **RESULTS:** A significant group-by-time interaction was observed for hand-grip strength, $F(1, 18) = 7.92$, $p = .01$, with the two days per week group improving by 13% and the three days per week group decreasing by 1.9%. Interactions were not significant for chair stands test, arm curl test, 8 Foot Up-and-Go, or Gait speed, $p > .05$. There was a significant time effect for the chair stand test [$F(1, 15) = 7.54$, $p = .01$], gait speed [$F(1, 19) = 7.91$, $p = .01$], and hand-grip strength [$F(1, 18) = 4.61$, $p = .04$] with all tests indicating improvements from the first to second test. Univariate effect sizes indicate a trend toward greater improvements in the 2 d/wk group when compared to the 3 d/wk group with the exception of the arm curl which favors 3 d/wk. **CONCLUSION:** Although results are preliminary, this study indicates that handgrip strength was enhanced when participants were involved in a multi-component exercise program two days per week (13%). Chair stands test, arm curl test, 8 Foot Up-and-Go, and Gait speed increased regardless of the number of days per week of exercise. Notable limitations to the study are the number of males ($N = 6$) compared to females ($N = 30$) and participant's self-selection of exercise frequency. Also, we did not track outside influences such as physical activity levels, health status, and history of disease. Future studies should confirm these results using an experimental design in a larger, more diverse sample.

839 Board #73 May 29 3:30 PM - 5:00 PM
The SIENA Study: Sisters Integrating Exercise and Neuro Activity

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 (No relevant relationships reported)

PURPOSE: Alzheimer's disease (AD) dementia affects an estimated 4.7 million aging adults and is projected to significantly increase to 13.8 million by the year 2050. The prevalence of AD dementia is higher in women with more than two-thirds of all diagnosed cases exhibited in women. This condition is characterized by memory loss and cognitive decline. Pro-health behaviors including physical activity and meditation have been evidenced as neuroprotective behaviors among aging adults. Therefore, the purpose of this study was to explore health behaviors that may contribute to better cognitive functioning among aging women. **METHODS:** Catholic Sisters $n = 39$; $M_{age} = 78.9$, $SD = 8.2$ completed three cognitive assessments; digit symbols task (DST), controlled oral word association (COWAT) and animal naming (AN) and four functional fitness tasks; sit to stand (STS), get up and go (GNG), arm curl (AC) and six minute walk task (WALK). Demographics and prayerful meditation were measured via self-report. Bivariate correlation analyses between variables and mediation analyses using SEM in stata were conducted to explore direct and indirect effects. **RESULTS:** The DST was associated with three functional fitness tasks; AC ($r = .39$, $p < .05$) GUG

($r=-.49$, $p<.05$) and WALK ($r=.44$, $p<.05$). AN was associated with 2 functional fitness tasks; AC ($r=.44$, $p<.05$), GUG ($r=-.37$, $p<.02$) and COWAT was associated with WALK ($r=-.37$, $p<.03$). A mediation model was explored and explained 24% of the variance. There was a significant indirect effect of functional fitness on Age ($B=-.211358$, $SE=.49$, $z=-4.3$, $p<.001$) and Age on Cognition ($B=-1.32$, $SE=.41$, $z=-3.18$, $p<.001$). Functional fitness had a direct effect on meditative prayer ($B=-.28$, $SE=1.11$, $z=-2.55$, $p>.01$) but not on cognition ($B=-.784$, $p>.05$). **CONCLUSION:** Given the positive associations between functional fitness and cognition, yet the inverse association between fitness and prayer, future research should explore physically active prayer interventions and their influence on cognition.

840 Board #74 May 29 3:30 PM - 5:00 PM
Daytime Steps Per Minute Correlate With Functional Fitness In Hispanic Elders In Puerto Rico

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(No relevant relationships reported)

Walking cadence is a gait parameter associated with reduced risk of mortality, cardiovascular events, and falling among elder adults; but has not been reported among older Hispanics in Puerto Rico (PR). However, poor physical function, and low moderate to vigorous physical activity among older Puerto Rican adults in the USA and PR have been reported. **PURPOSE:** To evaluate the association between functional fitness and daytime walking cadence among Hispanic elders living in PR. **METHODS:** A group of 62 older adults ($F=38$, $M=24$; age = 76.4 ± 8.4 yr), participants in two HOPE centers in PR, completed a battery of senior fitness tests (and wore an accelerometer for 7-consecutive days. Spearman correlation and linear regression analyses were conducted to test associations between mean daytime walking cadence (steps/min) and functional fitness. **RESULTS:** Mean steps/day = $3,410 \pm 1,910$, and total daytime mean steps/min = 4 ± 2 . Significant correlations were observed between walking cadence and cardiorespiratory fitness (6 min walk) ($\rho = 0.41$, $P=0.001$), agility (foot up and go) ($\rho = -0.39$, $P=0.003$), muscle endurance (sit-ups and biceps curl) ($\rho = 0.27$, 0.29 ; $P=0.03$, 0.02 , respectively), and body composition (waist to height ratio) ($\rho = -0.27$, $P=0.03$). **CONCLUSION:** Supporting previous studies, walking cadence significantly correlated with most functional fitness parameters in our group of older Hispanic adults in PR; thus, suggesting that those with higher mean steps/min (uncensored mean cadence) have higher cardiorespiratory fitness, agility, muscle endurance, and lower waist to height ratio; all critical health parameters for this population.

841 Board #75 May 29 3:30 PM - 5:00 PM
Physical Activity, Sedentary Time, And Sleep Quality Among Hispanic Women With Rheumatoid Arthritis

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(No relevant relationships reported)

Rheumatoid Arthritis (RA) is a chronic inflammatory disease commonly associated with physical inactivity and poor sleep quality (SQ). No previous studies have evaluated these associations among Hispanic women, and none have used objective assessment of physical activity (PA) and sedentary time (ST) in this population. **PURPOSE:** To evaluate associations between PA, ST, and SQ among Hispanic women with RA. **METHODS:** A group of 16 Hispanic women with RA (mean age = 49.4 ± 14.5 yr, and BMI = 26.91 ± 5.3 kg/m²) wore an ActiGraph GT3X+ accelerometer attached to an elastic waist band in the right hip area for 7 consecutive days to determine PA and ST. Participants also completed the Pittsburgh Sleep Quality Index (PSQI). Correlation analyses were used to evaluate associations between PA, ST, and SQ components. **RESULTS:** Mean of total moderate to vigorous PA (MVPA) was 178.6 min/week, and ST was 6.2 hr/day. Considering total MVPA, 50% of study participants were considered active, while 33% were considered sedentary. From the PSQI, 62.5% had poor sleep quality. A significant association was observed between ST and sleep efficiency ($r = 0.61$, $P = 0.01$); thus, suggesting that ST negatively influence this aspect of sleep quality in our group of Hispanic women with RA. PA and ST did not appear to influence other sleep quality components. **CONCLUSION:** Different from other studies, physical inactivity and ST were not highly prevalent behaviors, but ST was an important determinant of sleep efficiency in our group of Hispanic women with RA. Regardless of PA classification, ST must be considered in any intervention aimed to improve sleep in this population.

842 Board #76 May 29 3:30 PM - 5:00 PM
The Effect Of A Multicomponent Exercise Program On Sleep Quality In Institutionalized Elderly

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Sleep disorders are one of the most prevalent changes in the elderly and this has been associated with a negative impact on health outcomes. Exercise to be a potential non-pharmacological treatment to improve sleep quality. However, the effects in older has been largely unexplored. **PURPOSE:** To evaluate the effects of exercise on sleep complaints in older adults residing in a nursing home. **METHODS:** A total of thirteen older adults (84.1 ± 6.9 years) were according to the inclusion criteria. Socio-demographic data was collected using a structured questionnaire. Anthropometric measures were obtained using standardized techniques. Sleep quality was collected by self-report through the face to face Oviedo sleep questionnaire. The EQ-D5 was used to assess the health related quality of life. The training program included a multicomponent exercise intervention (9 weeks; 2 times per week) focused on mobility, strength and balance. Student paired t-test was carried out to detect any significant differences between the pre-test and post-test in any variable. The difference between variables was calculated using the effect size (ES) through Cohen's d. The significance level was set at $p < 0.05$. **RESULTS:** The EQ-5D mean scores were similar for the four dimensions (pre-post intervention) including mobility, pain/discomfort, self-care and usual activities; however the dimension related with depression improved 31% at the end of the intervention. The t-student test and Cohen's d showed a medium non-significant effect on sleep satisfaction ($p=0.26$; ES: 0.32; insomnia ($p=0.37$; ES: 0.38) and hypersomnia ($p=0.09$; SE: 0.52). **CONCLUSIONS:** A supervised exercise program has a moderately beneficial effect on sleep quality in terms of insomnia, hypersomnia and depression in older people.

843 Board #77 May 29 3:30 PM - 5:00 PM
Assessing The Health Needs Of Older Adults Living in an Underserved Urban Community

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(No relevant relationships reported)

Between 2012 and 2050, the population of older adults (>65 years old) is projected to nearly double and the preservation of their capacity to live independently remains a large public health concern. The American Gold Star Manor is a not for profit trust that owns and operates an older adult living community, subsidized by the Housing and Urban Development Division of the United States. Located in an urban subset of northern Long Beach, California, the manor is home to seniors with relations to the United States military and veterans. **PURPOSE:** The purpose of this study was to assess the health needs of a multi-ethnic older adult population in an underserved urban community. The data collected from this study will be used in a future study to inform the development and assessment of a monthly walking program for older adults living at Gold Star Manor. **METHODS:** An information session was held at American Gold Star Manor where an eleven-item survey was used to assess the current health needs of residents living at Gold Star Manor. In total, 29 residents (62+ years) attended the information session and completed the survey. The residents were given a set of topics and instructed to mark all topics they were interested in learning more about. Additionally, they were given space to fill in any topics that were not part of the provided selection. **RESULTS:** Of the 29 individuals surveyed, we found that 55% residents preferred English as their spoken language, 35% residents preferred Korean as their spoken language, and 10 residents preferred Spanish. Of the choices provided, 66% residents selected joint health, 62% selected social health, 48% selected cardiovascular health, 34% selected pedestrian safety, and 34% selected hydration and nutrition. In the open-ended section, residents recorded interest in learning about diabetes management, physical fitness, and cognitive health. **CONCLUSIONS:** Based on the needs assessment, the topics garnering the most interest among the American Gold Star Manor residents include joint health, social health, cardiovascular health, pedestrian safety, hydration, nutrition, diabetes management, physical fitness, and cognitive health.

- 844** Board #78 May 29 3:30 PM - 5:00 PM
Handgrip Strength as a Screening Assessment for Functional Limitations
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There appears to be an undisputed strong relationship between isometric handgrip strength (HGS) and functional fitness test performance, ability to perform activities of daily living (ADLs), and mortality, but the extreme diversity in how HGS data are interpreted make it difficult to utilize the assessment in a meaningful way. **PURPOSE:** To simplify this interpretation by establishing a single and meaningful universal HGS cutoff that would inform the test administrator whether or not additional functional fitness testing was warranted. It was hypothesized that subjects scoring above the HGS cutoff would exhibit fewer perceived and actual functional limitations. **METHODS:** Male ($n = 24$; Age = 62.3 ± 14.3 years) and female ($n = 59$; Age = 64.7 ± 13.0 years) subjects self-reported their perceived ability to complete the variety of ADLs included in the Composite Physical Function Scale (maximum score of 24 indicating no perceived functional limitations). They additionally completed a battery of functional fitness assessments, which included HGS, 30-s Chair Stand, 8-ft Up-and-Go, 10 lb and 25 lb lift and carry, and 400 m Walk Test. A self-developed cell phone application was utilized to produce more outcomes, such as steady-state gait speed and cadence during the 400 m Walk Test. Independent samples *t*-tests were used to compare the perceived and actual functional fitness outcomes between subjects with grip strength < 30 kg and those with grip strength ≥ 30 kg. Additionally, positive predictive value (PPV), and negative predictive value (NPV) were calculated to investigate the accuracy of a 30 kg HGS cutoff to identify subjects with perceived or actual functional limitations. **RESULTS:** Subjects with a HGS ≥ 30 kg scored significantly higher on the CPF Scale, compared with subjects with a HGS < 30 kg (23.9 ± 1.2 vs. 22.4 ± 1.3 , respectively). Likewise, Subjects with a HGS ≥ 30 kg performed significantly better on every functional fitness test outcome, compared with subjects with a HGS < 30 kg. The NPV (true negative) was excellent ($\geq 90\%$) for all outcomes, while the PPV (true positive) was poor ($\leq 56\%$) for all outcomes. **CONCLUSIONS:** A HGS ≥ 30 kg appears to be an appropriate cutoff to accurately rule out current functional limitations in males and females 40 years of age and older.

- 845** Board #79 May 29 3:30 PM - 5:00 PM
Relationship Between Functional Physical Condition And Age In Institutionalized Older Adults In Bogotá-Colombia
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 (No relevant relationships reported)

Purpose

The quantification of functional physical condition (CFF) in the elderly is an important indicator to define the state of health, the level of dependence and the quality of life in functional physical condition this population. The objective of this study was to establish the relationship between age and age in a group of elderly people residing in retirement home in the city of Bogotá.

Methodology

Cross-sectional descriptive observational study, which evaluated the functional physical condition (SFT) in 253 older adults (42.6% men and 57.3% women) institutionalized in the city of Bogotá. The CFF was evaluated through the senior fitness test, in the application the protocols proposed in the validation to Colombia were followed. The measure consisted of 6 physical tests: chair stand (repetitions), arm curl (repetitions), aerobic capacity in 2 minutes (repetitions), flexibility (cm); and 8 foot up and go (ms). A univariate descriptive analysis and a correlation analysis between age and physical condition variables were performed. An appreciative scale of the correlations was established as follows: weak for values > 0.40 ; moderate, between 0.41 and 0.60; strong, between 0.61 and 0.80, and very strong, between 0.81 and 1.0.

Results

In all CFF tests, significant differences were found for all age ranges in both men and women ($p < 0.01$). The following correlations were identified between the CFF variables and age: chair stand ($r^2 = 0.850$), arm curl ($r^2 = 0.928$), trunk flexion ($r^2 = 0.928$), back scratch ($r^2 = 0.862$), 2-minute step ($r^2 = 0.914$), 8 foot up and go ($r^2 = 0.877$) in men. In the case of women, very strong correlations were observed in the aerobic capacity ($r^2 = 0.916$), chair stand ($r^2 = 0.764$), arm curl ($r^2 = 0.682$), back scratch ($r^2 = 0.678$), 8 foot up and go ($r^2 = 0.739$) and moderate in trunk flexion ($r^2 = 0.458$).

Conclusion.

There is a linear relationship between age and performance in CFF tests.

- 846** Board #80 May 29 3:30 PM - 5:00 PM
Objectively-determined Physical Activity And Its Association With Mobility Limitations In Older, Chronic Disease Patients
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 (No relevant relationships reported)

Mobility limitations are linked with increased risk of disability and mortality among older adults with chronic disease. Physical activity (PA) has consistently been associated with the preservation of mobility and improvements in physical function in aging populations. Although accelerometry is accepted as the gold standard of objective PA measurement, knowledge of objectively-determined PA in free living conditions and its association with mobility limitations among older adults with chronic disease remains limited. **PURPOSE:** To examine the association of objectively-determined PA in free-living conditions, assessed using the LIFEORDER EX (LC) accelerometer, with select mobility outcomes. **METHODS:** Associations between objectively-determined PA and mobility performance (400 MWalk and Stair Climb tests) and mobility-related self-efficacy (MRSE) were examined from the baseline assessments of 3 prior lifestyle intervention trials in 156 older prostate cancer and knee osteoarthritis patients. Moderate-Vigorous (MVPA) and light (LPA) were measured using LC accelerometry in free-living conditions across 7 consecutive days. **RESULTS:** Results of partial correlation analyses controlling for age revealed that total weekly MVPA was significantly correlated with 400 MWalk ($r = -.36$; $p < .01$), Stair Climb ($r = -.29$; $p < .05$), and MRSE ($r = -.27$; $p < .01$). LPA was also significantly correlated with 400 MWalk ($r = -.49$; $p < .01$), Stair Climb ($r = -.40$; $p < .01$), and MRSE ($r = -.38$; $p < .01$). **CONCLUSIONS:** The present findings demonstrate that objectively-determined PA measured using the LC accelerometer are associated with mobility performance and MRSE in older adults with chronic disease. The results also provide evidence further supporting the validity of accelerometry as a measure of mobility limitations among older prostate cancer and knee osteoarthritis patients. Given the established complexity of objective PA assessment in aging populations, the present findings have implications for PA interventions in the preservation of mobility among older adults with chronic disease.

- 847** Board #81 May 29 3:30 PM - 5:00 PM
Cardiovascular Risk Among Non-sedentary Elderly: Circumferences Trend Analysis Over Three Decades
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 (No relevant relationships reported)

Purpose: To describe and analyze the trend of adiposity-related circumferences of non-sedentary women between 1998 and 2017 **Methods:** The present study is part of the Mixed Longitudinal Project of Physical Fitness and Aging of SCS, developed by CELAFISCS, since 1998, in Brazil - SP. Sample comprised only female subjects, 50 years-old and older, and who were involved in a PA program and participated in at least one evaluations between 1998 and 2017, totalizing a sample of 6367 individuals. The circumference analyzed were waist, hip and waist for hip ratio (WHR). To analyze the trend, the sample was divided into age groups: 50 to 59 years, 60 to 69 years and 70 years and over **Statistical analysis:** Polynomial regression models were estimated. In the modeling process, the mean of each one of the anthropometric variables was considered as dependent variable (Y) and the years of evaluation as independent variable (X). For each variable, the model with the highest statistical significance (p) and the best accuracy measure (r^2) was selected. Was considered significant model $p < 0.05$. **Results:** Waist circumference presented a negative trend in the three age groups analyzed. Hip circumference presented a negative trend in the age groups of 60 to 69 and 70 years and over, while WHR showed a negative trend in the age groups of 50-59 and 70 years and over. In the age group of 50 to 59 years, the mean WHR was 0.88 cm, with a decrease of 0.01 cm every year. In the age group of 60 to 69 years, the mean waist circumference was 87.90 cm, and there was a decrease of 0.05 cm in each year; the mean hip circumference was 98.82 cm, with a decrease of 0.02 cm every year. In the age group of 70 years and over, the mean waist circumference was 88.62 cm, with a decrease of 0.07 cm every year; the mean WHR was 0.89 cm, with every year decrease of 0.01 cm. **Conclusion:** Over the three decades analyzed, elderly active women of all age groups showed a tendency to decrease CV risk, although it still remained at a high risk, suggesting a positive impact of a PA program on CV risk.

Table. Trend analysis of adiposity-related circumferences of non-sedentary elderly according to age group

	50 to 59 years			60 to 69 years			70 years and over		
	Model a	p	Model b	Model c	p	Model d	p	Model e	p
Waist Circum. (cm)	$y = 89.80 - 0.04^a$	0.36	0.0000	$y = 87.30 - 0.05^a$	0.51	0.0000	$y = 86.02 - 0.07^a$	0.64	0.0001
Hip Circum. (cm)	$y = 102.13 - 0.05^a$	0.12	0.1531	$y = 98.82 - 0.02^a$	0.61	0.0001	$y = 99.50 - 0.02^a$	0.71	0.0000
Waist	$y = 8.88 - 0.01^a$	0.35	0.0002	$y = 102.11 - 0.05^a$	0.91	0.9311	$y = 9.89 - 0.03^a$	0.69	0.0001

a. First-order regression model; b. second-order regression model; c. third-order regression model

848 Board #82 May 29 3:30 PM - 5:00 PM Different Exercise Training On Reaction Time In Older Adults With Mild Cognitive Impairment

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PURPOSE: To examine the effects of reaction ability after 12 weeks of two different types of exercise intervention in community-dwelling elderly with mild cognitive impairment.

METHODS: 72 participants aged over 60 years old were classified as probable mild cognitive impairment (MCI) using the Saint Louis University Mental Status (SLUMS) examination. Participant were assigned to 3 groups (CG, n=22, 74.58±5.78 years; RTG, n=24, 72.00±7.15 years; MEG, n=26, 72.77±5.65 years). Exercise groups performed twice-weekly resistance training or multicomponent exercise training for 1.5 hours led by certified fitness instructors, and the control groups performed twice-weekly tablet personal computers course for 12 weeks. The primary outcome measures were the simple reaction time and simple movement time were measured by Vienna-test system (VTS), the total body reaction time was measured with both their feet on a measuring instrument (HELMAS NH-30001).

RESULTS: After the training period, of the 72 participants, 53 completed 12-week trial (18 in the MEG group, 18 in RT group, 17 in CG group). The total body reaction time for the MEG (-21.93%), and RTG (-9.04%) had decreased significantly than the CG (+1.13%) (p<.05), and the simple movement time for the MEG (-7.41%), and RTG (-0.81%) had decreased significantly than the CG (+27.58%) (p<.05).

CONCLUSIONS: These findings indicate that participating in the multicomponent exercise and resistance exercise program on building community for health promotion can improve reaction time in elderly with cognitive impairment. These findings suggest that short time twice-weekly MET and RTG are promising and effective strategies in community-based health promotion activities with mild cognitive impairment.

849 Board #83 May 29 3:30 PM - 5:00 PM Bone-targeted Exercise For Older Men With Osteopenia And Osteoporosis: LIFTMOR For Men Trial Preliminary Findings

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PURPOSE: The LIFTMOR (Lifting Intervention For Training Muscle and Osteoporosis Rehabilitation) for Men trial was designed to compare the effects of 2 novel bone-targeted exercise programs on risk factors for falls and fracture in men with low bone mineral density (BMD). **METHODS:** LIFTMOR for Men is a 3-arm, 8-month, semi-randomised, intervention trial. Men ≥50 years of age with low BMD, screened for conditions and medications known to affect bone, were recruited. Eligible participants were randomised to 2/week, supervised high-intensity resistance and impact training (HiRIT) or bioDensity (bD) machine-based isometric exercise. Intervention responses are compared with those of a self-selected, non-randomised control (CON) sample of age-matched men following their habitual lifestyles. Outcomes at baseline and follow-up include: anthropometry; DXA-derived lumbar spine (LS) and femoral neck (FN) BMD; physical function (back extensor strength [BES], lower extremity strength [LES], timed-up-and-go [TUG], and 5-times sit-to-stand [STS]); and safety and compliance. Per-protocol analyses of preliminary outcomes were conducted using repeated measures ANCOVA, controlling for age, calcium consumption, prior physical activity, and initial values for BMD [adjusted mean change ± SE and adjusted p values are presented]. **RESULTS:** 93 men (67.1±7.5yr; 82.1±11.6kg; 175.2±6.7cm) with low BMD (FN T-score -1.6±0.6) were recruited, and designated CON (n=26) or randomly assigned to HiRIT (n=34) or bD (n=33). To date, 67 have completed the study and are included in these preliminary findings (21 CON; 24 HiRIT; 22 bD). Compliance is 75.6±17.9% for HiRIT and 81.1±12.1% for bD (NS). Between-group differences have appeared in several outcome measures but only the improvement in LS BMD (HiRIT 0.049±0.01g/cm² vs CON 0.013±0.01g/cm²; p=0.01) and STS (HiRIT 1.6±0.3s vs bD 0.8±0.3s; p=0.01) have reached significance. Within-group improvements have been observed for LS

and FN BMD in both HiRIT and bD, all functional outcomes for HiRIT (all p<0.05), and in LES, TUG, and STS for bD (all p<0.05). There have been no adverse events. **CONCLUSION:** Although preliminary, findings suggest that both novel bone-targeted exercise programs improved BMD and physical function in older men with osteopenia and osteoporosis. Data collection is ongoing.

850 Board #84 May 29 3:30 PM - 5:00 PM Behavioral Responses on a Virtual Reality Induced Cognitive Task Between Young and Older Adults

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(No relevant relationships reported)

Controlling for and measuring explanatory variables can be difficult but virtual reality (VR) is emerging as a viable means for replicating authentic physical activity settings within the lab. **PURPOSE:** Using VR, we determined if young and older adults differ on behavioral responses of reaction time and accuracy during standing, walking and fast walking conditions that require dual-task completion. **METHODS:** Thirty-two young adults (Mean age= 21.03) and thirteen older adults (Mean age= 69.6) participated in this study and were instructed to stand or walk on a Motek instrumented treadmill integrated with a 180° VR projection screen. Participants performed three eight-minute physical activity conditions; standing, walking and fast walking. During the conditions, 60 red and green objects appeared at random on the VR screen to replicate a Go/No Go cognitive task. Using gloves that had kinematic-motion capture markers, participants were instructed to strike the green objects. A motion capture system connected to the treadmill recorded reaction time and accuracy on correct object strikes for all conditions. **RESULTS:** We used paired sample t-tests to verify that the physical activity conditions increase in intensity by comparing heart rate measurements between conditions. There was a significant increase in heart rate (bpm) between the standing and walking conditions (p<0.05) and between the walking and fast walking conditions (p<0.05) for both the young and older adults. T-tests determined that there were no significant differences in accuracy between the young and older adults during any of the three conditions (p>0.05). T-tests determined that young adults had a significantly quicker reaction time than older adults during all three conditions (p<0.05). **CONCLUSIONS:** Surprisingly, older adults performed just as accurately as young adults during dual-task cognitive conditions carried out in a VR environment. VR may be an appropriate intervention to enhance cognitive stimulation to attenuate cognitive decline.

851 Board #85 May 29 3:30 PM - 5:00 PM Relationship Between Attention And Balance In Older Adults

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Several studies found that the reduction of capacity of concentration in older adults contributed to gait and mobility disturbances. The natural walking pattern was disrupted by diverting their attention to a secondary task, and the situation was even more serious among balance-impaired older adults who showed impairments when shifting their attention from task to task. However, there is limited information about the performance of attention and balance in old adults.

Purpose: To investigate the relationship between attention and balance in community-dwelling older adults.

Method: Thirty-three elderly (67.9±4.8 years) with no cognitive or neurological deficits (MMSE score: 28.41±2.33) volunteered attending the test. The balance ability was measured by Y-balance which included three parameters, right front side, right rear inner stride and right rear outer stride. The single and dual tasks were used to measure the attention of the subjects. The single task was face emotion recognition including happy face and sad face. The dual task was face emotion recognition while walking with self-selected speed. Face recognition correct rate and face recognition correct reaction time in single and dual task were gathered. Person correlation coefficient (r) was used to determine the relationship between attention and balance.

Results: Some low-to-moderate correlations were found between attention and balance, which were summarized in the table below:

Tasks			Balance		
			right front side	right rear inner stride	right rear outer stride
Sad face	Dual task	Correct rate	-0.12	-0.17	-0.08
		Correct reaction time	-0.32*	-0.33*	-0.32*
	Single task	Correct rate	-0.16	-0.12	-0.14
		Correct reaction time	-0.12	-0.20	-0.21
Happy face	Dual task	Correct rate	0.19	0.06	0.09
		Correct reaction time	-0.31*	-0.33*	-0.31*
	Single task	Correct rate	-0.08	-0.10	-0.18
		Correct reaction time	-0.16	-0.27*	-0.25

Note: *= $p < .05$.

Conclusions: The attention does have low-to-moderate relationship with balance, which means that we may promote one through training another one.

Key words: attention; balance ability; elderly.

- 852** Board #86 May 29 3:30 PM - 5:00 PM
The Effects of Modified Parkour Exercise on Arterial Health and Fitness Components in Elderly Individuals
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Aging is associated with declines in vascular and muscular functions. It is crucial to reduce the negative effects of aging on vascular and muscular health by implementing appropriate lifestyle interventions, such as exercise training. Modified Parkour Exercise (MPK) has been found to increase agility and balance in elderly individuals. However, the possibility of MPK improving vascular and muscular functions in the elderly is currently unknown. **PURPOSE:** The purpose of this study was to examine the effects of a MPK regimen on blood pressure (BP), wave reflection (AIx), muscular strength and flexibility in elderly individuals. **METHODS:** Eighteen elderly individuals [age (69 ± 1 years); BP (126/78 mmHg) and body mass index (28.3 ± 1.6 kg/m²)] were randomized to either MPK (n=9) or no-exercise control group (n= 9) for 8 weeks. MPK consisted of modified dynamic and static bodyweight exercises 3 x week. Training volume was progressed by increasing the number of exercises (2 to 5), sets and repetitions for dynamic exercises (3 to 4 sets and 8 to 20 repetitions) and duration for static exercises (30 s to 60 s). Modified Parkour movements were progressed by increasing their complexity. Supine BP, AIx, and heart rate (HR), 30s chair stands (CHAST) and sit and reach (SITNR) scores were measured at baseline and after 8 weeks.

RESULTS: There were significant group-bytime interactions ($P < 0.05$) for BP, AIx, CHAST and SITNR. There were significant decreases ($P < 0.05$) in systolic BP (-4±1 mmHg), diastolic BP (-3±1 mmHg) and AIx (-4±1 %) as well as significant increases ($P < 0.05$) in CHAST (2±1 stands) and SITNR (6±2 cm) following MPK compared with no changes after control. No significant changes were observed in HR for both groups.

CONCLUSIONS: MPK led to reductions in BP, wave reflection in elderly individuals. MPK may be an effective intervention in the prevention of hypertension and cardiovascular events as well as declines in muscular strength and flexibility in the elderly.

- 853** Board #87 May 29 3:30 PM - 5:00 PM
Changes in Physical Function and Body Composition among Group Lifestyle Balance Program Participants with Arthritis
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 (No relevant relationships reported)

Weight loss through diet and physical activity (PA) is recommended for osteoarthritis (OA) management. The Group Lifestyle Balance Program (GLBP) is an evidence-based, behavior change program designed to promote weight loss in individuals with prediabetes or metabolic syndrome through PA and healthy eating. To date, the GLBP has not been evaluated on those with OA specifically.

PURPOSE: To examine the effects of the GLBP on measures of body composition and physical function (PF) in overweight and obese (BMI ≥ 27) individuals with OA (N=15).

METHODS: This study used a single-group, quasi-experimental design with repeated measures. All participants received the GLBP and outcome variables were obtained at baseline, 3, 6, and 12 months. Lean mass (LM), fat mass (FM), and body fat percentage (BF%) were obtained via bioelectric impedance. Total weight (WT), Body Mass Index (BMI), and waist circumference (WC) were also obtained. Measures of PF included the Short Physical Performance Battery (SPPB), grip strength (GS), 30-second chair stand test (CS30), and the Long Distance Corridor Walk (LDCW). The SPPB includes the time to complete 5 repeated chair stands (5CS), balance testing (side-by-side stand, semi-tandem stand, and tandem stand), and an 8-foot walk. The Friedman test was used to examine differences in SPPB scores and one-way repeated measures analysis of variance was used to examine mean differences in scores for all other outcomes.

RESULTS: Participants had a mean age of 70.20 ± 3.95 years and were primarily white (93%), female (80%) and college educated (67%). There was a significant effect of time for WT ($F_{(1.448, 20.275)} = 6.591$, $p = .011$), BMI ($F_{(1.529, 21.408)} = 6.474$, $p = .010$), and WC ($F_{(2.898, 40.566)} = 4.826$, $p = .006$). Bonferroni post hoc analyses indicated WT ($p = .001$), BMI ($p = .002$), and WC ($p = .022$) significantly improved from baseline to 3 months. There was also a significant effect of time for 5CS ($F_{(3, 42)} = 3.190$, $p = .033$) and CS30 ($F_{(3, 42)} = 6.956$, $p = .001$). Post hoc analyses indicated CS30 scores significantly improved from baseline to 3 months and from baseline to 12 months ($p = .007$). There were no significant differences observed for any other outcome measure ($p > 0.05$).

CONCLUSION: The GLBP may be effective at improving weight and physical function measures in people with OA, but more research is warranted.

- 854** Board #88 May 29 3:30 PM - 5:00 PM
Role of Physical Exercise on Cognition & Falls Risk Factors in Alzheimer's Disease
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 (No relevant relationships reported)

PURPOSE: Falls are one of the leading cause of mortality and morbidity in older people and the risk of falling is exacerbated by impaired mental status due to dementia. However, whether persons with dementia benefit from fall prevention exercise training is unclear. This study aimed to evaluate the contribution of an exercise multicomponent training (MT) on cognition, balance, mobility and lower limbs muscle strength in the elderly with dementia as important risk factors for falling. **METHODS:** Sixty-four elders (78.5 ± 8.3 years) clinically diagnosed with dementia, were divided for convenience into two groups: Experimental Group (EG, n= 38) and Control Group (CG, n= 26). The EG participated in a 6-month supervised MT intervention (2 days/week, 60 min/session including aerobic, muscular resistance, flexibility, coordination and postural exercises). Cognitive function (MMSE), functional mobility (Time Up and Go -TUG -Test), balance and gait (POMA, Tinetti Index) and lower muscle strength (30-second Chair Stand) were assessed before and after 6 months of the experimental protocol. **RESULTS:** A two-way ANOVA, with repeated measures, revealed significant group and time interactions on cognitive function, TUG and Tinetti Index, presenting the EG a significantly better performance over the time compared to the CG. However, no statistically significant main effect was founded on the lower muscle strength. **CONCLUSIONS:** Our results suggest that a 6-month exercise multicomponent training can have a positive influence on the gait, balance, mobility and cognition, and therefore, seems to be an important strategy to reduce the risk of falling in dementia older adults. Support from IPDJ and FCT (CIAFEL -UID/DTP/00617/2013; "Body and Brain" -POCI-01-0145-FEDER-031808).

855 Board #89 May 29 3:30 PM - 5:00 PM

Physical Activity Levels in a Structured Physical Exercise Community Program in ElderlyRenata A. Miyabara, Ovidiu Constantin Baltatu, Luciana Aparecida Campos Baltatu. *Universidade Anhembi Morumbi, São Paulo, Brazil.*

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(No relevant relationships reported)

PURPOSE: A decline in physical activity levels in older people is related with worsening of quality of life and a lower cardiorespiratory fitness level, which are associated with cardiovascular disease events and mortality from all causes. The aim of this study was to survey the level of self-reported physical activity in elderly people practicing different levels of physical activity program. An urban community of Sao Paulo was investigated. **METHODS:** This was a community-based cross-sectional study of a cohort of 50 individuals aged 60 or over, participating in a 6-month structured physical exercise community program and a control group of 50 sedentary elderly individuals age-matched. The structured physical exercise community program adheres to the Position Stand of the American College of Sports Medicine, as it included combined aerobic exercise, muscle strengthening exercises, and flexibility exercises. Physical activity levels were evaluated using the International Physical Activity Questionnaire (IPAQ).

RESULTS: The group participating in a physical exercise program had significantly higher levels of physical activity in the moderate activity (318.8 ± 561.8 vs. 238.5 ± 831.6 MET-min/wk, $p < 0.001$), vigorous (125.8 ± 245.7 vs. 66.2 ± 228.9 MET-min/wk, $p < 0.002$) and total activity (846.0 ± 951.1 vs. 691.0 ± 1239.1 MET-min/wk, $p < 0.05$). No differences between these groups were observed in walking activity (275.6 ± 289.8 vs. 320.1 ± 498.4 MET-min/wk, $p = 0.6$).

CONCLUSIONS: Our structured physical exercise community program proved effective in order to overcome the decline in physical activity levels in elderly population.

856 Board #90 May 29 3:30 PM - 5:00 PM

Effects Of Resistance, Power, And Multicomponent Training With Elastic Resistance On Strength In Older WomenNicole L. Rogers¹, Pedro Gargallo², Álvaro Jueas², Eva Tamayo², Sara Torkamanech², J.F. Guzmán², J. Fernández-Garrido², Guillermo Saez², Michael E. Rogers, FACSM¹, Juan C. Colado². ¹Wichita State University, Wichita, KS. ²University of Valencia, Valencia, Spain. (Sponsor: Michael E. Rogers, FACSM)

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The associations between strength losses in lower limbs and functional limitations are high for older adults. It is necessary to know the effects of modalities such as power training (PT) and multicomponent training (MT) on muscle strength compared to traditional resistance training (TRT) in this population. **PURPOSE:** To investigate the effects of 20-weeks of PT, MT, and TRT using variable resistance (elastic bands with loops) on isokinetic strength in older women (OW). **METHODS:** 136 sedentary OW (68.09 ± 4.78 yr) were randomized into PT ($n=34$), MT ($n=34$), TRT ($n=34$), and control groups (CG) ($n=34$). All exercise groups trained twice weekly for 20 weeks. PT performed 6 exercises, 3-4 sets of 10-12 repetitions, at a 4 rate of perceived exertion (RPE) in the first repetition and no more than 6 in the last. MT performed balance, muscular endurance (2 exercises, 3-4 sets of 15 repetitions at 7-9 RPE), aerobic, flexibility, and coordination exercises. The TRT performed 6 exercises, 3-4 sets of 6 repetitions at 7-9 RPE. Maximum strength of knee extensors (KE) and hip abductors (HA) was measured at 60°/s and 180°/s in the dominant side with an isokinetic dynamometer. Trial (2) by group (4) repeated measures ANOVA was used to determine differences regarding time and groups. **RESULTS:** PT group showed a significant increase in HA (+89.61%) and KE (+22.75%) muscle strength at 180°/s with significant differences ($p < 0.05$) between MT, TRT, and CG groups for HA, and between CG for KE. TRT group showed a significant improvement in HA (+76.74%) and KE (+11.29%) at 60°/s with significant differences between CG in both. MT showed a significant increase in HA at 60°/s (+13.5%) and 180°/s (+29.85%), and also in KE at 60°/s (+4.62%) with significant differences between CG in HA at 180°/s and KE at 60°/s. No significant changes were observed for the CG. **CONCLUSIONS:** PT is the most effective training modality for increasing muscle strength output at high velocity, while TRT is more effective for improving maximal strength at low velocity, for HA and KE. MT can be an effective alternative as it induces adaptation at high velocity on HA and at low velocity on KE. The use of elastic bands with loops (CLX bands) can facilitate the application of these types of programs.

857 Board #91 May 29 3:30 PM - 5:00 PM

Multicomponent, Power, And Resistance Training With Elastic Resistance: Effects On Physical Function In Older WomenMichael E. Rogers, FACSM¹, Pedro Gargallo², Álvaro Jueas², Eva Tamayo², Sara Torkamanech², J.F. Guzmán², J. Fernández-Garrido², Guillermo Saez², Nicole L. Rogers¹, Juan C. Colado². ¹Wichita State University, Wichita, KS. ²University of Valencia, Valencia, Spain.Email: michael.rogers@wichita.edu
(No relevant relationships reported)

For older adults, the maintenance of muscle power and balance is a key factor in everyday task performance. Understanding the effects of emerging training modalities such as power training (PT) and multicomponent training (MT) compared to traditional resistance training (TRT) is of benefit to this age group. **PURPOSE:** To investigate the effects of 20-weeks of PT, MT, and TRT using variable resistance (elastic bands with loops) on physical function in older women (OW). **METHODS:** 136 sedentary OW (68.09 ± 4.78 yr) were randomized into PT ($n=34$), MT ($n=34$), TRT ($n=34$), and control groups (CG) ($n=34$). All exercise groups trained twice weekly for 20 weeks. PT performed 6 exercises, 3-4 sets of 10-12 repetitions, at a 4 rate of perceived exertion (RPE) in the first repetition and no more than 6 in the last. MT performed balance, muscular endurance (2 exercises, 3-4 sets of 15 repetitions at 7-9 RPE), aerobic, flexibility, and coordination exercises. The TRT performed 6 exercises, 3-4 sets of 6 repetitions at 7-9 RPE. Variables analyzed were static balance (Romberg), agility (Up & Go), gait speed (4m), muscle strength (30-s chair stand), and aerobic capacity (6-minute walk test). Trial (2) by group (4) repeated measures ANOVA was used to determine differences regarding time and groups. **RESULTS:** MT showed significant improvements ($p < 0.05$; +56.8%) in static balance with significant differences between TRT and CG. PT showed significant improvements in all variables except static balance, with significant differences between MT and CG in muscle strength (PT: +29.20%; MT: +21.14%; CG: -2.69%), being the group with greatest improvements in 3 of 5 variables (agility: -14.26%; gait speed: -13.83%; muscle strength: +29.20%). PT, MT, and TRT showed significant improvements over time and between CG in agility, gait speed and aerobic capacity. No significant changes were observed for the CG. **CONCLUSIONS:** The three interventions are effective in improving physical function in OW, although the PT program induces greater adaptations in lower limb muscle strength, gait speed, and agility, while MT had a larger influence on balance. The use of elastic bands with loops (CLX bands) can facilitate the application of these types of programs.

858 Board #92 May 29 3:30 PM - 5:00 PM

Compositional Associations Of Objectively Measured Activities With Declined Cognitive Function In Older Adults: NEIGE StudyShiho Amagasa¹, Shigeru Inoue¹, Hiroshi Murayama², Takeo Fujiwara³, Hiroyuki Kikuchi¹, Noritoshi Fukushima¹, Masaki Machida¹, Sebastien Chastin⁴, Yugo Shobugawa⁵. ¹Tokyo Medical University, Tokyo, Japan. ²The University of Tokyo, Tokyo, Japan. ³Tokyo Medical and Dental University, Tokyo, Japan. ⁴Glasgow Caledonian University, Glasgow, United Kingdom. ⁵Niigata University, Niigata, Japan.

(No relevant relationships reported)

There is a growing literature that takes into account the co-dependence of time-use domains. Less is known about the combined effect of time spent in sedentary behavior (SB) and accumulating physical activity (PA) at different intensity and bout length. **PURPOSE:** To investigate a cross-sectional association of objectively-determined activities and cognitive function in community-dwelling older adults. **METHODS:** A random sample of older adults ($n=512$, 47% male, aged 65-84 years) from NEIGE study in Tokamachi city, Niigata, Japan wore a tri-axial accelerometer (HJA-750C, Omron) for seven consecutive days and responded to a questionnaire in the fall of 2017. We assessed SB, light-intensity PA (LPA), short-bout (<10min) moderate-to-vigorous PA (MVPA), and long-bout (≥ 10 min) MVPA. Cognitive function was assessed by interviewers using the Mini-Mental State Examination, regarding a score of ≤ 26 as declined cognitive function. Data were analyzed using the compositional regression approach using isometric log-ratio transformations of the time-use composition, adjusting for age, sex, residential area, living arrangement, working with income, educational attainment, BMI, perceived health, and number of disease.

RESULTS: One third of older adults had declined cognitive function. SB, LPA, short-bout MVPA, and long-bout MVPA accounted for 50.2%, 43.8%, 3.4% and 2.6% of accelerometer wear time, respectively. A significant beneficial association was observed between larger proportion of long-bout MVPA relative to other activities and cognitive function. SB, LPA, and short-bout MVPA were not associated. **CONCLUSIONS:** Promoting long-bout MVPA may be important for cognitive health among older adults.

859 Board #93 May 29 3:30 PM - 5:00 PM

Changes in Fitness and Fatness Levels in Qatari Schoolboys Over the Last Decade

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(No relevant relationships reported)

PURPOSE: This study examined changes in anthropometric and cardiorespiratory fitness (CRF) characteristics of 26,325 Grade 6 (G6) schoolboys (11.0 -12.99 y) living in the State of Qatar between 2003-2016. **METHODS:** Anthropometric measures included standing height (cm), body mass (kg) and body mass index (BMI, kg/m²). A multistage shuttle run test (MSRT, laps) was used to assess CRF. Comparisons between Qatari and non-Qatari boys were also conducted. **RESULTS:** The results showed a trend for decreasing CRF (less MSRT laps) and increasing fatness (higher BMI) across the study period, irrespective of nationality. Qatari students generally performed worse on the MSRT test and were fatter than their non-Qatari peers. Also, the Qatari students displayed bigger decreases in MSRT (10 vs 4 laps) and their body mass (2.5 vs 0.7 kg) and BMI (1.3 vs 0.6 kg/m²) increased more over the study period than their non-Qatari peers. Furthermore, the percentage of G6 schoolboys classified as overweight or obese increased over the study period for all nationalities, with Qatari boys showing a greater prevalence of overweight or obesity than their non-Qatari peers. For example, the percentage of Qatari boys classified as overweight or obese by Centers for Disease Control and Prevention (CDC) standards increased from an average of 40.1% between 2003-2006 to 49.3% between 2013-2016 while the average for non-Qatari boys increased from 32.6% to 39.9% for the same periods. **CONCLUSIONS:** These data support the need to establish a mechanism for the prevention and treatment of obesity and the development of physical activity strategies in the State of Qatar.

860 Board #94 May 29 3:30 PM - 5:00 PM

Participation in Physical Activity is Associated with Sexual Activity in Older English Adults

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(No relevant relationships reported)

Purpose: Physical activity (PA) is a potential modifiable correlate of the age-related decline in sexual function, but no studies have explicitly tested associations between PA and sexual activity. This study aimed to examine associations between PA, sedentary behaviour and sexual activity, problems and concerns in older adults. **Methods:** A Cross-sectional observational population study. Data were from the English Longitudinal Study of Ageing, a nationally representative sample of older men and women living in England. A total of 7,038 older men and women aged ≥50 years were included. PA and TV viewing time were self-reported. Sexual behaviour and concerns were assessed by validated self-completion questionnaire and analyses were weighted for non-response. Covariates included age, partnership status, socioeconomic status, limiting long-standing illness, smoking status, alcohol intake and depressive symptoms. Adjusted logistic regression were used to investigate associations between PA, sedentary behaviour and sexual activity, problems and concerns. **Results:** The odds of reporting any sexual activity were increased among individuals who participated in moderate (OR=1.64, 95%CI:1.24-2.15 in men, OR=1.21, 95%CI:0.97-1.52 in women) or vigorous (OR=2.06, 95%CI:1.50-2.84 in men, OR=1.42, 95%CI:1.09-1.85 in women) PA at least once a week. Erectile difficulties were less common among men who were active (OR=0.58, 95%CI:0.44-0.77 for vigorous PA). Results linking sedentary behaviour with sexual activity and function were less consistent, although women who watched ≥6 hours of TV/day had lower odds of thinking about sex frequently (OR=0.69, 95%CI:0.50-0.96) or, if they did not live with a partner, being sexually active (OR=0.40, 95%CI:0.22-0.72). **Conclusions:** Encouraging older adults to be more physically active could help to improve sexual relationships and, as a result, mental health and wellbeing.

861 Board #95 May 29 3:30 PM - 5:00 PM

Lower Aerobic Reserve is Associated with Poorer Physical Function in Community Dwelling Older Adults

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(No relevant relationships reported)

Reduced gait speed in older adults is a well-established predictor of disability and mortality. Recent evidence indicates that this decline in gait speed is accompanied by an increase in the energetic cost of walking and a decrease in peak energy expenditure. However, the association between this loss of aerobic reserve (AR) and functional performance has not been explored. **PURPOSE:** To examine the relationship between AR and physical function in older men and women. **METHODS:** AR was calculated as the percentage of the energetic cost of slow walking relative to peak walking energy expenditure in 20 participants of the Longitudinal Aging Study at Towson (65% women, age 70±8 yrs). Slow walking energy expenditure was assessed as the average rate of oxygen consumption during the final 2 minutes of a 5 minute standardized treadmill walking test at 1.5 mph (0.67m/s) using indirect calorimetry. Peak walking energy expenditure was assessed as the average steady-state rate of oxygen consumption during 400 meters of fast-paced walking over a 20-meter course using a portable indirect calorimeter. Physical function (PF) was assessed using components of the expanded Short Physical Performance Battery (ExSPPB) test consisting of time to complete 5 repeated chair stands, standing balance, and two measures of gait speed over 6 meters (normal walk and narrow walk). The association between AR and functional performance was modeled using linear regression models, adjusted for age and body mass index. **RESULTS:** In fully adjusted models, PF was negatively associated with AR ($\beta = -0.014$, $p = 0.002$), indicating that PF score improved 0.014 for each one-percentage higher AR. In further analyses of the individual components of PF, time to complete 5 chair stands ($\beta = -0.006$ chair stands per second, $p = 0.02$) and normal gait speed ($\beta = -0.009$ m/s, $p < 0.005$) were found to be negatively associated with AR, but there was no association with standing balance. **CONCLUSION:** Greater aerobic reserve was associated with higher physical function, specifically chair stand time and normal gait speed. These results suggest that maintaining AR is critical to preserving lower extremity strength and speed with aging. Interventions to improve mobility in older adults should aim to both increase peak capacity and reduce energetic costs to optimize potential benefits.

862 Board #96 May 29 3:30 PM - 5:00 PM

Detrimental Links Between Inflammation and Muscle Mass are Moderated by Physical Activity in Older Adults

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(No relevant relationships reported)

While age-related elevations in systemic inflammation may contribute to the accelerated loss of skeletal muscle mass, previous findings have been based on a limited number of biomarkers. Moreover, whether links between inflammation and muscle mass are independent of protein intake and habitual physical activity (PA) remain unknown. **PURPOSE:** The aim of the study was to explore links between skeletal muscle mass and inflammatory biomarkers in older women with different metabolic risk status, while accounting for adherence to guidelines on protein intake and PA.

METHODS: Skeletal muscle mass index (SMI) was assessed in 112 women (67±1.5 years) by bioelectrical impedance together with the equation of Janssen et al. (2002) to obtain muscle mass expressed in relation to body weight. Fasting blood samples were obtained following standardized protocols. Acute-phase proteins C-reactive protein (CRP) and fibrinogen were determined, together with the following inflammatory biomarkers: Adiponectin, Oncostatin-M (OSM), Leukemia inhibitory factor-receptor (LIF-R), Interleukin-6 (IL-6), IL-8, IL-12, and IL-18. Protein intake and PA were determined during 6 days by food record and accelerometry, respectively. Classification of metabolic risk status was based on the metabolic syndrome. Multivariate regression models were used to explore links between SMI and inflammatory biomarkers while adjusting for adherence to PA and protein intake guidelines and metabolic risk status.

RESULTS: Variations in SMI were inversely linked to levels of CRP (β -coefficient: -0.47; $p < 0.05$) and OSM (β -coefficient: -0.20 $p < 0.05$), where the OSM link was attenuated after further adjustment for PA. In contrast, positive links between SMI and adiponectin (0.19 $p < 0.05$) and LIF-R (0.24 $p < 0.05$) were observed, which both remained significant in fully adjusted models. Links to other biomarkers were non-significant. **CONCLUSIONS:** Several inflammatory markers are linked to skeletal muscle mass in older adults, where detrimental or beneficial actions are indicated depending on the

biomarker. While adherence to PA guidelines moderates some of these links, others seem unaffected by either PA and protein intake or metabolic risk status. Further research is needed to elucidate mechanisms underlying these observations.

B-58 Free Communication/Poster - Physical Activity and Health I

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

863 Board #97 May 29 2:00 PM - 3:30 PM The Relationship between Physical Activity and Physical Performance and Cognitive Abilities in the Chinese Elderly

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(No relevant relationships reported)

PURPOSE: Decreased physical and cognitive ability have become seriously problematic in aging. Studies seldom describe the relationship between physical activity (PA), physical performance and cognitive abilities, most of which by measuring only one or two specific abilities using questionnaires. The study was thus designed to examine the relationship between PA and physical performance and multiple cognitive abilities in the Chinese elderly.

METHODS: The design was a cross-sectional study. 148 people aged 65.15±7.79 were included from Guangxi Province in southern China. PA was measured by the Physical Activity Scale for the Elderly (PASE, Cronbach's $\alpha=0.752$; Test-retest reliability=0.980). Physical performance included coordination and lower limb strength, functional walking ability and the balance ability. Cognitive abilities were measured by computer-based tests, including simple reaction time and executive function (stroop task and shifting task). The association between PA and the outcomes were examined using correlation matrix and linear regression.

RESULTS: 1) The average time spent on physical activity was 1.8h/d; 2) High levels of PA significantly associated with better gait speed ($B=-0.67, p<0.05$), 30-s chair-stand test ($B=0.72, p<0.05$) and reaction abilities ($B=0.89, p<0.05$); 3) The gait speed significantly correlated with the accuracy of stroop task ($r=0.23, p=.018$) and shifting task ($r=0.21, p=0.023$), grip strength significantly correlated with the accuracy and the reaction time of the stroop task ($r=0.19, p=0.04$ & $r=0.19, p=0.04$). However, other physical performance outcomes had no significant correlation with the cognitive abilities.

CONCLUSIONS: More physically active residents scored higher on physical performance outcomes. Positive associations were found between physical performance, executive function and reaction ability.

864 Board #98 May 29 2:00 PM - 3:30 PM Cardiorespiratory Fitness and Body Mass Index with Gastroesophageal Reflux Disease in Older Adults

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(No relevant relationships reported)

Purpose: To examine the associations of cardiorespiratory fitness (CRF) and body mass index (BMI) with prevalence of Gastroesophageal Reflux Disease (GERD) in older adults.

Methods: This cross sectional study included 566 older adults (57% women; 72 years old) who were without heart attack, stroke, or cancer in the past 5 years. CRF was assessed via a 400-meter walk test and the minutes to complete the test were divided into sex-specific quartiles (fourths). Participants were categorized into normal weight (<25 kg/m²), overweight (25-29 kg/m²), and obese (≥ 30 kg/m²) BMI groups. GERD cases were identified via self-report on a medical history questionnaire. Logistic regression was used to calculate the odds ratios (ORs) and 95% confidence intervals (CIs) of GERD among CRF quartiles and BMI groups while adjusting for sex, age, smoking, heavy alcohol consumption, meeting walking guidelines based on $\geq 7,500$ steps/day, and BMI (in CRF analyses) or CRF (in BMI analyses).

Results: Of the 566 adults, there were 123 (22%) GERD cases. Compared with the first quartile of CRF (least fit), the ORs (95% CIs) of having GERD were 0.70 (0.40-1.22), 0.65 (0.37-1.16), and 0.46 (0.25-0.87) among those in the second, third, and fourth (fittest) quartiles of CRF, respectively, after adjusting for all confounders except BMI. However, these associations were not significant after adjusting for BMI. Compared with the normal weight group, the ORs (95% CIs) of having GERD were 2.67 (1.51-4.72) and 4.32 (2.30-8.09) among the overweight and obese groups,

respectively, after adjusting for all confounders including CRF. In a joint analysis, compared with the unfit (first quartile of CRF) and obese, ORs (95% CIs) were 0.13 (0.03-0.48), 0.41 (0.17-0.96), 0.17 (0.08-0.36), 0.44 (0.23-0.83), and 0.53 (0.26-1.07) for the unfit-normal weight, unfit-overweight, fit-normal weight, fit-overweight, and fit-obese, respectively, after adjusting for all confounders.

Conclusions: Although both CRF and BMI appears to be associated with GERD in this sample of older adults, BMI was found to be more strongly associated with GERD independent of CRF. Among obese individuals, having high CRF may be associated with lower odds of GERD, but more research is warranted. Supported by unrestricted research grant by Biospace.

865 Board #99 May 29 2:00 PM - 3:30 PM Longitudinal Stability of Exercise Behavior Across Exercise Domains

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PURPOSE: Many previous studies that have assessed the tracking of leisure time exercise behavior focused on various parts of the life span, and have treated exercise behavior as a uniform construct. This study provides novel insight by assessing the longitudinal tracking of exercise in six different domains: (1,2) team-based versus solitary activities, (3,4) competitive versus non-competitive, and (5,6) externally paced versus internally paced activities across the life-span (8-80 years).

METHODS: From the Netherlands Twin Register (NTR) all subjects with longitudinal exercise data were selected ($N=43,889$) and used to analyse the tracking of exercise behavior over time. With this dataset, we were able to examine tracking as a function of baseline age (8 to 80 years) and tracking duration (2 to 22-year follow-up), taking into account sex differences using generalized estimating equations.

RESULTS: Two-year tracking coefficients for total volume of exercise across age at baseline, ranging from .38 to .77 with a median of .57. Tracking coefficients tend to decrease as the distance to follow-up increases, down to a median of .38 for the 22-year tracking coefficients. The patterns of tracking were largely similar for solitary, competitive, non-competitive, externally and internally paced activities. With the exception of team-based activities, tracking was seen to increase as a function of baseline age.

CONCLUSIONS:

We conclude that exercise is moderate to highly stable across the lifespan, especially in late adulthood the tracking of exercise is high. This stability reinforces the existing evidence that exercise habits may be hard to change, but simultaneously suggests that successful intervention can lead to life-long habits.

866 Board #100 May 29 2:00 PM - 3:30 PM Parasympathetic Nervous Regulation and Prevalence of Lifestyle-related Diseases In Japanese: Waseda's Health Study

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PURPOSE: Limited data are available on the relationship of parasympathetic nervous regulation with the prevalence of lifestyle-related diseases in Japanese men and women. We conducted a cross-sectional study to investigate the relationship between diving reflex (DR) and heart rate recovery after exercise (HRR) - markers of parasympathetic nervous regulation - with the prevalence of hypertension, diabetes, and dyslipidemia among Japanese men and women in WASEDA'S Health Study.

METHODS: WASEDA'S Health Study is a cohort study which was launched in 2014. We used data collected at baseline in this study. Participants were 193 Japanese men [median (IQR) age 57 (48-67) years] and 81 women [median (IQR) age 52 (44-58) years] who completed a medical examination, maximal exercise test, and diving reflex test. The participants were divided into tertiles based on DR indexes and HRR indexes. DR indexes were the peak value of the R-R interval during the test (R-Rmax), the relative difference between the baseline and peak response due to the test (R-Rchange), and the latency of DR (Latency). Also, HRR indexes were defined as the reduction in the heart rate from the rate at peak exercise to the rates 1, 2, and 3 minutes after the cessation of exercise (HRR1, HRR2, and HRR3). Odds ratios and 95% confidence

intervals for the prevalence of lifestyle-related diseases were obtained using logistic regression models while adjusting for sex, age, body mass index, physical activity, family history of lifestyle related diseases, cigarette smoking, and alcohol intake.

RESULTS: 119 participants had hypertension, 17 had diabetes, and 125 had dyslipidemia. Using the lowest DR indexes and HRR indexes as reference, we calculated odds ratios and 95% confidence intervals for the outcomes of interests. We found statistically significant dose-response relationships between R-Rmax and diabetes (P for trend = 0.016) as well as R-Rchange and diabetes (P for trend = 0.010). There was also a statistically significant dose-response relationship between Latency and dyslipidemia (P for trend = 0.013) and HRR3 and hypertension (P for trend = 0.047).

CONCLUSIONS: In cross-sectional analysis, the data suggest diving reflex may be related to the prevalence of lifestyle-related diseases, particularly diabetes.

867 Board #101 May 29 2:00 PM - 3:30 PM
Impact Of Physical Activity Participation On Waist-to-hip Ratio[unnsupported Ansi Character - 2]]fa Propensity Score Analysis

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Impact of Physical Activity Participation on Waist-to-Hip Ratio: A Propensity Score Analysis

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PURPOSE: To examine the impact of physical activity (PA) participation on college students' WHR using the propensity score analysis.

METHOD: A total of 1,144 college students (Male = 53.8%) from a major Chinese university were recruited for the study and their waist circumference (WC) and hip circumferences (HC) were measured, and WHR were computed. In addition, their daily time spent on the internet (ITT), their PA participation frequency per week (PAFW), time spent on PA each time (PATE) and time spent on PA per week (PATW) were collected through a survey. Using the propensity score analysis, in which sex, age, ITT, PATE, PAFW and PATW were used as the matching variables so that the impact of PA participation on WHR can be independently examined.

RESULTS: The descriptive statistics of key variables measures are summarized as below:

Variables	Mean	SD
Age (yr.)	20.570	3.424
WC (cm)	74.22	0 7.600
HC (cm)	92.200	5.297
WHR	.805	.066
ITT (hr.)	6.410	2.773
PAFW	3.780	2.312
PATE (hr.)	1.708	.794
PATW (hr.)	7.350	5.951

Using the ACSM 3-time per week recommendation as a criterion, 439 of 703 college students were extracted as the high frequent PA participation (HFPA) group and the rest as the low frequent PA participation (LFPA) group, and their group difference in WHR was computed and compared:

LFPA (M±SD) 0.834±0.048
 HFPA (M±SD) 0.758±0.056

Mean Difference 0.081

Effect size 0.642

p -value <0.001

t -value 24.347

Coefficients 0.779

Conclusion: After using the propensity-score matching, the impact of the frequency of PA participation became very significant ($ES = .64$ and $p < 0.001$), which indicates regular PA participation is the key for college students' weight control and management.

868 Board #102 May 29 2:00 PM - 3:30 PM
Stronger Relationships Between Cardiometabolic Risk Factors and Physical Fitness than Objectively Measured Physical Activity

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Previous studies have shown that physical fitness is more strongly associated with cardiometabolic health outcomes than self-reported physical activity (PA). However, objectively measured PA may offer more precision in defining PA than self-report methods. Therefore it is of interest to determine associations of objectively measured PA with cardiometabolic risk factors.

PURPOSE: To assess associations of objectively measured PA, as well as aerobic and muscular fitness, with cardiometabolic risk factors.

METHODS: 415 young healthy adult men (28±6 yrs.) participated in the study. PA was measured with a tri-axial accelerometer (Hookie Am 20, Traxmeet Ltd, Espoo, Finland) to assess light intensity (LIPA, 1.5-2.9 METs) and moderate-vigorous (MVPA, ≥3.0 METs) PA. Physical fitness was measured with 1-min push-ups and sit-ups (reps/min) and standing long jump tests. In addition, maximal isometric force of the leg and arm extensors was measured. All muscular fitness results were converted into a muscular fitness index (z-score). Cardiorespiratory fitness (VO2max) was determined using an indirect graded cycle ergometer test until exhaustion. In addition, blood pressure was measured and blood samples were drawn after an overnight fast. The analyzed cardiometabolic risk factors consisted of serum lipids (total cholesterol, LDL, HDL, triglycerides) and plasma glucose, insulin and HbA1C.

RESULTS: After adjustments for age and smoking, LIPA was associated with insulin ($\beta = 0.14$, $p < 0.005$), whereas MVPA was associated with HDL ($\beta = 0.13$, $p < 0.05$). Aerobic fitness was inversely associated with blood pressure and serum lipids ($\beta = -0.15$ to -0.42 , $p < 0.005$), excluding HDL, which was positively associated with aerobic fitness ($\beta = 0.32$, $p < 0.001$). Muscular fitness was inversely associated with diastolic blood pressure, serum lipids and insulin ($\beta = -0.10$ to -0.26 , $p < 0.05$), and positively with HDL ($\beta = 0.20$, $p < 0.001$).

CONCLUSIONS: MVPA was positively related only to HDL concentration, whereas physical fitness was related with numerous cardiometabolic risk factors. These findings emphasize the stronger relationship of physical fitness to cardiometabolic risk factors compared to physical activity. MVPA leading to higher fitness levels should be promoted in order to provide cardioprotective effects.

869 Board #103 May 29 2:00 PM - 3:30 PM
Sedentary Behavior in Cardiac Patients

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Sedentary Behavior (SB) is associated with increased risks for many adverse outcomes. Evidence is limited about 1) the amount of SB in cardiac patients and whether this changes after cardiac rehabilitation (CR), and 2) which cardiac patients present higher levels of SB. **PURPOSE** To examine 1) the amount of SB in cardiac patients and whether SB changes following completion of a supervised CR program, and 2) characteristics of cardiac patients with high levels (≥ 8 hrs per day) of SB. **METHODS** To investigate aim 1, cardiac patients (n=84) were included upon enrolment of a Dutch CR program with supervised exercise training sessions. SB was objectively assessed during 7 consecutive days using the ActivPal3 micro. Data were collected at baseline, directly after and 2-3 months after completion of the CR program. For aim 2, patients (n=600) who participated in CR were invited to complete an online questionnaire about general and disease-specific characteristics. Sedentary time was assessed using the Sedentary Behavior Questionnaire. **RESULTS Aim 1.** The mean sedentary time in cardiac patients (mean age 65 [SD 33] yrs, 79% male) was 10.2 (SD 1.7) and 10.4 (SD 1.8) hours per week- or weekend day, respectively. Sedentary time did not change after completion of the CR program (mean difference weekdays = 0.26 [95% CI -0.02; 0.54]; weekend day = 0.40 [95% CI -0.06; 0.88] hrs/day), or 2-4 months later (mean difference weekdays = 0.23 [95% CI -0.12; 0.58]; weekend day = 0.35 [95% CI -0.17; 0.88] hrs/day). **Aim 2.** Being employed (prevalence ratio

(PR) 1.46 [95% CI 1.26; 1.70]), being divorced or widow(er) (PR 1.75 [95% CI 1.21; 2.53]), being resuscitated (PR 1.31 [95% CI 1.09; 1.59]), a high level of cardiac anxiety (PR 1.38 [95% CI 1.19; 1.59]), and living in a rural environment (PR 0.80 [95% CI 0.66-0.97]) were independently associated with high levels (≥ 8 hrs per day) of self-reported SB. **CONCLUSION** Cardiac patients present high levels of SB, and SB did not change after CR. Several patient characteristics (i.e. employment, marital status, resuscitation, cardiac anxiety and living environment) were significantly associated with sedentary time, which provides insight in who is the most at risk for SB associated adverse outcomes. Our data suggest that tailored initiatives are needed to target high levels of SB among cardiac patients.

870 Board #104 May 29 2:00 PM - 3:30 PM
Measured Vs. Self-reported Height, Weight And BMI: Relationships With Anthropometry, Fitness, And Physical Activity

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Researchers, policy makers, and clinicians commonly use height and weight to determine BMI and classify weight status. Self-report measures are utilized in a considerable portion of the scientific literature and national surveys, but often result in misreporting of height and weight, and consequentially underestimation of BMI and therefore potentially BMI category (weight status) misclassification. **PURPOSE:** To examine differences in self-reported and measured height, weight and BMI values, and whether discordance is associated with other anthropometric measures, fitness levels, and physical activity (PA) and sedentary behaviors (SB). **METHODS:** Data were collected from college students via: (1) a pre-consultation online questionnaire where participants self-reported sex, height, and weight; (2) an objective fitness assessment that assessed height, weight, body fat percentage, abdominal girth, predicted aerobic fitness, and muscular endurance; and, (3) a post-assessment electronic survey that assessed PA and SB. Parametric and non-parametric analyses were used to examine differences between groups. **RESULTS:** Self-report and measured height and weight data were collected from 1,061 participants, 224 of whom also provided PA and SB data. Women significantly under-reported weight ($p = .003$, $\eta^2 = .02$), and both sexes over-reported height ($p < .001$, $\eta^2 \geq .07$), resulting in a significant difference between BMIs calculated using self-reported and measured values ($p < .001$, $\eta^2 \geq .07$) and misclassification of BMI category of ~15% of both sexes. Minimal differences were found in anthropometric, fitness, or PA between those who over and underreported their height, but significant differences were found based on reporting differences for weight ($p \leq .015$) and BMI ($p \leq .015$). **CONCLUSIONS:** Students were found to have a tendency to underreport weight and overreport height, resulting in BMI category misclassification. Findings suggest that those who underreport weight tend to be in poorer health, as indicated by lower aerobic fitness in and higher abdominal girth and body fat percentage in particular. With respect to PA, overreporters tended to report lower PA levels than under and accurate reporters. Further research is required to establish the link between underreporting weight and overreporting PA.

871 Board #105 May 29 2:00 PM - 3:30 PM
Muscle Strength and Bone Strength Assessed with Osteo-sono Assessment Index Among Recreationally Athletic Japanese Women

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(No relevant relationships reported)

Low muscle strength is an independent risk factor for low bone strength, which is a well-established predictor of osteoporotic fracture. However, the association between muscle strength and bone strength remains unclear among recreationally athletic Asian women.

PURPOSE: To investigate the association between muscle strength and bone strength among recreationally athletic Japanese women.

METHODS: This cross-sectional study was conducted in 7091 recreationally athletic Japanese women [mean (standard deviation), age 50.3 (15.2) years] who had undergone medical checkup and various exercise tests voluntarily from 1998 to 2016 at a preventive medical center. Participants completed a maximal voluntary knee extension test, quantitative ultrasound (QUS), calcaneal measurements, a medical examination, and questionnaires on lifestyle. Muscle strength, expressed as Nm per body weight in kilogram (Nm/kg), was measured at 60 degrees/s in the knee with an isokinetic dynamometer. The osteo-sono assessment index (OSI) evaluated right calcaneus heel bone strength using a QUS measurement. Multiple linear regression

analysis assessed independent association of muscle strength and OSI ($\times 106$) after adjustment for age, systolic blood pressure, smoking, drinking, prevalence of diabetes, and body mass index.

RESULTS: Muscle strength had a positive association with OSI score after adjustment for potential confounding factors ($\beta = 0.17$, 95% confidence interval; 0.15-0.19, $p < 0.001$). Furthermore, age-stratified (≥ 50 years and under) analyses showed similar patterns of association.

CONCLUSIONS: Our results suggest a dose-response association between muscle strength and bone strength after adjustment for potential confounding factors. We need to further investigate longitudinal relationship between muscle strength and bone strength in a cohort study.

872 Board #106 May 29 2:00 PM - 3:30 PM
Cardiorespiratory Fitness and Prevalence of Lifestyle-related Diseases In Japanese Men And Women: WASEDA'S Health Study

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Many epidemiological studies report that there is an inverse relationship between cardiorespiratory fitness and the prevalence of lifestyle-related diseases. However, limited data are available on this relationship among Japanese men and women.

PURPOSE: This cross-sectional study is to investigate the relationship between cardiorespiratory fitness and the prevalence of hypertension, diabetes, and dyslipidemia among Japanese men and women in WASEDA'S Health Study.

METHODS: WASEDA'S Health Study is a cohort study which was launched in 2014. We used part of the baseline data collected for this study. Participants were 631 Japanese men [median (IQR) age 56 (48-65) years] and 306 women [median (IQR) age 50 (45-57) years] who completed a medical examination, and maximal exercise test at baseline. The participants were then divided into quartiles based on cardiorespiratory fitness. The prevalences of lifestyle-related diseases were based on self-reports from questionnaires, blood pressure, and/or blood test at the medical examination. Odds ratios and 95% confidence intervals for the prevalences of lifestyle-related diseases were obtained using logistic regression models while adjusting for sex, age, body mass index, physical activity, family history of lifestyle-related diseases, cigarette smoking, and alcohol intake.

RESULTS: 366 participants had hypertension, 55 had diabetes, and 420 had dyslipidemia. Using the 1st quartile of cardiorespiratory fitness as reference, odds ratios and 95% confidence intervals for 2nd, 3rd, and 4th quartiles are shown in the table below.

CONCLUSIONS: These results suggest that there is an inverse relationship between cardiorespiratory fitness and the prevalence of hypertension and diabetes, but not dyslipidemia, among Japanese men and women. We intend to continue prospective follow-up of participants, to obtain more robust findings with longitudinal analyses.

	Cases	Q1 (lowest)	Q2	Q3	Q ₄ (highest)	P for trend
Hypertension	366	1.00 (reference)	0.36 (0.22-0.60)	0.51 (0.30-0.85)	0.35 (0.19-0.62)	0.005
Diabetes	55	1.00 (reference)	0.93 (0.44-1.93)	0.39 (0.15-1.00)	0.46 (0.16-1.32)	0.049
Dyslipidemia	420	1.00 (reference)	0.98 (0.65-1.48)	1.06 (0.69-1.64)	0.92 (0.56-1.51)	0.850

873 Board #107 May 29 2:00 PM - 3:30 PM
Association of Active Commuting with Sport Time and Outdoor Play Time in Chinese Schoolchildren

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PURPOSE: Active commuting has been proved to be related to higher levels of physical activity in children in Western countries. Whether this relationship exists for specific forms of physical activity, e.g., sport participation and outdoor play, remains

unclear, especially among Chinese children. This study aimed to investigate the association of active commuting with sport time and outdoor play time in Chinese schoolchildren.

METHODS: A total of 441 children (49.7% boys, mean age = 8.3 ± 0.9 years) in grades 1 to 3 from four primary schools in Beijing participated in this study. Information of children's walking trips, daily sport time, and daily outdoor play time was reported by parents using the modified Chinese version of the children's leisure activities study survey. Children were categorized as either active (≥ 6 walking trips per week) or passive commuters (< 6 walking trips per week) based on the parent-reported number of trips walking to and from school. Children reported their own sex, age, and exercise self-efficacy. Children's body weight and height were measured by researchers to calculate body mass index (BMI). Differences of daily sport time and outdoor play time between active vs. passive commuters were examined by the analysis of covariance (ANCOVA) adjusting for children's age, BMI, and exercise self-efficacy. ANCOVA were conducted separately for boys and girls.

RESULTS: 42.7% of boys and 40.3% of girls were classified as active commuters. In boys, no difference was found for daily sport time between active and passive commuters (62.0 ± 46.7 min/d vs. 55.4 ± 41.4 min/d, $P = 0.266$), whereas active commuters had more time of outdoor play than passive commuters (194.8 ± 122.4 min/d vs. 153.7 ± 122.3 min/d, $P = 0.041$). For girls, neither daily sport time (64.1 ± 37.7 min/d vs. 54.1 ± 43.9 min/d, $P = 0.110$) nor daily outdoor play time (146.3 ± 129.6 min/d vs. 178.5 ± 141.4 min/d, $P = 0.156$) differed between active and passive commuters.

CONCLUSIONS: Boys who actively commute to school have higher levels of outdoor play time. Promoting active commuting may increase levels of physical activity in Chinese schoolchildren.

874 Board #108 May 29 2:00 PM - 3:30 PM
A Comparison of Obesity and Other CVD Risk Factors between Boys and Girls in Kuwait

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The prevalence of childhood obesity in Kuwait, among the highest globally including the US, is higher in boys than girls. Cardiovascular disease (CVD) risk is hence a concern, but data are limited comparing other CVD risk factors between boys and girls. **PURPOSE:** To compare the mean level and prevalence of CVD risk factors between 5th grade boys and girls in Kuwait. **METHODS:** A cross-sectional study of 367, 5th graders at 10.4 ± 0.4 years of age, (53% girls), from 16 schools in 6 Kuwaiti cities. Outcome variables and at-risk cut points included: Body mass index (BMI) to classify overweight (OW) or obese (OB) [WHO 2007], total cholesterol (TC ≥ 170 mg/dL), low-density lipoprotein (LDL ≥ 130 mg/dL), high-density lipoprotein (HDL < 40 mg/dL), TC:HDL-C (≥ 3.5), triglycerides (TG ≥ 100 mg/dL), resting systolic (SBP), and diastolic blood pressure (DBP) (≥ 90 th centile). Trained research assistants took measures with a portable anthropometer, scale, Cardiocheck Plus analyzer, and BP via auscultation with manual cuff. Physical activity (PA) and screen time (ST) were self-reported. Differences were examined with ANOVA or χ^2 (significance $p \leq 0.05$). **RESULTS:** Mean and % at-risk for boys vs girls was: BMI Z score ($1.32 \pm .11$ vs $1.29 \pm .09$; $p < 0.44$), OW (15.5% vs 27.1%, $p < 0.007$), and OB (41.1% vs 37.8%, $p < 0.487$). There were no significant differences in blood lipids except girls had higher TG (108.5 ± 58.6 vs 91 ± 42.7 mg/dL, $p < 0.009$). Girls vs boys had higher (non-significant) % at risk for TC (29% vs 23%; $p < 0.28$), low HDL-C (21% vs 12%; $p < 0.06$), TC:HDL-C (29.5% vs 22%; $p < 0.16$), and TG (38% vs 30%; $p < 0.19$); and lower % at risk for LDL-C (3.2% vs 4.5%; $p < 0.60$). Girls also had significantly higher SBP (107.7 ± 12 vs 102.4 ± 11.5 mmHg; $p < 0.001$) and DBP (70.3 ± 9.6 vs 64.8 ± 8.7 mmHg; $p < 0.0001$), and % at-risk for BP (10% vs 6%; $p < 0.16$), respectively. Boys mean PA (ds/wk ≥ 60 min; 3.37 ± 2.36 vs 2.47 ± 2.24 ; $p < 0.001$) and ST (hrs/d; 4.97 ± 2.56 vs 4.50 ± 2.77 ; $p < 0.119$) were higher than girls. Most girls and boys ($> 80\%$) did not meet PA or ST (≤ 2 hrs/d) recommendations. **CONCLUSION:** Contrary to previous data Kuwaiti boys did not have significantly higher obesity prevalence vs girls. Girls had significantly higher OW % at risk; and mean TG, SBP, DBP, and lower PA levels. Intervention studies on Kuwaiti children are warranted to reduce CVD risk factors including improving PA and ST behaviors.

875 Board #109 May 29 2:00 PM - 3:30 PM

Handgrip Strength and Congestive Heart Failure in Aging Adults: Getting a Grip on Heart Health

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(No relevant relationships reported)

Handgrip strength is a powerful biomarker of aging that is linked to a variety of health conditions; however, it is not well understood how handgrip weakness factors into certain cardiovascular diseases such as congestive heart failure (CHF). **PURPOSE:** To determine the association between handgrip weakness on time to CHF for aging adults in the United States. **METHODS:** A discrete sample of 12,658 adults aged at least 50 years (age: 68.0 ± 10.2 years at baseline) who participated in at least one wave of the 2006-2014 waves of the Health and Retirement Study were included. Interviews were conducted on participants biennially. Healthcare provider diagnosed CHF was self-reported at each wave. A spring-type hand-held dynamometer assessed maximal handgrip strength. Age- and race-specific maximal handgrip strength cut-points were used for determining weakness (Black men: < 40 -kilograms, Black women: < 31 -kilograms, White men: < 35 -kilograms, White women: < 22 -kilograms). A Cox proportional hazard regression model examined the association between handgrip weakness and time to CHF. Sex, race, age, body mass index, current smoking status, smoking history, self-rated health, diabetes status, and previously reported heart conditions aside from CHF were controlled for in the analyses. **RESULTS:** For those included, 4,141 (32.7%) were weak and 252 (2.0%) developed CHF during the mean follow-up of 5.6 \pm 4.5 years. The covariate-adjusted Cox model revealed that those who were weak had a 35% higher hazard of CHF (hazard ratio: 1.35; 95% confidence interval: 1.02, 1.80), relative to those who were not-weak. **CONCLUSIONS:** Our findings suggest that handgrip weakness was associated with an increased risk of incident CHF for aging adults in the United States. Measures of handgrip strength should become more commonplace in clinical settings for assessing age-related weakness and risk for poor clinically-relevant health outcomes such as CHF. Similarly, interventions aiming to prevent or treat CHF in aging adults should incorporate measures of handgrip strength. Engaging in muscle strengthening activities and behaviors earlier in life may help to preserve strength and lower risk for CHF during aging.

876 Board #110 May 29 2:00 PM - 3:30 PM

Association Between Grip Strength and Diabetes Prevalence in 45- to 60-Year Old Chinese Men

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Several studies showed that grip strength is related to cardiovascular risk factors, but few on the relationship between grip strength and prevalence of diabetes, especially for Chinese people.

PURPOSE: To explore the associations between grip strength and fasting blood glucose of diabetes and diabetes prevalence in 45- to 60-year old Chinese men. **METHODS:** All the subjected were recruited from three health management centers of hospitals in China, they finished the basic medical examination and grip strength test and VO_{2max} test. Diabetes was assessed by physical diagnosis or fasting blood glucose. Grip strength was tested in dominant hand; and VO_{2max} was measured by YMCA cycle test.

RESULTS: 1) There are 800 men recruited in this study, 82 of them are diabetes, the prevalence of diabetes is 10.25%. 2) The grip strength of diabetes patients is lower than that of other people [(35.50 ± 6.96) kg vs. (37.26 ± 7.40) kg, $P < 0.05$], and also the VO_{2max} is lower than that of other people [(35.17 ± 7.86) mL/kg/min vs. (32.72 ± 6.06) mL/kg/min, $P < 0.05$]. 3) In all men, the grip strength is negatively correlated with fasting blood glucose ($r = -0.10$, $P < 0.05$). In diabetes men, the grip strength is also negatively correlated with fasting blood glucose ($r = -0.21$, $P < 0.05$), after adjusted the age and BMI, the relationship is still significant ($r = -0.233$, $P < 0.05$). 4) If 5 kg increase in grip strength, the fasting blood glucose of diabetes men can decrease 1.165 mmol/L, and the prevalence of diabetes men will decrease 36.22%.

CONCLUSIONS: 1) The grip strength of diabetes men is related to fasting blood glucose; improving the grip strength can improve the blood glucose level of diabetes men and reduce the prevalence of diabetes. 2) Fasting blood glucose is negatively correlated with grip strength in men, which indicated that grip strength, a simple test index, could be as a predictor of diabetes in men.

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- 877** Board #111 May 29 2:00 PM - 3:30 PM
Non-Exercise Estimated Cardiorespiratory Fitness Mediates the Relationship Between Comorbidities and Health-Related Quality of Life in Korean Older Adults
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 (No relevant relationships reported)

PURPOSE: To investigate whether or not CRF mediates the relationship of comorbidities with health-related quality of life (HRQoL) in a representative sample of Korean older adults.

METHODS: Data from a total of 7,350 Korean older adults aged ≥ 60 years (58% women) who participated in the 2008-2011 Korean National Health and Nutritional Examination Survey were used in this analysis. HRQoL was assessed with the EuroQoL-5 dimensions (EQ-5D) index and EuroQoL visual analogue scale (EQ-VAS). Comorbidity was defined as physician-diagnosed chronic conditions. CRF was estimated with a non-exercise regression equation derived from sex, age, body mass index, and self-reported physical activity. The SPSS macro provided by Preacher and Hayes was used to test whether CRF mediated the relationship between comorbidity and HRQoL at statistical significance of $p=0.05$.

RESULTS: The total effect of the presence of comorbidities on HRQoL was significant (path c: $\beta=-3.091$, $p<0.001$). The presence of comorbidities was negatively related to eCRF in HRQoL model (path a: $\beta=-0.403$, $p<0.001$). As illustrated in Fig. 1, the effect of eCRF as a mediator on HRQoL was also significant (path b: $\beta=1.574$, $p<0.001$). The mediation analysis using the bootstrapping method (5,000 resamples) showed that eCRF mediated the relationship between the presence of comorbidities and HRQoL in Korean older adults (path a \times b: $\beta=-0.635$, 95% CI= $-0.746 \sim -0.524$, Sobel test result $Z=-11.029$, $p<0.001$). In addition, a direct effect of the presence of comorbidities on HRQoL was also significant (path c': $\beta=-2.456$, $p<0.001$).

CONCLUSIONS: The current findings suggest that CRF mediates the relationship between comorbidities and HRQoL in Korean older adults. Supported by the National Research Foundation funded by the Korean Government (NRF-2018R1D1A1B07048153 and NRF-2016R1A6A3A11932432).

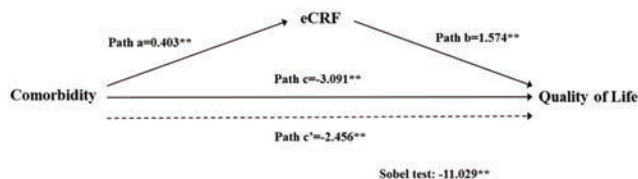


Fig. 1 The estimation of the direct and indirect effect of eCRF on health related quality of life

- 878** Board #112 May 29 2:00 PM - 3:30 PM
Longitudinal Associations Between Handgrip Strength and Cardiovascular Biomarkers Among Rural Adults: A Project FRONTIER
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The decrease in muscular strength is one of the key symptoms of sarcopenia in older adults. A growing body of literature shows inverse associations of maximal isometric handgrip strength, a simple and non-invasive measure of skeletal muscle strength, with risk for cardiovascular disease (CVD)-related morbidity and mortality. However, the evidence is equivocal and there is little research examining the relationship of the concurrent longitudinal change in handgrip strength and CVD biomarkers. **PURPOSE:** This study examined longitudinal relationships between maximal handgrip strength and CVD biomarkers in older adults living in rural areas. **METHODS:** Data for this study came from Project FRONTIER (N=138; 59 \pm 12y, average 2.8 follow-up years), an ongoing epidemiological study monitoring the health of adults in rural northwest Texas, USA. Handgrip strength normalized to body mass index and CVD biomarkers including triglycerides, fasting blood glucose, high-density lipoprotein cholesterol (HDL-C), waist circumference (WC), and blood pressure (BP) were obtained. The association between strength and CVD biomarkers was examined at baseline, with strength as a predictor of the annual change in biomarkers, and in a parallel fashion between the annual change in strength and CVD biomarkers. **RESULTS:** After adjusting for demographic information, results for the total sample showed strength to associate with WC ($b=-13.6$, $P<0.001$) and diastolic BP ($b=6.1$, $P=.025$) at baseline. Strength was not found to predict the annual change in any biomarker.

Rather, the annual change in strength was positively associated with the change in HDL-C ($b=12.7$, $P=.003$). Interestingly, when participants were stratified into low and higher CVD risk groups, low risk adults who did not lose strength had greater annual increases in HDL-C than low risk adults that lost strength (2.3 vs. -1.4 mg/dl/year, $P<0.001$). Adults with higher CVD risk who did not lose strength had greater annual decreases in triglycerides ($P=.054$) and BP ($P\leq 0.05$) than higher risk adults that lost strength. **CONCLUSIONS:** Collectively, the present findings suggest that maintenance of muscle strength with aging is related to positive changes in CVD risk factors.

- 879** Board #113 May 29 2:00 PM - 3:30 PM
Reallocating Sedentary Time to Sleep or Physically Active Behaviors: Associations with BMI in College Students
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PURPOSE: More than 160 million US adults aged 20 years and older are overweight or obese. College students represent a subpopulation at a higher risk for excess weight gain, which is often influenced by daily health behaviors, such as time spent in sleep, sedentary time (SED), and physical activity (PA). **METHODS:** This study applied a novel isotemporal substitution model approach to investigate how reallocating time spent in SED activities to sleep and PA influenced body mass index (BMI). College students ($n=1,533$, mean age: 20.1 ± 1.5 years, mean BMI: 24.4 ± 4.7 kg/m²) provided self-reported height, weight, and time spent in sleep, SED, and PA data anonymously through an online survey. Sleep was assessed via the Pittsburgh Sleep Quality Index. PA and SED were assessed via the International Physical Activity Questionnaire.

RESULTS: Sleep ($r=-0.070$) and moderate-to-vigorous intensity PA (MVPA) ($r=-0.068$) were weakly but significantly associated with BMI (all $P<0.05$). SED ($r=0.043$) and light-intensity PA (LPA) ($r=-0.014$) were not associated with BMI (all $P>0.05$). In both the single and partition models, sleep ($B=-0.223$ and $B=-0.238$, respectively) and MVPA ($B=-0.333$ and $B=-0.348$, respectively) were inversely associated with BMI (all $P<0.05$). Among the total sample, reallocating 60-min of SED behavior with sleep ($B=-0.277$, 95% CI: $-0.461, -0.093$) or MVPA ($B=-0.386$, 95% CI: $-0.635, -0.147$) was associated with a small but significant decrease in BMI. In a subgroup analysis of overweight and obese participants ($n=543$, mean BMI: 29.2 ± 4.3 kg/m²), reallocating 60-min of

SED behavior with sleep ($B=-0.384$, 95% CI: $-0.667, -0.108$) or MVPA ($B=-0.796$, 95% CI: $-1.15, -0.436$) was associated with a decrease in BMI, with the strongest association occurring when MVPA was substituted for SED. **CONCLUSION:** Reallocating 60-min of sedentary time with sleep or MVPA was associated with favorable effects on BMI among college students. Reductions in BMI were greater among overweight and obese individuals, especially when SED was replaced with MVPA.

- 880** Board #114 May 29 2:00 PM - 3:30 PM
Co-existence Of Physical Activity And Sedentary Behavior Among Children And Adolescents In Shanghai, China
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There is limited evidence for the prevalence of the co-existence of meeting physical activity (PA) and sedentary behavior (SED) guidelines, and their correlates among children and adolescents.

PURPOSE: To investigate the prevalence of PA and SED guidelines, and their co-existence, and to examine the associations between PA or SED, or both with gender and age among children and adolescents in Shanghai, China.

METHODS: Using a cross-sectional study design (conducted from September to December 2014), 50,090 children and adolescents (10-18 years old, 50.4% boys) were included in this study. A self-report questionnaire was used to measure participants' socio-demographic characteristics, PA, and SED. Descriptive statistics were used to describe sample characteristics, the prevalence of meeting PA and SED guidelines, and their co-existence. A Generalized Linear Model was conducted to explore the associations between the prevalence of PA and SED, and their co-existence with gender and age separately.

RESULTS: Of the children and adolescents studied, only 18.4% met the guidelines for PA, 25.5% met the guidelines for SED, and 5.7% met the guidelines for both. Boys

were more physically active (aOR = 1.43, 95% CI: 1.36-1.50), and girls were less sedentary (aOR = 1.29, 95%CI: 1.24-1.34). The prevalence of PA, SED, or both all declined as age increased ($p < 0.001$). Stratified analysis by gender revealed greater declining trends of meeting the PA or SED guidelines, or both in girls with increasing age (all $p < 0.005$).

CONCLUSIONS: Very few children and adolescents showed active lifestyles, and this was significantly related to age. Effective interventions aiming to promote PA and concurrently to limit SED among children and adolescents should be implemented as early as possible.

881 Board #115 May 29 2:00 PM - 3:30 PM
Association Of Cardiovascular Health Trajectories And
Cardiorespiratory Fitness: The Cardia Study

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Ideal cardiovascular health (CVH) is a composite metric of seven health factors and behaviors. How cardiorespiratory fitness (CRF) is related to CVH is unclear. **Purpose:** To identify associations of CVH trajectories throughout adulthood with CRF in late-middle age. **Methods:** CVH components were measured in Black and White adults (N=2723, aged 18-30 yrs. at baseline) in the CARDIA Study at seven in-person examinations over 20 years. Graded treadmill tests at years 0 and 20 were used to measure CRF (minutes duration). CVH was determined by assigning each metric a score of 2 (ideal), 1 (intermediate), or 0 (poor) and summing the scores (range 0-14). Latent class modeling was used to identify subgroups of individuals with similar CVH trajectories from young adulthood to middle age. Multivariable logistic Poisson regression was used to assess the association between 20-year CVH trajectories and race- and sex-specific quartiles of CRF at year 20. **Results:** Five distinct CVH trajectories were identified: high (n=485), high-moderate (n=666), moderate (n=805), low-moderate (n=603), and low (n=164). Compared to the high trajectory group, odds ratios for low fitness (bottom quartile) at year 20 were 3.2 (95% CI: 1.9-5.2) for high-moderate, 6.6 (4.1-10.7) for moderate, 9.9 (6.1-16.4) for low-moderate, and 14.0 (8.2-24.0) for the low CVH trajectory groups after adjusting for race, sex, education, center, baseline CVH, and baseline CRF. **Conclusion:** Lower CVH trajectories throughout adulthood are associated with higher odds of low CRF in late-middle age.

882 Board #116 May 29 2:00 PM - 3:30 PM
A Prospective Cohort Study of Physical Fitness and
Incident Glaucoma: The Niigata Wellness Study

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There is limited evidence exploring the association between cardiorespiratory fitness and the incidence of glaucoma. However, associations between other components of fitness and incident glaucoma are still unknown.

PURPOSE: To investigate the association between muscular and performance fitness and the incidence of glaucoma among Japanese workers in the Niigata Wellness Study. **METHODS:** Participants included 26,183 workers (18,129 men) [median (interquartile range) age 50 (44-56) years] free of glaucoma who underwent physical fitness tests in 2001. Muscular and performance fitness index was calculated using a summed z-score by sex and age from grip strength, vertical jump, single-leg balance with eyes closed, forward bending, and whole-body reaction time. The participants were divided into quartiles according to the muscular and performance fitness index and each physical fitness test. During 2002-2007, participants were followed for development of glaucoma, which was defined based on physician diagnosis. Hazard ratios (HRs) and 95% confidence intervals (95% CIs) for the incidence of glaucoma

were estimated using Cox proportional hazards models after adjusting for age, sex, body mass index, cigarette smoking, alcohol intake, hypertension, dyslipidemia, and diabetes.

RESULTS: During the follow-up, 292 participants developed glaucoma. The HRs (95% CIs) for developing glaucoma across quartiles of muscular and performance fitness index (lowest to highest) were 1.00 (reference), 0.99 (0.74-1.34), 0.64 (0.46-0.89), and 0.64 (0.46-0.89) (P for trend = 0.001). For vertical jump, the HRs (95% CIs) of developing glaucoma across quartiles (lowest to highest) were 1.00 (reference), 0.73 (0.54-0.99), 0.76 (0.56-1.03), and 0.54 (0.38-0.77) (P for trend < 0.001). For whole-body reaction time, the HRs (95% CIs) across quartiles (slowest to fastest) were 1.00 (reference), 0.77 (0.57-1.04), 0.65 (0.47-0.89), and 0.51 (0.37-0.72) (P for trend < 0.001). There were no associations between the other physical fitness tests and the incidence of glaucoma.

CONCLUSIONS: Muscular and performance physical fitness may be associated with lower risk of incident glaucoma. The precise mechanisms, which may include beneficial changes to intraocular pressure and antioxidant effects, are unknown and should be explored.

883 Board #117 May 29 2:00 PM - 3:30 PM
Effects of Arterial Stiffness Between Objectively
Measured Physical Activity and Domain-Specific
Cognition in Older Adults

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PURPOSE: To examine the effects of arterial stiffness (AS) on the associations between objectively measured physical activity (PA) and domain specific cognitive functioning in older adults. **METHODS:** This cross-sectional analysis included baseline data from 415 older adults enrolled in the Physical Activity and Aging Study (PAAS). Cognitive functioning was measured by working memory using Digit Span Test and selective attention and processing speed using computerized Stroop Test. PA over 7 days was measured with Omron accelerometer-based pedometers and time engaged in light-, moderate-, and vigorous-intensity PA with FitBit Charge 2 wristbands. AS was derived from carotid-femoral pulse wave velocity (cfPWV; AtCor Sphygmocor XCEL). High AS was defined as cfPWV ≥ 10 m/s, which is an established risk factor of cardiovascular diseases. Multivariable linear regression was used to model the associations between PA, AS, and each cognitive-domain score. **RESULTS:** Participants were a mean age of 72 (± 6) years old and were well educated with 82% having a bachelor's degree or higher. Participants were also cognitively healthy (Mean Score of Mini-Mental State Examination 29.2 [± 1.29] out of 30). Participants with high AS (20.96%, n=87) accumulated fewer total steps per day ($p=0.01$), engaged in less light-intensity PA ($p<0.01$), and had worse precision on the Stroop test ($p<0.01$) compared to those with low AS. There were no significant group differences for other cognitive test scores. Light-intensity PA was associated with better performance on the digit span forward among those with high AS ($p=0.01$), but not those with low AS, after adjusting for age, sex, education, diabetes, hypertension, and current smoking status ($p=0.01$) from linear regression. However, no significant results were found in other PA variables regardless of AS status. **CONCLUSIONS:** These results suggest a possible association of increased light-intensity PA with better working memory, particularly among older adults with high AS who are at higher risk of developing cardiovascular diseases.

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884 Board #118 May 29 2:00 PM - 3:30 PM
Benefits of Behavior: Exercise Enhances Perception of
Physical Function Independent of Improvement Among
Diabetic Patients

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In the U.S., approximately 1.5 million new cases of diabetes arise each year. Although these patients commonly report lower quality of life (QOL) than those without chronic illness, much of the literature remains focused on the physical benefits of weight loss and blood glucose management. To deliver individualized care, practitioners must also evaluate psychological health, including patient perceptions. **PURPOSE:** To determine factors that affect perception of physical function in diabetic patients. **METHODS:** 38 men and women with diabetes completed a 10-week, 20-session exercise program that included both aerobic and resistance training components. At baseline and follow-up, we measured body fat percent (BF%), body mass index (BMI), and performance on

six standard functional tests. Subjects also completed a self-report QOL questionnaire in which perception of physical function was assessed. Linear regressions tested the effect of functional performance (baseline capacity and 10-week change) on perception of function. **RESULTS:** Patients were 67.9 ± 9.1 years of age, mean BMI was 31.5 ± 6.1 , and self-reported physical functioning ranged from 5.0 (very poor) to 100.0 (optimal); mean score was 54.7 ± 26.8 . At baseline, perception of physical functioning was not related to sex ($p=0.751$), age ($p=0.405$), BMI ($p=0.610$), or BF% ($p=0.864$). It was related to improved performances in six-minute walk ($p<0.001$), functional reach ($p=0.046$), timed up-and-go ($p=0.080$), chair stand ($p=0.006$), and sit-and-reach ($p=0.024$). At follow-up, perceptions of functioning improved by 13.8 ± 24.5 points (25.7%; $p=0.002$) but there was no association with improvement in any anthropometric or functional tests: BMI ($p=0.457$), BF% ($p=0.526$), six-minute walk ($p=0.131$), functional reach ($p=0.293$), timed up-and-go ($p=0.226$), arm curl ($p=0.966$), chair stand ($p=0.592$), and sit-and-reach ($p=0.970$). **CONCLUSION:** 10 weeks of exercise improved perception of physical function by more than 25% in patients with diabetes. Improvement was unrelated to enhancement of any anthropometric or performance domain. Patients with diabetes seem to improve their perceptions via participation rather than progress. Thus, it may be important to incorporate the behavior of exercise into treatments, even if it fails to elicit physical improvement.

885 Board #119 May 29 2:00 PM - 3:30 PM
Sedentary Behavior and Physical Inactivity among College Students Affect Core Strength, Flexibility, and Posture

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Sedentary behavior and physical inactivity have increased with advancements in technology. College students are high utilizers of computers and mobile devices, often for long periods with poor posture, putting them at risk for negative health consequences. **PURPOSE:** To evaluate the effects of sedentary behavior and physical activity participation on core strength, flexibility, and posture in college students. **METHODS:** College students ($N=33$; $n=22$ female, $n=11$ male) completed physical measures and questionnaires of sedentary behavior (SB) and physical activity (PA). Curl-up tests, sit and reach, and plumb line assessments indicated core strength, flexibility, and posture, respectively. Two-way ANOVAs were performed with participants categorized by their posture measures (rounded shoulders; RS, and forward head posture; FHP) on weekday and weekend SB, and PA per week. Associations were determined between SB, PA, core strength, flexibility, and body fat percentage by computing Pearson's correlation coefficients. **RESULTS:** There were no significant differences in SB and PA between postural groups. However, participants with RS and FHP spent an hour more per day being sedentary on average than those with RS alone (RS & FHP: SB weekday, $M=3.74$ hrs ± 0.79 , SB weekend, $M=3.74$ hrs ± 0.9 ; RS only: SB weekday, $M=2.62$ hrs ± 0.36 , SB weekend, $M=2.77$ hrs ± 0.48). SB was associated with decreased flexibility (SB weekday: $r=-0.47$, $p<0.01$; SB weekend: $r=-0.48$, $p<0.01$), while physical inactivity was associated with higher body fat percentage ($r=0.36$, $p=0.04$) and decreased core strength ($r=-0.51$, $p<0.01$). Furthermore, college students who were sedentary during the week were also sedentary on the weekend ($r=0.82$, $p<0.01$). **CONCLUSIONS:** Sedentary behavior and physical inactivity were associated with negative changes in core strength, flexibility, posture, and body composition. Interventions targeting improvements in these behaviors among college students should include guidance on reducing screen time and limiting improper posture.

886 Board #120 May 29 2:00 PM - 3:30 PM
Effects Of BMI And VO_{2peak} On Cardiometabolic Health In Inactive, Overweight And Obese Adults

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PURPOSE: Body mass index (BMI) and cardiorespiratory fitness (CRF; VO_{2peak}) are significant predictors of cardiovascular health with high CRF being protective in the presence of high BMI. The current analysis aimed to determine relative contribution of overweight (OW) vs obese (OB) BMI while cross-stratifying with higher (HF) and lower (LF) CRF on blood lipids and glycemic markers. We hypothesized that an OW-HF group was more likely to have normal biomarkers compared to the OB-LF CRF group.

METHODS: Insufficiently-active participants ($N=89$, male=22, female=67, BMI range=25-50) underwent the following assessments with the following cut-points for normal/abnormal: fasting glucose (GLU, ≤ 100 mg/dL), insulin (≤ 10 μ U/mL), HOMA-IR (≤ 2.5), total-cholesterol (TC, ≤ 200 mg/dL), LDL-cholesterol (LDL-C, ≤ 130 mg/dL), HDL-cholesterol (HDL-C, male ≥ 40 mg/dL, female ≥ 50 mg/dL), triglycerides (TG, ≤ 150 mg/dL). BMI was calculated from measured height and weight and VO_{2peak} was estimated using a modified Balke protocol. BMI was stratified by overweight/obese cut-offs; high/low fitness was stratified at ≥ 6 -MET from VO_{2peak} . Groups were:

OW-HF ($n=28$), OW-LF ($n=36$), OB-HF ($n=5$), OB-LF ($n=20$). Odds ratios (OR) for having normal biomarker concentrations were reported using multiple logistic regressions ($\alpha = 0.05$).

RESULTS: Participants biomarker concentrations were (mean \pm SD): GLU: 92.0 ± 8.8 mg/dL, insulin: 14.1 ± 8.4 μ U/mL, HOMA-IR: 3.3 ± 2.2 AU, TC: 173.5 ± 29.5 mg/dL, LDL-C: 119.6 ± 29.0 mg/dL, HDL-C: 48.9 ± 13.6 mg/dL, and TG: 109.1 ± 47.5 mg/dL. Measured height and weight confirmed BMI (33.4 ± 5.9 kg/m²). Estimated VO_{2peak} was 23.5 ± 3.8 mL/kg/min. Compared to OB-LF, the OW-HF group was more likely to have normal HOMA-IR (OR 1.6; 95%CI = 1.04, 2.4; $p = .03$) and desirable HDL-C concentrations (OR 1.9; 95%CI = 1.2, 2.8; $p < .01$). No significant cross-stratified differences for HDL-C or HOMA-IR were observed. There were no significant differences for the other five biomarkers.

CONCLUSIONS: In this sample of insufficiently-active overweight and obese individuals, when cross-stratifying by CRF and BMI, a combination of OW and HF factors were related to normal HOMA-IR and HDL levels.

887 Board #121 May 29 2:00 PM - 3:30 PM
Temporal Trends Of Physical Activity Among High School Students In The United States, 2011-2017

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(No relevant relationships reported)

BACKGROUND: Physical activity has long been considered an important component of a healthy lifestyle. The habit of physical activity as a childhood affects adults as well. Therefore, it is important to investigate the trend of physical activity among adolescents. **PURPOSE:** The purpose of this study was to evaluate temporal trends in physical activity among US high school students. Physical activity trends were evaluated by the whole group and the various subgroups, including different gender, race-ethnicity, and body mass index (BMI) levels. **METHODS:** Data from a total of 52,288 high school students who participated in the Youth Risk Behavior Survey (YRBS) from 2011 to 2017 were analyzed for this study. Physical activity was measured using a question of YRBS; during the past 7 days, on how many days were you physically active for a total of at least 60 minutes per day? BMI was categorized into four levels: (1) Obese (i.e., BMI ≥ 95 th percentile by age and gender); (2) Overweight (i.e., 85th percentile \leq BMI < 95 th percentile by age and gender); (3) Normal weight (i.e., 5th \leq percentile BMI < 85 th percentile by age and gender); (4) Underweight (i.e., BMI < 5 th percentile by age and gender). SAS (v 9.3) and Stata (v. 12) were used to examine the temporal trends of physical activity among US high school students. Tests for trend over the years were performed using linear and quadratic-specific orthogonal polynomial coefficients. **RESULTS:** For the overall sample, there were no linear and quadratic trends found in the weighted mean of number of days per week children engaged in at least 60 min/d of physical activity (linear: $\beta = .05$, $p = .29$; quadratic: $\beta = .08$, $p = .28$). Further, for nearly all subgroups, linear and quadratic trends were not observed. However, there was a linear trend observed by BMI; only students who are obese increased their physical activity from 2011 to 2017 ($\beta = .15$, $p = .03$). **CONCLUSIONS:** Despite the increased emphasis on physical activity over recent years, engagement in physical activity did not increase. Continuous monitoring of surveillance data is necessary to provide information on the allocation, development, implementation, and evaluation of community-based physical activity programs for adolescents.

888 Board #122 May 29 2:00 PM - 3:30 PM
Temporal Associations of Nocturnal Sleep Duration with Physical Activity and Sedentary Time in Preschool Children

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PURPOSE: To examine the associations between nocturnal sleep duration and physical activity (PA), sitting time (ST) and sit-to-stand transitions the following days among young children in Hong Kong.

METHODS: 114 young children (71 boys) aged 3-6 years were recruited from 3 kindergartens. They were instructed to wear an activPALTM for 24-hour over 7 consecutive days to determine PA, ST, sleep duration, and sit-to-stand transitions. For each participant, 7 pairs of sleep \rightarrow PA/ST/transitions were generated, representing unique rows of sleep duration the preceding evening (e.g., Monday) and PA/ST/transitions the following day (e.g., Tuesday). To account for total waking hours, the

outcomes were presented in relative values (e.g., PA/waking hour). Linear mixed models were performed to determine the associations of nighttime sleep duration with PA, ST, and sit-to-stand transitions the following days, adjusting for age, sex, body weight status, parental educational attainment, and number of wear days. The repeated outcomes of sleep duration and activity patterns the following day nested within participants were treated as random effect.

RESULTS: Seventy children provided valid data of PA, ST, and sleep. On average, the children accumulated 2.37 hours of PA a day (SD 0.45) and slept for 9.72 hours per night (SD 0.97). Sleep duration in the preceding night was positively associated with daytime PA ($b = 0.007$; 95% CI, 0.002 to 0.012; $p = 0.011$) and sit-to-stand transitions ($b = 0.573$; 95% CI, 0.336 to 0.810; $p < 0.001$), while was negatively associated with ST ($b = -0.016$; 95% CI, -0.028 to -0.004; $p = 0.008$) the following day.

CONCLUSIONS: Longer nocturnal sleep duration was associated with more PA, frequent posture transitions, and less sitting time in the following day for preschool children. More work is needed to investigate how sleep parameters other than duration affect daytime activity behaviors.

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889 Board #123 May 29 2:00 PM - 3:30 PM

An Extended Twin-pedigree Study Of Voluntary Exercise Behavior In The Netherlands

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(No relevant relationships reported)

PURPOSE: In the current research we investigated the heritability of voluntary regular exercise behavior using extended pedigrees, this allowed us to estimate the contribution of shared household effects in the presence of non-additive genetic effects, in contrast to much of the earlier work based on twin data. In addition, rather than assessing the total volume of exercise behavior as a unitary construct we have separated this across three domains: time spent on (1) any voluntary exercise and sports, (2) solitary exercise and sports, or (3) team-based exercise and sports.

METHODS: For the participants in the Netherlands Twin Register (NTR) we constructed the extended pedigrees which specify all relations among nuclear and larger twin families in the register. A total of 253,015 subjects from 58,645 families were linked to each other, to the degree that we had information on the relations among participants. For 56,161 adolescent and adult NTR participants in 20,897 families data were available on harmonized scores for total weekly MET hours, and the six domains. We analyzed these data in the Mendel software package to estimate the contributions of additive and non-additive genetic factors.

RESULTS: The estimated broad-sense heritability of total weekly MET hours spent on (1) any voluntary exercise and sports was 41% (26% additive genetic effects (A), and 15% non-additive genetic effects (D)). A shared household effect explained 24% and unique environmental factors explained the remaining 35% of the variance. For weekly MET hours spent on team-based exercise non-additive (dominance) genetic factors (28%) were a larger contributor compared to additive genetic factors (19%), while in solitary exercise these results were reversed (12% and 22% respectively).

CONCLUSIONS: In concordance with previous literature, our results suggest that exercise is a heritable trait, however our varying results in the various domains of exercise suggest that, at least in behavioral genetics, splitting exercise over domains rather than treating it as a unitary construct may be preferable.

890 Board #124 May 29 2:00 PM - 3:30 PM
Diurnal and Circannual Variation in Body Temperature: Implications for Heat Illness Protocols

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(No relevant relationships reported)

As warm-season temperatures continue to rise, the incidence of heat illness is likely to increase. Although preventive protocols currently consider environmental risk factors, there may be reason to emphasize

diurnal and seasonal influences. Data supporting seasonal fluctuation in body temperature are abundant in animals but limited in humans. **PURPOSE:** To examine circannual and diurnal patterns of body temperature in a patient population.

METHODS: We analyzed 2,184 men and women admitted to a major hospital in Indiana over 3 years. Demographic, anthropometric, and cardiometabolic variables were collected along with season, month, and time of admission. The National Centers for Environmental Information's National Climate Report was used to generate month-by-month ambient temperature data; there were clearly defined cold (October through April) and warm (May through September) periods. All patients received oral temperatures. We used t-tests and ANOVAs to detect differences in

body temperature by time conditions; we used linear regression to test the effect of chronological variables on body temperature, holding all measured confounders constant. **RESULTS:** Mean body temperature was $98.16 \pm 0.73^\circ\text{F}$. The warmest period of the day was 6:00 to 10:00pm (98.27°F). The coldest period was 2:00 to 6:00am (98.05°F ; $p < 0.001$). ANOVA revealed differences in body temperature by month ($F = 2.525$; $p = 0.004$) and by season ($F = 3.656$; $p = 0.012$). The strongest comparison was the cold vs. warm period ($T = -3.835$; $p < 0.001$). Patients admitted during the cold period ($N = 1,139$) had a temperature of $98.10 \pm 0.81^\circ\text{F}$ while patients admitted during the warm period ($N = 1,045$) had a temperature of $98.22 \pm 0.63^\circ\text{F}$ ($p < 0.001$). Lower temperatures were also found among patients ≥ 65 years ($p < 0.001$) and those with a positive blood alcohol test ($p = 0.004$). Holding all measured confounders constant, being admitted during the warmer months predicted an elevation in body temperature of 0.13°F ($p < 0.001$). **CONCLUSION:** These findings support diurnal and circannual variations in humans. Coaches and athletic trainers may consider this when designing and monitoring practice conditions. Athletes will likely require closer observation along with updated prevention protocols when practicing outdoors to minimize the risk of a heat-related event.

891 Board #125 May 29 2:00 PM - 3:30 PM

Compliance with Physical Activity Guidelines and Associations with Physical Literacy Among Future Physical Educators

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(No relevant relationships reported)

Purpose: To examine the relationship between pre-professional physical educators meeting the U.S. Physical Activity Guidelines and steps per week and physical literacy.

Methods: Twenty-five physical education teacher education (PETE) undergraduate majors (19 males, 6 females, aged 19-24 years) participated in assessments of Physical Literacy using the Canadian Assessment of Physical Literacy and wore GTX3+ accelerometers on their waist for a week. Freedman 1998 cut-points were used for determining moderate-to-vigorous physical activity (MVPA). Descriptive statistics were calculated for all variables. Correlations were calculated to examine the relationships between measured MVPA, measured steps, Physical Literacy, self-reported PA and sedentary time, and physical competence. **Results:** 16% were compliant with MVPA guidelines, 4% were compliant with both MVPA and 10,000 steps recommendations, 56% met MVPA but were considered low active steps, and 24% did not meet any recommendations. Participants' physical literacy considered below that of a proficient 12-year old. Significant relationships existed between self-reported PA and Physical Competence ($r=0.40$, $p \leq .05$), and MVPA and Physical Literacy ($r=0.42$, $p \leq .05$); however, no other relationships existed. **Conclusions:** These findings suggest that while PETE students may meet the minimum guidelines for physical activity, more work needs to be done to address their Physical Literacy.

892 Board #126 May 29 2:00 PM - 3:30 PM

Association Between Walking and Sunburn: A Potential Trade-Off Between Cancer Prevention and Risk Factors

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The association between higher physical activity levels and increased sunburn prevalence is a health behavior trade-off between the health benefits of physical activity and potential increased risk of skin cancer. Walking is a common form of physical activity accessible to most people yet has an unknown association with sunburn. This is important because risk of melanoma doubles with five or more sunburns. **PURPOSE:** To examine whether sunburn prevalence varied by walking behavior.

METHODS: This study used the 2015 National Health Interview Survey of adults ($N=26,632$), age ≥ 18 years. We defined four exclusive categories of weekly walking: 1) those who reported no walking or less than ten minutes total; 2) only transportation walking; 3) only leisure walking; and, 4) both categories of walking. It was necessary to disaggregate walking into categories, as there are different behaviors and contexts associated with leisure and transportation walking. We estimated the adjusted prevalence of sunburn (one or more in the past 12 months) by walking category and separately for walking duration; we stratified by gender and sun-sensitivity (any reported skin burn when not protected from the sun for one hour).

RESULTS: The adjusted sunburn prevalence was not different between walking categories for women, but it was for men. Specifically, prevalence was lower for men who reported no walking, 34.1% (95% CI: 32.2%-36.1%) compared to 38.8% (95% CI: 36.5%-41.2%) who walked for both purposes ($P=0.003$). Among sun-sensitive individuals, the adjusted sunburn prevalence was not different by walking category for women ($P=0.28$) or men ($P=0.21$). Regardless of sun-sensitivity status, weekly minutes of transportation or leisure walking was not significantly associated with sunburn prevalence for women or men.

CONCLUSIONS: The results suggest that walking, unlike leisure-time physical activity, may not be generally associated with sunburn, except for the higher sunburn prevalence for men who walked for both leisure and transportation purposes. Research is needed into public health messages that encourage walking for physical activity and advise sun protection, with special attention to men.

893 Board #127 May 29 2:00 PM - 3:30 PM

Relationship between Neighborhood Environment and Physical Activity in Freshmen from Tsinghua University in Beijing, China

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Neighborhood walking environment is an environmental issue affecting human health-related behaviors in China and worldwide. Few studies so far have researched the relationship between neighborhood environment walkability and physical activity among freshmen in China.

PURPOSE: We examined the relationship between neighborhood environment walkability and physical activity. **METHODS:** Neighborhood environment was measured using the Neighborhood Environment Walkability Scale for Youth (NEWS-Y). Physical activity data by the Global Physical Activity Questionnaire (GPAQ) were collected. The data were analyzed by Stata14.0. **RESULTS:** We conducted a cross-sectional questionnaire study on 3,411 freshmen from Tsinghua University in Beijing, China. Of the total sample size, 2,318 were male (67.96%), and 1,093 were female (32.04%). One of seven environmental attributes were significantly related to moderate and vigorous physical activity (MVPA) (MET-minutes/week) in neighborhood aesthetics (168.64 [44.12-293.16]; $p=0.008$). One of seven environmental attributes were significantly related to vigorous physical activity (VPA) (MET-minutes/week): neighborhood aesthetics (151.57 [45.08-258.07]; $p=0.005$). Two of seven environmental attributes were significantly related to moderate physical activity (MPA) (MET-minutes/week): walking facilities (75.56 [5.36-145.76]; $p=0.035$) and neighborhood aesthetics (68.07 [3.51-132.62]; $p=0.039$). One of seven environmental attributes were significantly related to sitting time (minutes/week) in walking facilities (-18.64 [-32.57 - -4.71]; $p<0.001$). **CONCLUSIONS:** A positive correlation between neighborhood environment walkability, especially neighborhood aesthetics and walking facilities, and physical activity was found.

894 Board #128 May 29 2:00 PM - 3:30 PM

Factors Leading to Discrepancies in Accumulated Physical Activity During School Hours in Elementary School Students

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(No relevant relationships reported)

Inconsistently implemented state physical activity (PA) mandates lack oversight and regulation. **PURPOSE:** This study quantifies sex and racial differences of in-school PA among fourth grade students. **METHODS:** Students ($N=148$) from eight rural, low socioeconomic schools wore accelerometers during school for one week. Teachers recorded data related to PA setting and duration. **RESULTS:** Of the 148 students, only 12 met the 150 minutes of in-school moderate-to-vigorous physical activity (MVPA) per week, in accordance with the state's mandate. Students spent a significant percentage of the total school day sedentary (75.7±5.7%, mean±SD). Males spent significantly more of daily recess engaged in MVPA than females (24.9% and 18%, respectively). White students spent a higher percentage of recess in MVPA than Non-White students (29.2±13.1% and 21.1±13.1%, respectively). Schools with a certified physical education instructor ($n=2$) participated in significantly more minutes of MVPA during recess (9.1±7.3) and physical education class (3.1±2.0) than other schools (5.2±2.7 and 2.5±1.8, respectively). **CONCLUSIONS:** Very few students achieved the state-mandated 30 minutes of MVPA per day during school hours; however, schools with certified physical educators achieved more MVPA throughout the school day. Recess PA contributed considerably to this discrepancy, highlighting the importance of encouraging active play and other types of PA during breaks in the school day.

895 Board #129 May 29 2:00 PM - 3:30 PM

Title: Association of Sleep and Physical Activity with Cardiometabolic Risk in Older Women: A Compositional Analysis

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PURPOSE: To investigate the effect of daily (24-hour) activity behaviors (sleep, sedentary, light and moderate physical activity [LPA and MVPA]) on cardiometabolic risk among older women, using a compositional data analysis approach.

METHODS: Participants from the Healthy Women Study 2010-11 follow-up visit ($N=145$, aged 73.3±1.7 years, white=91.5%) wore an ActiGraph GT1M accelerometer (hip) and an Actiwatch-2 (wrist) for 7 consecutive days, to objectively monitor physical activity and sleep. The estimated duration of sleep, sedentary, LPA, and MVPA, were averaged across valid wear days (≥ 4 days of ≥ 10 hours). For each participant a composite cardiometabolic risk score was calculated by transforming metabolic syndrome (MetS) components including waist circumference, blood pressure, fasting triglyceride, fasting high-density lipoprotein (HDL), and fast blood glucose into z-scores and summing z-scores to create a continuous MetS z-score. A 24-hour time composition of activity behaviors was derived and isometric log-ratio multivariable linear regression was used to predict MetS z-score. Additional 24-hour compositions were created where a fixed durations of time was reallocated from one activity behavior to another (e.g., sedentary to LPA), while time spent in the remaining activities was unchanged. Reallocation was defined as 15 minutes for sleep, sedentary and LPA, behaviors; and 5 minutes for MVPA. **RESULTS:** Participants had a mean MetS z-score -0.01 ± 3.22. Mean daily time (minutes) spent in activity behaviors was 403, 749, 282, and 7; for sleep, sedentary, LPA and MVPA, respectively. The 24-hour composition was a statistically significant correlate of MetS z-score ($P < 0.001$). Reallocation of 5 minutes from MVPA to sleep, sedentary, and LPA, increased the predicted MetS z-score by 1.07, 1.07, and 1.06, respectively. The predicted MetS z-score was reduced by 0.88, 0.91, and 0.85 when 15 minutes of sleep, sedentary, or LPA time was replaced with MVPA. Reallocation 15 min of sedentary time to LPA reduced the predicted MetS z-score by 0.05. **CONCLUSIONS:** This cross-sectional study demonstrates the beneficial effect of MVPA on cardiometabolic risk among older women. The exchange of sedentary time for LPA may also reduce cardiometabolic risk in older women.

896 Board #130 May 29 2:00 PM - 3:30 PM

Screen and Non-screen Sedentary Time in Older Adults Living in a Retirement Community

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PURPOSE: This study aimed to describe the magnitude and composition of screen (SST) and non-screen sedentary time (NSST) in older adults living in a retirement community (RC); documenting gender, mobility aid, chronic disease and exercise participation in screen and non-screen sedentary time variation. **METHODS:** One hundred subjects (84.7 ± 6.3 years; 70% female) were recruited from a RC located in the Midwest area of United States. Sedentary behavior (SB) was measured using a questionnaire specifically developed for the older adult population. The questionnaire comprises of 10 questions related to time spent in different activities (eight related to NSST and two related to SST). Based on the questionnaire, three metrics were calculated and expressed as hours per day: a) NSST, given by the sum of time spent in the eight out of 10 possible activities; b) SST, given by the sum of time spent in two out of 10 activities and; c) total sedentary time (TST), given by the sum of the time spent in NSST and SST. **RESULTS:** The findings indicated that overall older adults living in a RC spend on average 10 hours per day in sedentary activities; being 6.5 in NSST and 3.5 hours in SST. Older males reported spending significant higher SST compared to their older female counterparts (4.5 vs. 3.1; $P<.05$). Those not making use of a mobility aid reported significant higher TST (10.2 vs. 9.3) and NSST (6.8 vs. 5.6) compared to those using a mobility aid ($P<.05$). Older adults presenting with ≥ 3 chronic diseases reported significant higher TST (10.6 vs. 9.5) and NSST (6.9 vs. 5.5) compared to those with less than 3 chronic diseases ($P<.05$). No differences were observed for TST, NSST and SST between older adults engaged and not engaged in a regular exercise. The findings further indicated that activities such as TV watching and reading comprise nearly 45% of participants' TST and computer use accounted for about 12%. **CONCLUSION:** The findings indicated that older adults living in a RC spend a large number of hours in sedentary activities and that 65% of this time is

spend in NSST and 35% in SST. The findings further suggest that significant gender, mobility aid, and chronic disease variations exist in terms of TST, NSST and SST in this population. Supported by Dean's Research Grant COE-NIU (2017-2018)

897 Board #131 May 29 2:00 PM - 3:30 PM
Geographical Effects In Familial Clustering Of Physical Activity, Adiposity And Metabolic Syndrome

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Metabolic syndrome (MetS) risk factors, adiposity and physical activity (PA) levels have a multifactorial aetiology, comprising genetic and non-genetic factors. Notwithstanding the consistent findings about their aetiology, biological and behavioural traits do not explain the total variation and the increase of metabolic disorders and physical inactivity over the past decade. Additionally, links may be identified between built and natural environments, namely PA environments, on adiposity, MetS and PA phenotypes, as well as how they may affect different behaviours, especially within families. **PURPOSE:** The purpose of this study was to estimate the magnitude of genetic and environmental factors on adiposity, MetS risk factors and PA levels, and to investigate the role of PA environments on these traits. **METHODS:** The sample comprised 259 nuclear families (781 individuals) from a rural city of Portugal. All PA facilities' locations and families' home addresses were geocoded and Euclidian distances were calculated. Percentage of total body fat was estimated by bioelectrical impedance. Systolic and diastolic blood pressure, waist circumference, fasting glucose, triglycerides and total cholesterol were measured. PA was estimated by the Baecke questionnaire. Quantitative genetic models were used and computations performed in SOLAR software.

RESULTS: Genetic and shared environmental factors explained 22% and 38% of PA and body fat total variance, respectively. MetS risk factors were moderate-to-highly heritable, ranging from 26% to 73%. Spatially structured data of PA environments had significant effects on MetS risk factors, adiposity and PA phenotypes ($p < 0.05$), except for waist circumference, contributing to low adiposity levels ($p < 0.05$), increases in PA ($p < 0.05$), and being protective against the development of MetS risk factors ($p < 0.05$). **CONCLUSIONS:** Taken together, these results have important implications for the design of intervention programs, which need to consider the familial context and PA environments to promote physically active lifestyles and their positive effects on health.

898 Board #132 May 29 2:00 PM - 3:30 PM
Objectively-Measured PA and Sedentary Behavior Across The Lifespan Of Individuals With and Without Metabolic Syndrome

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PURPOSE: To investigate whether PA and sedentary behavior (SB) differ across the lifespan of individuals with and without metabolic syndrome (MetS). Few studies investigating lifestyle behaviors in this population have utilized objective measures of PA or included youth. **METHODS:** Participants from NHANES 2003-2006 (ages 6-85) were divided into 5 age categories: Childhood (≤ 12 years) ($N=6,672$), adolescence (13-19 years) ($N=5,938$), early adulthood (20-40 years) ($N=5,537$), middle adulthood (40-64 years) ($N=5,176$), and late adulthood (≥ 65) ($N=3,730$). Classification of MetS was based upon waist circumference (men $> 40"$, women $> 35"$), triglycerides (≥ 150 mg/dl), HDL cholesterol (men < 40 mg/dl, women < 50 mg/dl), plasma glucose (≥ 110 mg/dl or medicated), and blood pressure (≥ 130 mmHg or medicated). Participants ($N=27,053$) wore Actigraph AM-7164 accelerometers on the right hip for 7 days and were included in analyses if they wore the device for ≥ 10 hrs per day for 4 days. Independent samples t-tests were conducted between each group at each stage on counts per min (cpm), sedentary minutes, and minutes of light PA and MVPA. **RESULTS:** In this sample, MetS prevalence was 0% in children, 1% in adolescents, 4% in early adulthood, 13% in middle adulthood, and 17% in late adulthood. Pairwise comparisons of accelerometer values revealed no significant differences between groups in adolescence or early adulthood (all $ps > .05$). However, groups diverged sharply in middle adulthood, where adults with MetS evidenced lower cpm ($M=316 \pm 150$ vs. $M=249 \pm 127$), higher minutes of sedentary behavior ($M=481 \pm 120$ vs.

$M=504 \pm 121$), and fewer minutes of light PA ($M=259 \pm 70$ vs. $M=241 \pm 71$) and MVPA ($M=22 \pm 23$ vs. $M=13 \pm 18$) (all $ps < .01$). Differences remained in late adulthood for cpm ($t=3.473$, $p=.001$) and minutes of light PA ($t=3.004$, $p=.003$) only. **CONCLUSION:** No differences were identified during the first 40 years of life, suggesting that MetS at these ages may be less behaviorally based. However, beginning in middle adulthood there was a divergence in accelerometer-measured behaviors, which coincided with a spike in prevalence in this age group. Middle adulthood is characterized by increasing responsibility through roles as caregivers and bread winners and may be an appropriate target for PA interventions to prevent chronic disease.

899 Board #133 May 29 2:00 PM - 3:30 PM
Vitamin D Status And Muscular Strength In Youth: NHANES 2011-2014

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 (No relevant relationships reported)

Vitamin D is a critical component of musculoskeletal health in youth. While several studies have established the importance of vitamin D for bone development, research specific to muscular strength is lacking. **PURPOSE:** To investigate the association between serum 25-hydroxyvitamin D (25OHD) status and muscular strength in a nationally-representative sample of U.S. youth. **METHODS:** The analysis included 1,706 boys and 1,644 girls from the National Health and Nutrition Examination Survey 2011-2014 between 6-18.9 years. Status of 25OHD was defined as: severe/deficient ≤ 37.5 nmol/L, insufficient > 37.5 to < 50 nmol/L, and sufficient ≥ 50 nmol/L. Muscular strength was assessed via handgrip and expressed as age- and sex-specific percentiles of relative strength (kg strength/kg body mass). General linear models were used to quantify differences in strength percentile by 25OHD status. Logistic models were used to compare the odds of low strength ($< 25^{\text{th}}$ percentile) between 25OHD groups. All analyses were stratified by sex while controlling for age, calcium intake, socio-economic status, race/ethnicity, physical activity, body mass index, and season of testing. **RESULTS:** Boys with sufficient 25OHD had a higher mean (SE) relative strength percentile than those in the insufficient or severe/deficient groups, 49.1 (1.8), 43.5 (2.2), and 40.7 (2.9), respectively ($p < 0.05$). Relative strength percentile was also highest for girls with sufficient 25OHD compared to the insufficient or severe/deficient groups, 51.8 (1.9), 45.6 (2.4), and 41.1 (3.3), respectively ($p < 0.05$). Further, boys in the insufficient group had a higher odds of low strength than 25OHD sufficient boys (odds ratio, OR = 1.8, 95%CI 1.1 to 3.0). Both girls in the insufficient and severe/deficient groups were more likely to have low strength compared to those with sufficient 25OHD, OR = 1.8 (1.1 to 2.8) and 3.3 (1.8 to 5.9), respectively. **CONCLUSIONS:** Youth with less than sufficient levels of 25OHD were consistently found to have lower relative handgrip strength and were more likely to have strength values below the 25th percentile. These findings underscore the importance of vitamin D for muscular strength in youth and future prospective studies to elucidate the mechanisms would be of benefit.

900 Board #134 May 29 2:00 PM - 3:30 PM
Is Seasonal Affective Disorder A Symptom Of A Larger Collection Of Sedentary And Obesity-related Disorders?

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 (No relevant relationships reported)

Seasonal affective disorder (SAD) is a subtype of major depressive disorder (MDD) that occurs during cold and overcast months. Physical activity (PA) is known to counteract depressive symptoms; however, the relationship between seasonal changes in PA and MDD is largely unexplored. Physical inactivity and consequent weight gain may contribute to a host of cardiometabolic and cerebral complications, with SAD being one diagnostic feature. **PURPOSE:** To evaluate seasonal differences in MDD among obese and non-obese patients in conjunction with cardiovascular, metabolic, and cerebral diagnoses. **METHODS:** We analyzed 2,306 consecutively-admitted patients at a Midwestern hospital over 3 years. Mean environmental temperature of the hospital's city during each of the 36 months was computed. Patients were assessed for obesity, MDD, diabetes, hypertension, peripheral vascular disease, congestive heart failure, cerebrovascular accidents, and dementia. Logistic regressions tested the effects of season and temperature on all diagnoses. **RESULTS:** Patients were 52.1 \pm 22.4 years old, 16.3% were obese, 1.1% had MDD, 14.3% had diabetes, 36.8% had hypertension, 0.7% had peripheral vascular disease, 4.4% had congestive heart failure, 3.6% had a cerebrovascular accident, and 4.6% had dementia. Between March 1 and June 30, MDD incidence was 532.8% higher than it was during all other months ($p < 0.001$). These were not the coldest months (mean temperature was 5.9°F higher during this

period; $p < 0.001$), but it was the period of greatest obesity (33.3% higher incidence; $p = 0.003$). Likewise, colder temperature was a poor predictor of MDD ($p = 0.465$), but predicted elevated rates of obesity ($p < 0.001$), diabetes ($p = 0.034$), hypertension ($p < 0.001$), congestive heart failure ($p = 0.013$), peripheral vascular disease ($p = 0.058$), cerebrovascular accidents ($p = 0.003$), and dementia ($p = 0.001$). **CONCLUSION:** MDD diagnosis was highest at the end of the cold season, when obesity was at its peak; in turn, the likelihood of numerous obesity-related diagnoses was increased. This suggests a possibility that seasonal incidence of depression is not exclusively caused by diminished exposure to sunlight. Perhaps a colder environment limits engagement in PA; in turn, SAD is one component of a larger picture, which includes dysfunction of numerous systems.

901 Board #135 May 29 2:00 PM - 3:30 PM
Muscular Strength and Whole-Body Bone Mineral Density in Older Adults With and Without Artificial Joints

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Purpose: Artificial joints (AJ) are prevalent in older adults, yet commonly ignored in bone related studies. We examined the effect of AJ on the association between muscular strength (MS) and whole-body bone mineral density (BMD) in older adults. **Methods:** This cross-sectional study included 303 older adults (58% women) ≥ 65 years old from the Physical Activity and Aging Study (PAAS). MS (peak torque at 60°/sec) was assessed by leg extension (LE), leg flexion (LF), elbow extension (EE), and elbow flexion (EF) on the dominant limbs using isokinetic dynamometry (Biodex). Whole-body BMD (t-score) was assessed by dual-energy X-ray absorptiometry (DXA). Low BMD was defined as t-score < -1.0 . AJ status was identified via medical history questionnaire. Linear and logistic regression were conducted in stratified samples of AJ status (yes/no) and sex including MS, age, hormone therapy (women only), smoking, cardiorespiratory fitness (400-meter walk test), physical activity, and body mass index (BMI). Odds ratios (ORs) of low BMD by sex-specific tertiles of MS were calculated in each stratum.

Results: Forty-five (15%) older adults had AJ. T-scores were higher in individuals with AJ compared with individuals without AJ in both men (-0.6 vs. 1.9) and women (-1.4 vs. 0.6) (both $p < 0.01$) since most materials in AJ (e.g., metals) are considered as bone tissues by DXA. LE, EE, and EF were positively associated with BMD in men without AJ (all $p < 0.05$), but not in men with AJ after adjusting for the possible confounders including BMI. There were no associations between MS variables and BMD in women, regardless of AJ status (all $p > 0.05$). Compared with the lowest (weakest) third of LF, ORs (95% confidence intervals) of low BMD for the middle and upper thirds of LF were 0.40 (0.15 - 1.08) and 0.27 (0.09 - 0.85) among men without AJ after adjusting for the possible confounders without BMI. We found similar results in LE. However, no associations were observed after further adjustment for BMI, possibly due to the confounding effects of BMI on both MS and BMD.

Conclusion: Higher MS appears to be associated with higher BMD and lower odds of having low BMD in men without AJ, but not in men with AJ. These results indicate that AJ status should be considered in studies of muscular strength and bone health in older men.

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902 Board #136 May 29 2:00 PM - 3:30 PM
Changes in Psychological State Measures After Green versus Suburban Walking Exercise: A Pilot Crossover Study

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PURPOSE: Green exercise may have psychological benefits. This study compared changes in anxiety, mood, directed-attention abilities, and stress after walking in green (i.e., nature-based) and suburban environments.

METHODS: Twenty-three adults (4 male; 50 ± 7 yr; BMI 31 ± 8 kg/m²) participated in a crossover study comprised of once-weekly 50-min moderate-intensity walking sessions. Participants walked for three weeks in each of two treatment conditions: green and suburban, separated by a two-week washout period. In the first treatment period, 11 participants were assigned to green walking and 12 to suburban walking. Previously validated psychological questionnaires measured pre- and post-walk values for: 1) Anxiety: assessed by the State-Trait Anxiety Inventory; 2) Mood: evaluated via the Positive and Negative Affect Schedule; 3) Directed-attention: measured with the visual Backwards Digit-Span (BDS) Test; and 4) Stress: assessed by the Perceived

Stress Scale. Linear mixed models for repeated measures assessed pre- to post-walk changes between treatments. Baseline BDS scores were included as a covariate in the BDS outcome model to control for a learned effect.

RESULTS: Pre-walk outcomes were similar between walking conditions. Results indicated that anxiety decreased after green walking and increased after suburban walking (-1.75 vs. $+1.13$ units, respectively; $p < 0.001$). For mood, positive affect improved after green walking and decreased after suburban walking ($+2.16$ vs. -0.32 units, respectively; $p < 0.003$), and negative affect decreased marginally after green and suburban walking (-0.59 vs. -0.04 units, respectively; $p = 0.06$). Directed-attention abilities did not improve after green and suburban walking (-0.09 vs. -0.08 units, respectively; $p > 0.9$). Stress levels were slightly but not significantly reduced after green and suburban walking (-0.91 vs. -0.69 units, respectively; $p > 0.5$). There were no sequence effects. Finally, no carryover effects were observed - suggesting adequate washout between treatments.

CONCLUSIONS: Green exercise was effective in reducing anxiety and improving mood in this sample but not in improving stress and directed-attention. Future research should identify the optimal dose of green exercise for maximum psychological health gain.

903 Board #137 May 29 2:00 PM - 3:30 PM
Relationship Of Physical Activity And Quality Of Life During ART Treatment Among People Living With HIV

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(No relevant relationships reported)

Physical functional impairments are seen among HIV-infected persons on effective antiretroviral therapy (ART). The impact of physical activity (PA) on health-related quality of life (HRQoL) during ART treatment is currently unknown. **Purpose:** To study the relationship between PA and physical and mental components of HRQoL in people living with HIV (PLWH) in China. **Methods:** This cross-sectional study is based on an HIV disclosure intervention study in Guangxi Zhuang Autonomous Region which initially enrolled 791 PLWH in 2013. The participants completed a total of six follow-up surveys at 6 month intervals. The International Physical Activity Questionnaire (IPAQ) was added only after the 4th follow-up in 2015 in which 718 PLWH participated. After excluding those with missing PA data ($n = 199$), those with PA outlier ($n = 24$), and those not under ART treatment ($n = 49$), we included 446 participants (40.4% women, mean age 39.8 years) in the final analysis. Participants with a MET-minutes/week ≥ 500 were defined as active, and those < 500 as inactive based on the current PA guidelines. The 12-item short-form health survey (SF-12) was used to measure HRQoL that is summarized by physical and mental component scores (PCS and MCS, respectively). Logistic regression was used to compare the odds of having a HRQoL component score above the norm between active and inactive participants. **Results:** The proportion of participants with a mean PCS and MCS 50 or above was 44% and 55%, respectively. More than 70% of participants met the current PA guidelines. Inactive individuals served as the referent group. After adjusting for age, gender, education, marital status, smoking, drinking, substance use, and body mass index, active participants had a 60% higher odds (odds ratio (OR), 1.60; 95% confidence interval (CI), 1.01-2.55) of MCS above the norm comparing with inactive participants. Additional adjusting for HIV duration did not change the association. However, no significant relationship was observed between physical activity and PCS. **Conclusion:** Physically active PLWH from China have greater QoL in mental health domain. PLWH commonly experience long-term psychological sequelae and impaired QoL. Findings from this study highlight the importance of examining the influence of PA on mental health in this high-risk population.

904 Board #138 May 29 2:00 PM - 3:30 PM
Physical Activity, Sedentary Time, And BMI In 1st-4th Grade Hispanic Children In Puerto Rico

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(No relevant relationships reported)

Low physical activity (PA) and high sedentary time (ST) are behaviors associated with poor health among children and adolescents, and are known to increase with age. Evidence of these associations among Hispanic children is sparse. **PURPOSE:** To compare PA and ST among 1st to 4th grade Hispanic children in Puerto Rico, and determine their association with BMI. **METHODS:** Children from 6 to 10 years of age attending 1st ($n = 44$), 2nd ($n = 124$), 3rd ($n = 90$), and 4th ($n = 70$) grade wore an ActiGraph® accelerometer for 7 consecutive days, and measures of height and weight were obtained to determine BMI. Generalized least squares fit model with random effects and post-hoc analyses were performed to detect differences and associations by school year and sex in PA (moderate to vigorous PA [MVPA]), ST, and BMI. **RESULTS:**

Minutes/day of MVPA averaged 287.4 ± 54.5 in 1st, 277.4 ± 55.4 in 2nd, 262.7 ± 53.1 in 3rd, and 219.1 ± 60.3 in 4th grade; with a significantly lower value in 4th grade, and girls being less active than boys (199.4 ± 72.4 vs. 238.7 ± 48.1 min/day, $P < 0.05$). Average hours/day of ST was 6.1 ± 1.2 in 1st, 6.4 ± 1.1 in 2nd, 6.6 ± 1.2 in 3rd, and 7.3 ± 1.5 in 4th grade; with higher values observed in 3rd and 4th grade ($P < 0.05$), and no differences by sex. BMI percentile for most children was in the normal weight range (girls = 62.5%, boys = 69.0%), and 33.4% were in a percentile representing overweight and obesity (girls = 37.5%, boys = 28.5%, $P = 0.04$). No association was detected between BMI, PA, and ST. **CONCLUSION:** Although mean MVPA indicates compliance with current PA recommendation for children, lower values at 4th grade suggests a potential trend that must be addressed. No consensus yet exists regarding ST among children; however, the increase from 2nd to 3rd grade is another potential pattern to watch. Results also suggest that BMI classification might not affect PA and ST behavior in these young children. Supported by UPRRP/DEGI/FIPI.

905 Board #139 May 29 2:00 PM - 3:30 PM
Modeling Longitudinal Changes in Physical Activity Levels: Oporto Growth Health and Performance Study

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Adolescence is often viewed as a critical window for the development of healthy behaviors which can prevent the development of metabolic risk factors and related comorbidities. Although there is evidence of the independent associations of physical activity with subject and contextual factors, few studies examined the joint longitudinal links of these factors. **PURPOSE:** We aim to model longitudinal changes in youth total physical activity (TPA) as a function of their biological maturation (BM), weight status, socioeconomic status (SES), physical fitness (PF), sleep habits, fruits and vegetables consumption and built environment. **METHODS:** This is a mixed longitudinal study and the data comprised 7315 adolescents (3621 girls) divided into four age cohorts (10 to 12, 12 to 14, 14 to 16 and 16 to 18 years) measured annually for three consecutive years. TPA was estimated with the Baecke questionnaire; BM was indirectly assessed by the maturity offset; weight status was defined with cut-off points for age and sex defined by the International Obesity Task Force; SES was determined by the Portuguese schools' social support system; PF was assessed with the Fitnessgram test battery; sleep habits, fruits and vegetables consumption and built environment information were obtained by questionnaire. Random effects mixed-models were used and computations done in SuperMix v.1. **RESULTS:** Girls' TPA at baseline (10 years) was 7.27 points (possible range: from 3 to 15), being boys systematically more active ($\beta = -0.85$, $p < 0.001$); with increasing age, TPA decreases, independently of sex ($\beta = -0.07 \pm 0.03$, $p = 0.022$); and the fittest teenagers were those more active ($\beta = 0.29 \pm 0.039$, $p < 0.01$); favorable neighborhood environments to healthy lifestyles were positively linked to TPA over the age (built facilities: $\beta = 0.06 \pm 0.02$, $p < 0.01$; sociocultural: $\beta = 0.09 \pm 0.02$, $p < 0.01$; and economic/political: $\beta = 0.07 \pm 0.02$, $p < 0.01$); although marginally, BM was positively associated with TPA changes ($\beta = 0.07 \pm 0.04$, $p = 0.064$). The others predictors did not show any significant association with TPA trajectories either sex. **CONCLUSIONS:** These results showed the decline of TPA during adolescence, emphasize the relevant role of PF, as well as favorable neighborhood environments to provide increments in TPA among adolescents.

906 Board #140 May 29 2:00 PM - 3:30 PM
Additive And Interactive Effects Of Mvpa And Sitting Time On Metabolic Syndrome Risk Indicators

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(No relevant relationships reported)

Purpose: This study was purposed to estimate the associations between MVPA and sitting time and metabolic syndrome risk in Korean adults. **Methods:** A total of 8997 non-institutionalized Korean adults (age=19-65) participated in the 2014-2015 KNHANES. Daily physical activity and sitting time during a typical week was measured using GPAQ. Metabolic syndrome risk factors were examined at the mobile examination center. The associations between MVPA + sitting time and metabolic syndrome risk indicators were analyzed using logistic and ordinary logistic regression.

Results: Sitting time was associated with elevated risk for central obesity ($OR = 1.04$, $p < .001$), hypertriglyceridemia ($OR = 1.04$, $p = .001$), low HDL-cholesterol ($OR = 1.02$, $p = .05$), hypertension ($OR = 1.04$, $p < .001$). MVPA was significantly associated with

Impaired glucose tolerance ($OR = .96$, $p = .004$), hypertension ($OR = 1.02$, $p < .035$). Also, MVPA significantly moderated the association between sitting time and hypertriglyceridemia ($OR = .997$, $p = .053$) and hypertension ($OR = .996$, $p = .011$). According to the ordinary logistic model, sitting time was significantly associated with increased chance for having more number of metabolic syndrome risk indicators in the abnormal range ($OR = 1.04$, $p < .001$). Even though MVPA did not have significant direct effects, it significantly moderated the sitting time-metabolic syndrome association in the same model ($OR = .997$, $p = .009$). **Discussion:** While sitting time and MVPA are respectively a risk and protective factor for metabolic syndrome, negative effects of sitting time may be attenuated by participating in more MVPA or vice versa. Therefore, lifestyle interventions for the metabolic syndrome prevention should include both increasing MVPA and reducing sedentary behavior strategies.

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907 Board #141 May 29 2:00 PM - 3:30 PM
Associations of Cardiorespiratory Fitness and Muscular Strength with Arterial Stiffness in Older Adults

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(No relevant relationships reported)

Purpose: To evaluate the associations of cardiorespiratory fitness (CRF) and muscular strength (MS) with arterial stiffness (AS) in older adults.

Methods: This cross-sectional study included 390 older adults aged ≥ 65 years (mean age 72). Participants were free of diabetes and cardiovascular disease events that occurred within the past 2 years. CRF was assessed by time (minutes) to complete a 400-m walk test and MS by grip strength (Jamar Plus+ 12-064). Carotid-femoral pulse wave velocity (PWV) was used to assess AS (AtCor, Sphygmocor Xcel). High AS was defined as a PWV of 10 m/s or greater, as it has been established as a threshold for increased cardiovascular risk. Logistic regression was used to calculate odds ratios (ORs) and 95% confidence intervals (95% CIs) of having high AS across sex-specific tertiles of CRF and MS. Further, CRF and MS were dichotomized into either weak or unfit (lower one-third), or strong or fit (upper two-thirds) in a joint analysis of CRF and MS with high AS. All logistic regression models included age, mean arterial pressure, body mass index, physical activity, smoking, heavy alcohol consumption (>14 drinks per week for male, >7 for female), and MS or CRF for each other.

Results: Sixty-three (16%) adults were identified as having high AS. Compared to the lowest CRF tertile (lowest 33%), ORs (95% CIs) of having high AS were 0.36 (0.16-0.81) and 0.51 (0.21-1.22), for middle and upper CRF, respectively, after adjusting for the possible confounders including MS. Compared to the lowest MS tertile (lowest 33%), ORs (95% CIs) of having high AS were 0.68 (0.33-1.39) and 0.31 (0.13-0.74), for middle and upper MS, respectively, after adjusting for the possible confounders including CRF. In the joint analysis, compared to the unfit and weak group, ORs (95% CIs) for high AS were 0.47 (0.16-0.81) for unfit and strong, 0.37 (0.13-1.04) for fit and weak, and 0.25 (0.12-0.60) for fit and strong.

Conclusion: Higher levels of both CRF and MS were independently associated with reduced odds of having high AS in older adults. Future prospective studies could evaluate longitudinal associations of CRF and MS and attenuation of age-related AS, which is an emerging risk factor for cardiovascular diseases. Supported by unrestricted research grant by Biospace.

908 Board #142 May 29 2:00 PM - 3:30 PM
Effects Of Physical Activity For Relative Risk Of Falls And Fall-related Fractures In The Elderly

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Fracture is a common source of morbidity and mortality in the elderly, approximately 10% of falls resulting in fractures.

Purpose: To examine whether physical activity could reduce the risk of falls and fall-related fractures, which based on the epidemiological survey of older Chinese people.

Methods: Referring to the questionnaire by the Disease Control and Prevention Center of Jurong. The Han nationality elderly over 60 years old (including 60) was involved. 6117 questionnaires were collected and 161 invalid questionnaires were deleted. The MET value was referred to the IPAQ. According to Physical Activity Index, the physical activity level (PAL) was divided into "Low", "Moderate" and "High". Comparisons between different groups were performed through Two-way ANOVA.

Results: The significant difference was shown in height, weight, BMI and bone density between males and females ($P < 0.01$). The height had significant differences between different PAL. Bone density increased significantly with the increase of PAL. (Table1)

Table 1. Characteristics of subjects in baseline					
Characteristics	sex	PAL			P
		Low 3,617	Moderate 911	High 1,428	
Height(cm)	M	163.58(6.32)	164.52(6.44)	163.47(6.26)	0.003
	F	152.71(5.78)	153.32(5.46)	153.36(5.31)	
Weight(kg)	M	64.92(10.70)	66.64(10.83)	64.31(10.39)	0.032
	F	58.83(10.01)	59.35(8.98)	59.14(9.27)	
BMI	M	24.24(3.76)	24.60(3.73)	24.03(3.45)	0.238
	F	25.18(3.76)	25.22(3.41)	25.13(3.61)	
Bone density(T value)	M	-0.57(0.81)	-0.48(0.75)	-0.40(0.76)	0.000
	F	-1.28(0.79)	-1.15(0.74)	-1.02(0.76)	

The RR of falls of "Moderate" decreased significantly compared with "Low" (RR=0.83, 95%CI=0.59-1.16). The RR of fall-related fractures of "Moderate" and "High" decreased significantly compared with "Low" (RR=0.58 and 0.69, 95%CI=0.26-1.28 and 0.37-1.27). (Figure 1)

Conclusions: Physical activity could increase the bone density; and the moderate PAL could decrease the RR of falls and fall-related fractures of the elderly. Though the high PAL could increase the RR of falls which might be explained by the increasing of outdoor activities, it could reduce the incidence of fall-related fractures.

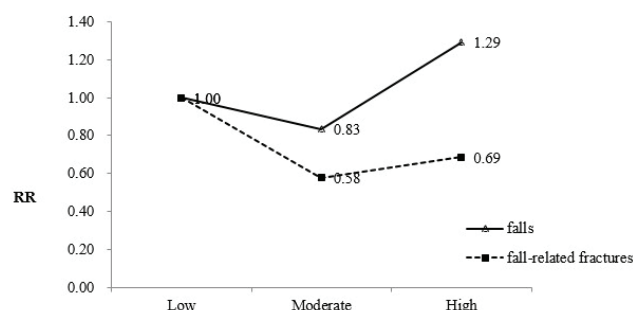


Figure 1. Relationship between PAL and falls and falls and the fall-related fractures (The calculation of relative risk: based on the "Low" PAL group)

909 Board #143 May 29 2:00 PM - 3:30 PM High Prevalence of Hypertension in Apparently Healthy Physically-Active College-Aged Adults Under the New Hypertension Guidelines

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Hypertension is an important risk factor for cardiovascular disease. Under the previous hypertension guidelines, 29% of adults in the US aged 18-60+ were hypertensive, with the highest prevalence (63%) in the 60+ age group. Prevalence in the 18-39 age group was the lowest at 7.5%. The newly revised American College of Cardiology/American Heart Association Hypertension Guidelines lowered the threshold for hypertension. Many more individuals are expected to be diagnosed with either elevated blood pressure (EBP, 120-129/<80 mmHg) or hypertension (Stage 1, 130-139/80-89 mmHg; Stage 2, ≥140/90 mmHg) than before. Prevalence of hypertension in the lower end of the young adult group, ages 18-25, is not well characterized, and how the new guidelines apply to this age group has not yet been studied. **PURPOSE:** We aimed to determine the prevalence of hypertension (EBP, Stage 1, and Stage 2) in active college-aged adults. We hypothesized that hypertension would be <30% in this population. **METHODS:** Resting blood pressure (BP) was measured with a sphygmomanometer according to AHA guidelines in 100 participants (21±2 y, 53 females (F), 47 males (M)) after sitting for 10-15 min. Participants avoided caffeine and exercise for 4 h prior to measurement. All were physically active (athletes or recreationally active exercisers), and none were taking medications or supplements that directly affect resting BP. **RESULTS:** Of 100 participants, 54 (17 M, 37 F) had normal (<120/<80 mmHg) blood pressure. 25 (13 M, 12 F) had EBP (SBP: 123±4, DBP: 76±10 mmHg),

and 21 were classified as either Stage 1 hypertension (n=13, 9 M, 4 F; SBP: 129±6, DBP: 81±13 mmHg) or Stage 2 hypertension (n=8: 7 M, 1 F; SBP: 144±3, DBP: 83±13 mmHg). **CONCLUSIONS:** Under the recently-revised hypertension guidelines, the prevalence of elevated BP and Stage 1 and 2 hypertension was much higher than expected in this apparently healthy, physically-active college-aged group. It is a matter of debate if this group should be considered an important target for lifestyle modifications beyond physical activity, or if the new guidelines are applicable in this particular group.

910 Board #144 May 29 2:00 PM - 3:30 PM

A Modifiable Factors-based Model for Detecting Physically Inactive Individuals Using the Eurobarometer Survey

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Reviews of physical inactivity (PIA) have not consistently identified systematic determinants influencing such behavior. Associations in subjective rather than objective measures may be important to consider when designing effective policy targeting PIA. **PURPOSE:** To analyze predictive variables that could influence PIA and how these factors may inform PIA-reducing policy. **METHODS:** Data from the 2014 Special Eurobarometer 412 (n = 27,919) were analyzed, including 40 separate variables and the International Physical Activity Questionnaire (IPAQ) for determining physical activity (PA) in MET-min per week. Variables included alternatives to car, places, reasons, and barriers to engaging in PA, memberships to clubs, and categorical responses regarding the extent of agreement with statements about the area, provision of activities, and local governance. A logistic regression model with a likelihood ratio statistic and a backward stepwise method was used to identify what variables contributed to PIA, which was defined as a "low" level based on IPAQ score. PIA was used as the dependent variable (0 = PA and 1 = PIA). Beta values (β) and standard errors (SE) are reported and Nagelkerke R² is indicated. A priori alpha level was set at 0.05. **RESULTS:** The model for detecting PIA (χ² = 2,023; p < 0.001; R² of Nagelkerke = 0.153) was able to identify 10.7% of the inactive and 96.9% of the active people (74.5% of the total sample). The variables contributing to the detection of PIA were (p ≤ 0.01): having a disability or an illness (β = 0.521, SE = 0.052), not having friends to do sport with (β = 0.314, SE = 0.089), lacking motivation or interest (β = 0.407, SE = 0.04), and being afraid of the risk of an injury (β = 0.190, SE = 0.073). Additionally, totally agreeing, tend to agree, and tend to disagree regarding the extent of local providers offering enough opportunities to be more active also contributed to the model (β = 0.302-0.433, SE = 1.353-1.542). **CONCLUSIONS:** Overall, the model was effective for detecting PA but not PIA. However, in the proportion where PIA was detected, key subjective factors influencing PIA began to emerge. Greater insight into these subjective mediators will be helpful in drafting effective policy around active living, and therefore better correlates should be included in future public health surveillance efforts.

911 Board #145 May 29 2:00 PM - 3:30 PM

Examining the Influence of Waist Circumference in Cardiovascular Disease Mortality Risk Prediction Modeling

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Despite the robust statistical association between waist circumference (WC) and cardiometabolic risk factors (hypertension, dyslipidemia), and outcomes (type 2 diabetes, cardiovascular disease (CVD)) there is little evidence exploring the addition of WC to risk factors commonly employed in CVD risk prediction models. **PURPOSE:** To assess the influence of adding WC to a CVD mortality risk model. **METHODS:** Data were obtained from the Aerobics Center Longitudinal Study. A total of 34,377 males (mean age 44.9 years; standard deviation (SD), 9.9 years) who completed a baseline medical examination between 1978 and 2002 were included. WC was measured at the level of the umbilicus and expressed as a continuous variable. CVD mortality was the main outcome. Deaths among participants were identified from the National Center for Health Statistics' National Death Index. Follow-up time of less than 1 year (baseline to December 31, 2003 or CVD mortality) were excluded.

RESULTS: A total of 645 CVD deaths occurred over a mean follow-up period of 13.6 years (SD 7.4 years), for a total of 467,213 person-years of follow-up. Mean WC of the cohort was 94 cm (SD 11 cm). In a Cox proportional hazards model, including age, total cholesterol, HDL cholesterol, systolic blood pressure, current smoking status, and diabetes, WC was independently associated with CVD mortality ($p < 0.0001$). The Harrell's C-index without WC in the model was 0.834, and 0.837 upon addition of WC to the model. **CONCLUSION:** In this large population sample of men, WC was significantly associated with cardiovascular disease mortality independent of cardiometabolic risk factors. However, the addition of WC to these variables did not meaningfully improve our cardiovascular disease mortality risk prediction model.

912 Board #146 May 29 2:00 PM - 3:30 PM

The Prevalence of Depression Among Diabetic Patients is Associated with Hemoglobin

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(No relevant relationships reported)

More than 400 million adults have diabetes. Complications associated with diabetes poorly impact quality of life, including interactions between cardiovascular risk and depression. A diagnosis of diabetes associates with a three-fold increase in depression. The consequences of low Hb values on increased depression among healthy populations are well defined; however, isolating the relationship within a diabetic population requires further investigation. **PURPOSE:** To explore the effect of diabetes on hemoglobin levels (Hb) and depression in a diabetic population. **METHODS:** 2,206 hospital patients, age 15-98 years old were sampled; 14.6% had a diagnosis of diabetes. Independent-samples t-tests characterized the differences between diabetics ($n=1,884$) and non-diabetics ($n=322$). One-way ANOVA examined group differences between categorical Hb values, Chi-Square determined the relationship between diabetes and hemoglobin category, linear regression determined Hb levels among diabetics, and logistic regression analyses predicted depression outcomes based on Hb levels. **RESULTS:** Patients with diabetes were older ($p<0.001$) and had lower hemoglobin ($p<0.001$) and oximetry levels ($p<0.001$). Non-diabetic patients had lower international normalized ratio ($p<0.001$), systolic blood pressure ($p<0.001$), mean arterial pressure ($p=0.015$), and pulse pressure ($p<0.001$). Hb categories differed in age, oximetry, international normalized ratio, pulse, diastolic blood pressure, mean arterial pressure, and pulse pressure ($p<0.001$); groups differed for systolic blood pressure ($p=0.013$). Additionally, chi-squared analysis demonstrated lower hemoglobin levels associated with increased diagnosis of diabetes ($p<0.001$). Linear regression, controlling for age, predicted a decrease in Hb among diabetic patients ($\beta=-0.460$; $p<0.001$). Lastly, logistic regression determined with each additional g/dL of Hb, the odds of experiencing depression decreased by 31% ($p<0.001$). **CONCLUSIONS:** Diabetes diminishes cardiovascular health, particularly Hb levels, and this predicts depression within this population. Physical activity should be a first-line intervention to improve quality of life in patients suffering from diabetes.

913 Board #147 May 29 2:00 PM - 3:30 PM
Changes In Physiological Factors And Performances In Female Track-and-field Athletes Transitioning To Senior

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Performance decline in female track-and-field (T&F) athletes transitioning to senior has been indicated but there has not been any solutions of that yet. **PURPOSE:** To examine changes of physiological factors in female T&F athletes transitioning to senior and analyze their relationship to performances. **METHOD:** Of 142 top-level female T&F athletes recruited, we analyzed the data of 38 subjects who were sprinters and jumpers aged 17-18 in the season of 2016. We measured body composition with whole body dual-energy X-ray absorptiometry device in post-season of 2016 (Po-16) and 2017 (Po-17). Athletes' performances were assessed by International Amateur Athletics Federation scoring system. Comparisons were made by a one-way analysis of covariance. **RESULTS:** Compared to performances in Po-16, 14 athletes (Group A) were able to maintain or improve in Po-17, while the other 24 (Group B) were not able to and the scores were significantly different between the two groups (991.36 ± 46.50 vs 947.46 ± 64.24 score, $p<0.05$). In Po-16, there were no significant

differences in their body composition between the two groups. In Po-17, however, fat mass (FM) and FM% increased in Group B in all body parts, while they did not in Group A in any, and were significantly different between the two groups (Upper extremities (UE): FM 833.07 ± 182.34 vs 1030.93 ± 260.77 g, $p<0.05$, FM% 15.90 ± 3.28 vs 18.44 ± 3.55 %, $p<0.05$; Trunk: FM 2587.11 ± 699.19 vs 3493.36 ± 856.99 g, $p<0.01$, FM% 11.18 ± 2.60 vs 13.99 ± 2.46 %, $p<0.01$; Lower Extremities (LE): FM 3175.16 ± 649.74 vs 4228.59 ± 830.73 g, $p<0.01$, FM% 16.84 ± 3.02 vs 20.54 ± 2.67 %, $p<0.01$; Total: FM 7467.39 ± 1440.28 vs 9638.89 ± 1821.62 g, $p<0.01$, FM% 14.44 ± 2.36 vs 17.29 ± 2.22 %, $p<0.01$, in Po-17, Group A vs Group B). In addition, lean mass (LM)% was significantly higher in Group A compared to Group B in Po-17 (UE: 79.22 ± 3.12 vs 76.65 ± 3.43 %, $p<0.05$; Trunk: 86.20 ± 2.59 vs 83.42 ± 2.36 %, $p<0.01$; LE: 78.68 ± 3.09 vs 75.17 ± 2.54 %, $p<0.01$; Total: 81.25 ± 2.30 vs 78.51 ± 2.08 %, $p<0.01$) in all body parts although there had been no significant difference in Po-16. **CONCLUSION:** While majority of female T&F athletes face performance decline when transitioning to senior, those who maintain or improve high performance levels were shown to have kept their FM and FM% low and LM% high. Supported by Japan Sports Agency, Support for female athletes.

914 Board #148 May 29 2:00 PM - 3:30 PM
Arterial Compliance is Improved Following a Community-led 12-week Indigenous Wholistic Health and Wellness Program

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(No relevant relationships reported)

PURPOSE: Indigenous peoples are at a higher risk for many chronic diseases compared to the general population. Colonization and forced assimilation have led to marked changes in traditional roles and healthy lifestyle behaviors. The purpose of this study was to examine vascular health (arterial compliance) prior to and following an Indigenous led, and community-based 12-week lifestyle program representing Indigenous views of wholistic health and wellness.

METHODS: Indigenous adults were recruited to participate in a healthy lifestyle program through a community walk on National Indigenous Peoples Day (21/06/2018) in an Indigenous community. The program was a once weekly education session on healthy lifestyle behaviours (e.g., traditional diet), including sharing circles and a physical activity component (e.g., walk). Arterial compliance was assessed using applanation tonometry (HDI/PulseWave CR-2000) at pre- and post-intervention.

RESULTS: A total of 11 participants (1 male; Age = 47.3 ± 10.7 yr, Height = 161.1 ± 6.4 cm, and Weight = 82.3 ± 18.3 kg) completed arterial compliance assessments. Large artery elasticity index was significantly improved over the program duration, $t=-2.3$, $p=0.04$ (pre: 10.4 ± 1.9 ; post: 12.0 ± 2.4 mL/mmHg x 10). There were no significant changes in resting systolic or diastolic blood pressure, pulse pressure, pulse rate, estimated cardiac output, cardiac index, systemic or total vascular resistance or small artery elasticity index following the program.

CONCLUSIONS: Arterial compliance, an important predictor of vascular health, is improved in Indigenous adults living in rural British Columbia following a 12-week program based on Indigenous worldviews. This data demonstrates health-related benefit of culturally appropriate programs. This project was funded by the Canadian Institutes of Health Research.

B-59 Free Communication/Poster - Physical Activity and Cancer

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

915 Board #149 May 29 3:30 PM - 5:00 PM
Effects of Combined Training on the Body Composition In Breast Cancer Survivors: A 1-y Follow-up

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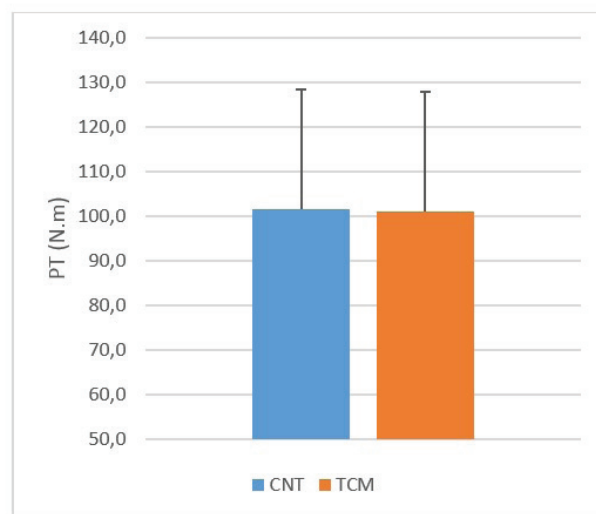
Purpose: Exercise program can improve the side effects of cancer treatment, such as, decreased total fat mass and trunk fat mass, however, it is not known whether these positive outcomes acquired are maintained long-term after program interruption. Thus,

the objective of this study was to verify if the effects of combined training on the body composition persisted over 1 year follow-up after training interruption in older breast cancer survivors undergoing aromatase inhibitor therapy.

Methods: Thirty-six breast cancer survivors (50+ years of age) that participated in a clinical trial during 9 months [Exercise group (EG): $n=18$ and Control group (CG): $n=18$] were assessed for the 1 year follow-up. Body composition (total fat mass, percentage of fat mass, trunk fat and lean body mass) and bone mineral density were evaluated by DXA. The exercise group performed about 40 min of resistance training plus 30 min of aerobic training, three times per week during 9 months. Two-way repeated measure of ANOVA was used to compare groups and a Bonferroni's post hoc test was conducted when a significant interaction was observed.

Results: There were a significant group \times time interaction for total fat mass (Pre= 30.7 ± 7.7 vs Post= 28.6 ± 7.8 vs Follow-up= 30.3 ± 8.1 kg, $F=4.864$, $p=0.012$) and percentage of fat mass (Pre= 45.4 ± 5.1 vs Post= 43.2 ± 5.8 vs Follow-up= 45.7 ± 5.4 %, $F=6.808$, $p=0.002$). The Bonferroni's Post hoc test showed a decreasing for fat mass only in the EG after 9 months of training but there was a regain over 1 year follow-up. There were no statistically significant interaction for lean mass, trunk fat and bone mineral density ($p>0.05$).

Conclusions: This study demonstrated the potential benefits of combined training (resistance plus aerobic) to decreased total and percentage of fat mass in breast cancer survivors undergoing aromatase inhibitor therapy, however, after training interruption there was a regain of body fat. Therefore, our results emphasize that is important to maintain an exercise training program over a prolonged period for this population.



916 Board #150 May 29 3:30 PM - 5:00 PM
Effects Of Chemotherapy On Muscle Performance In Women With Breast Cancer

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PURPOSE: To compare muscle performance on breast cancer women (BCW) during the treatment chemotherapy with apparently healthy women (CNT).

METHODS: 19 BCW (52.2 ± 13.1 yrs, 1.60 ± 0.07 m, 66.8 ± 12.33 kg, 27.6 ± 3.8 kg/m²) undergoing chemotherapy (between the third and fourth cycle of chemotherapy: AC+T - Doxorubicin + Cyclophosphamide - Paclitaxel) and 18 CNT (55.8 ± 8.37 yrs, 1.60 ± 0.06 m, 69.0 ± 11.49 kg, 28.3 ± 3.1 kg/m²) without breast cancer, performed 2 sets of 4 unilateral isokinetic knee extension repetitions at 60°/s (Biodex system III, Inc., Shirley, NY, USA). The rest interval between sets was 2 minutes. All subjects were not involved in exercise programs that included resistance exercise. The normality of the data was performed by the Shapiro-Wilk test and the Student *t* test to compare the groups. Statistical significance was set at $p \leq 0.05$ for all comparisons.

RESULTS: No significant differences were found in the peak torque values between groups ($p=0.95$). The peak torque was 101.1 ± 26.79 N.m for the BCW group and 101.7 ± 26.98 N.m for the CNT group. Separating the volunteers according to the level of physical activity, no differences were found between the groups for the PT values.

CONCLUSIONS: Women with breast cancer undergoing chemotherapy treatment, between the third and fourth cycle of chemotherapy, did not present differences in measures of muscle performance when compared to apparently healthy women.

917 Board #151 May 29 3:30 PM - 5:00 PM
Impact Of Prehabilitation In Oncology Via Exercise - Breast Cancer: The Improve-B Study

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The manifold benefits of exercise during and after breast cancer therapy are well investigated and lead international agencies to recommend exercise for breast cancer patients and survivors (Schmitz, 2010). However, there is still a knowledge gap regarding the efficacy of prehabilitative exercise for patients undergoing breast cancer surgery. **PURPOSE:** Investigate the effects of exercise before surgery (prehabilitation), on the health perception and functional capability of women after surgery. **METHODS:** 33 sedentary breast cancer patients scheduled for breast cancer surgery were randomized to either a partly supervised (SE), a home based (HE) resistance exercise groups or a usual care group (UC), each consisting of 11 patients. The patients were assessed before the intervention, immediately before surgery, before and after adjuvant treatment. The data were analyzed via linear Mixed-Effect-Models, questionnaire scales were standardized to the pooled pretest standard deviation. The reported results are the incremental effects in the intervention groups compared to the UC at the post-surgical follow up. **RESULTS:** The interim results showed superior functional fitness for both exercise groups, with an incremental increase in the 6min walk distance of 123.5 meter (95%-CI= 41.8 - 206.1) in the HE and 113.0 meter (95%-CI= 27.3 - 198.7) in the SE. The gain of grip strength in the dominant hand surpassed the gain in the UC by 7.0kg (95%-CI= 3.6 - 10.4) in the HE and 5.4kg (95%-CI= 3.4 - 7.3) in the SE. In the non-dominant hand the strength gains were lower with 3.2kg (95%-CI= -0.15 - 6.6) in the HE and 3.1kg (95%-CI= -0.5 - 6.7) in the SE. Both exercise groups showed superior improvements in quality of life compared to the UC. With large effects of $\beta=1.34$ (95%-CI= 0.18 - 2.50) in the HE and $\beta=2.60$ (95%-CI= 1.31 - 3.89) in the SE in role function, and $\beta=0.49$ (95%-CI= -0.29 - 1.27) in the HE and $\beta=1.54$ (95%-CI= 0.66 - 2.42) in the SE, in physical function measures. **CONCLUSION:** These results support the implementation of a brief prehabilitative exercise intervention and display the multidimensional effects of exercise on functional, as well as psychological health parameters.

918 Board #152 May 29 3:30 PM - 5:00 PM
Preliminary Findings from an eHealth Intervention to Increase Physical Activity Among Young Adult Cancer Survivors.

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 (No relevant relationships reported)

PURPOSE: This pilot study aims to determine the feasibility and acceptability of a remotely-delivered eHealth intervention that links physical activity and charity-based incentives to motivate young adult cancer survivors to initiate and maintain physical activity (PA). **METHODS:** Inactive cancer survivors (diagnosed between age 18-39y) were recruited through hospital support groups and online forums across the western United States. Screening and informed consent were done online; activity was measured via activPAL for 7-days at baseline and again at 12-weeks. Participants were randomized into either a PA only or Physical Activity+Charity Incentive group. Participants in the PA only group received a Fitbit One, personalized step goals, and weekly behavioral change content via email. PA+Incentive participants received the PA intervention plus donations to a cancer charity of their choice if daily step goals were attained. The primary aim was to evaluate feasibility and acceptability and the primary outcome was 12-week between-group changes in steps per day as measured by the activPAL. **RESULTS:** Seventy-six participants were screened; of those, 54 (71%) were eligible and provided informed consent and 51 (94%) completed the baseline assessments and were randomized. Those randomized were 88% female, 54% with prior breast cancer, 56.9% Non-Hispanic White; and had a mean age of 36.8 years. Of those eligible to date to complete the 12-wk measure (N=47), retention was high for the PA only (22/25) and PA+Charity (23/26) groups. The majority of participants reported they were "satisfied or very satisfied" with the overall intervention experience. There was some evidence that the PA+Incentive group was more satisfied with the overall experience as a study subject compared to the PA only group (45% vs 30% reporting "very satisfied"). This also holds true for the level of contact with staff (27% vs 15%) and content of emails (23% vs 10%). Some participants (23%) wanted more contact with study staff or other participants. **CONCLUSIONS:** These preliminary findings show that a mail-based intervention among young adult cancer survivors is feasible and acceptable to participants. The next step will be to evaluate if there was a significant change in daily steps as a result of the intervention. Support by Frost Fund and Cal Poly RSCA.

919 Board #153 May 29 3:30 PM - 5:00 PM
Higher Perceived Breast Cancer Risk is Associated with Less Aerobic Physical Activity in Women

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 (No relevant relationships reported)

PURPOSE: To examine the association between perceived breast cancer risk and aerobic physical activity among women. **METHODS:** We used cross-sectional data on women aged ≥ 18 years who participated in the 2015 National Health Interview Survey (n=17,967). Participants were asked to self-report whether they perceived themselves at less than average risk (ref), average risk, or higher than average risk for breast cancer. Aerobic physical activity was measured based on self-reported minutes of moderate-to-vigorous aerobic physical activity engaged in per week, then categorized into none (ref), some activity, and meeting the aerobic activity recommendation. Multinomial logistic regression models were fit, accounting for the complex survey design, to estimate associations between perceived risk of breast cancer with aerobic physical activity. Models were adjusted for age, education, race/ethnicity, and insurance. **RESULTS:** In adjusted models, compared with women who perceived themselves at low risk for breast cancer, those perceiving themselves at higher than average risk had 14% lower odds to meet the aerobic activity guideline, relative to no activity (Odds Ratio [OR]: 0.86; 95% Confidence Interval [CI]: 0.76-0.97). Similarly, compared with women who perceived themselves at low risk for breast cancer, those perceiving themselves at average risk for breast cancer had 23% lower odds to meet the aerobic activity guideline (OR 0.77, 95% CI 0.65-0.91). **CONCLUSIONS:** Among women, higher perceived breast cancer risk was associated with a lower likelihood of engaging in aerobic physical activity. Since greater physical activity can reduce the risk of breast cancer, future studies should also use longitudinal designs to determine if increasing physical activity decreases perceived breast cancer risk. Results suggest a possible role for health promotion interventions linking perceived breast cancer risk with physical activity. Supported by NIH P20CA221697-02, P20CA221696-02, and P20CA221697-01S1.

920 Board #154 May 29 3:30 PM - 5:00 PM
Effects Of Resistance Training On Muscle Strength Of Breast Cancer Survivors

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 (No relevant relationships reported)

PURPOSE: Examine the effects of highly supervised resistance training (RT) with low weekly frequency on muscle performance in women breast cancer survivors (BCS). **METHODS:** Seven BCS (55.85 \pm 3.62 years old, 68.48 \pm 11.21 kg) undergoing hormonal therapy (HT) (tamoxifen® or anastrozole), with no RT experience participated in the study. The BCS performed a full body RT protocol once a week for 8 weeks, followed by a resting period of 4 weeks and another 8 weeks of RT, totaling twenty weeks of the training protocol. The RT volume consisted of 3 sets of 8 to 12 repetitions until concentric volitional failure, performed on free weight and machines at 2 seconds of eccentric movement and 1 second of concentric movement, with 2 min of rest between sets on the following exercises: leg press (LP), stiff-legged deadlift, bench press (BP), supine lat pull down or seated cable row, and sit-up. Each BCS was individually supervised by trained physical education teachers. Muscle strength (MS) was assessed by the 10RM-test for the BP and LP. The assessments occurred pre-training (pre), post-training initial 8 weeks of training (post8), after 4 weeks of rest on week 12 (post12), and post-training second 8 weeks of training on week 20 (post20). Descriptive analyses are presented as mean and standard deviation. A repeated measurement ANOVA with the Bonferroni post hoc tests was used to examine differences between MS changes. **RESULTS:** MS was improved on the BP from pre to post8 (16.57 \pm 2.22 kg, 21.71 \pm 2.13 kg, $p < 0.01$), pre to post12 (16.57 \pm 2.22 kg, 20.14 \pm 1.67 kg, $p = 0.01$), and from pre to post20 (23.71 \pm 2.13 kg, $p < 0.0001$) and on the LP from pre to post8 (79.28 \pm 27.45 kg, 116.42 \pm 33.87 kg, $p < 0.01$), pre to post12 (79.28 \pm 27.45 kg, 108.57 \pm 34.24 kg, $p = 0.04$), and from pre to post20 (79.28 \pm 27.45 kg, 135.00 \pm 37.19 kg, $p < 0.01$). In addition, there was no significant difference during the rest period for upper and lower body strength ($p=0.25$ and $p=0.99$, respectively). **CONCLUSION:** It appears that weekly session of RT with individual supervision promotes gains in MS in women BCS undergoing HT. Furthermore, even with a rest period of 4 weeks from RT, MS in these women was maintained. Therefore, future studies examining the effects of RT on MS in women BCS should explore one day a week of RT protocols to confirm or refute the results of this promising new approach.

921 Board #155 May 29 3:30 PM - 5:00 PM
Effect of Exercise Therapy During Treatment for Gynecological Cancer: A Systematic Review and Meta-Analysis

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Side effects of gynecological cancer treatments (GCT), such as cancer related fatigue, physical pain, lower limb lymphedema, induced menopause and sexual dysfunction, negatively affect the patients' Quality of Life (QoL). **PURPOSE:** To evaluate the effect of exercise therapy in randomized controlled trials (RCTs) on QoL in women during GCT. Secondary outcomes were the effects on body composition (BC), training modality, safety and physical activity (PA) behavior. **METHODS:** A systematic search in PubMed, Cochrane, EMBASE and SPORTDiscus was carried out to identify exercise training RCTs during GCT. Primary endpoint was the change in QoL from baseline (PRE) to after (POST) exercise intervention. Exclusion criteria was investigations with participants' mean age < 18 years, not written in English and not published in peer-review journals. Meta-analysis of Standardized Mean Differences (SMD) and 95% Confidence Interval (95%CI) were performed. **RESULTS:** Seven RCTs were selected, including a total of 112 and 105 participants in the exercise therapy and the control group, respectively. Four studies underwent unsupervised, home-based (HB) exercise; one study received instructions for unsupervised HB training (walking and strength exercises); one study received a comprehensive care program (group education and self-help group support, relaxation and HB aerobic and strength exercises); one study underwent pelvic floor rehabilitation training supervised by a physiotherapist and instructions for HB exercise. After the exercise therapy an increase in PA has been reported for all included studies (SMD=0.56, 95%CI: 0.38, 0.74). Exercise therapy did not show any significant differences in waist circumference (PRE: 65.5 \pm 33.1 cm; POST: 64.9 \pm 33.6 cm; SMD=-0.10, 95%CI: -0.78, 0.59), body mass (PRE: 105.6 \pm 7.4 kg; POST: 102 \pm 7.8 kg; SMD=-0.09, 95%CI: -0.67, 0.50) or BMI (PRE: 29.5 \pm 8.3 kg/m²; POST: 30 \pm 8.2 kg/m²; SMD=0.01, 95%CI: -0.67, 0.70),

compared to the control groups. No adverse events were reported during the exercise intervention. **CONCLUSION:** Exercise therapy during GCT showed improvements in PA and QoL. However, exercise therapy seems safe during GCT. Further research is needed to evaluate effect of supervised exercise interventions on cardiorespiratory fitness, type, frequency and training intensity.

922 Board #156 May 29 3:30 PM - 5:00 PM

Factors Affecting the Change in Quality of Life in Participants of a Cancer Exercise Program

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Purpose: Anti-cancer treatment causes numerous cancer related symptoms (CRS) which may influence quality of life (QOL). The purpose of this analysis was to determine the relationship between having CRS and the magnitude of the change in QOL in cancer patients participating three to four months in various exercise classes at a comprehensive cancer center.

Methods: Data of 779 patients who participated between 2012 and 2017 in exercise classes at the National Center for Tumor Diseases (NCT) Heidelberg, Germany, were examined. Baseline characteristics assessed were anthropometric data, cancer diagnosis, peak power output (PPO) and, maximum peak oxygen uptake (VO_{2peak}) in a cycle ergometer test as well as CRS by a self-developed anamnesis questionnaire. QOL was assessed at the start of the exercise program (t0) and after three to four months (t1) using the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC QLQ-30, subscale global health status/QOL). CRS included fatigue, lymphedema, peripheral neuropathy, weight loss, pain, restricted mobility, and negative emotions (distress, anxiety, and depression). A multiple regression analysis was performed to determine the relationship between CRS and the change of QOL (Δ QOL) from t0 to t1.

Results: Participants' (71% female, 29% male, n=779) mean age was 56±12 years (16-88 years, n=772), and body-mass-index was 25±5 kg/m² (15-57 kg/m², n=755). Most frequent diagnoses were breast cancer (44%), colorectal cancer (7%), and gynaecologic tumor diseases (6%) (n=779). PPO averaged 1.7±0.6 W/kg (0.3-3.5 W/kg, n=273) and VO_{2peak} averaged 25±5 ml/min/kg (6-47 ml/min/kg, n=273). Δ QOL was 1.75±16.02 (-50.0-50.0, n=105). Multiple regression analysis revealed that CRS explained 16% of the variance in Δ QOL ($R^2=.158$, $F(7,97)=2.606$, $p<.05$) ($p=.272$, $n=105$). Restricted mobility ($\beta=.233$, $p<.05$) and weight loss ($\beta=.216$, $p<.05$) significantly affected Δ QOL.

Conclusion: Overall, QOL increased through exercise participation. Results indicated that participants who reported to have restricted mobility and weight loss at baseline tended to benefit more from exercise in terms of QOL. The results of this study can be used to understand how to modify the daily exercise sessions and focus on specific CRS to further improve QOL in cancer patients.

923 Board #157 May 29 3:30 PM - 5:00 PM

Home Exercise Program with Weekly Phone Calls Impacts Quality of Life in Cancer Survivors

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Studies have proven exercise as an effective intervention for cancer survivors to improve quality of life (QOL). Less research has focused on the impact in a home setting, specifically for those in early phases of recovery. Limited evidence exists on techniques that can improve compliance to carry out home exercise programs (HEP).

PURPOSE: To determine the impact of weekly phone calls on QOL and adherence to an individualized HEP while simultaneously identifying motivators and barriers to completion. **METHODS:** This study was a case control of a heterogeneous sample of 16 participants with various cancer types in active treatment or less than 90 days since treatment. At physical therapy (PT) initial evaluation and following an 8 week program, participants completed the European Organization of Research and Treatment of Cancer QoL Questionnaire-Cancer 30 (EORTC). Participants were allocated based on blocked randomization and provided with an individualized HEP including strength and aerobic exercise. They were instructed to perform at a frequency consistent with the American College of Sports Medicine (ACSM) guidelines and maintain activity logs. The intervention group received weekly phone calls by a student PT. The control group did not receive communication. Wilcoxon signed-rank, Mann-

Whitney U, and thematic analysis were used to analyze data. **RESULTS:** There was no difference between groups for HEP completion and 20% of participants across groups achieved ACSM guidelines. No difference was found between groups for the EORTC QoL ($p=.199$). The intervention group demonstrated significant improvements in the EORTC QoL ($p=.046$) and physical function ($p=.017$). Motivators found in the treatment group included phone calls, decreased fatigue, feeling better with exercise, self-motivation, caregiver support and confidence. Barriers included fatigue, medical complications, weather, lack of time, pain, social engagements, nausea and psychological well-being. Only one barrier was determined and seen in the control group; pain/injury. **CONCLUSIONS:** Although phone calls did not impact compliance in this small study, they may be an effective strategy to help cancer survivors identify weekly motivators and barriers to completing a HEP and create adequate support to improve QOL.

924 Board #158 May 29 3:30 PM - 5:00 PM

Personal Training vs. Group-based Exercise Prescription Compliance in Breast Cancer Survivors

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(No relevant relationships reported)

PURPOSE: Exercise interventions can improve fitness and quality of life among breast cancer survivors. The magnitude of these effects may be dependent on compliance to the intended exercise prescription (ExRx), but few studies in cancer survivors have reported this information. This study examined breast cancer survivors' ExRx compliance during a personal training (PT) or group-based exercise (GBE) intervention.

METHODS: Women (N=26) with stage I-II breast cancer who had completed chemotherapy and/or radiation treatment within the previous year were randomly assigned to PT or GBE for 8 weeks. All participants received supervised exercise twice per week for 60 minutes a session. Participants were compliant to aerobic ExRx if they completed 20-30 minutes at 50-80% of heart rate reserve. Participants were compliant to upper and lower body resistance ExRx if they completed 2-3 sets of 8 repetitions within 50-80% of 1RM for chest and leg press. Compliance to aerobic, upper, and lower resistance ExRx was coded dichotomously (yes/no) for each session, then summed and divided by the number of sessions attended to calculate percent compliance. Independent t-tests examined differences in ExRx compliance between PT and GBE. Results are reported as mean±SD.

RESULTS: Participants were aged 52±8.5 years, and 13.4±5.1 months post diagnosis. Of the N=24 who completed the intervention, exercise session attendance was 15.8±0.5 (99%) in PT, and 13.4±1.0 (82%) in GBE out of 16 possible sessions ($p=.000$). Compliance for aerobic ExRx was 77.2±0.17% in PT, and 70.1±0.17% in GBE ($p=.41$). Compliance for upper body resistance ExRx was 76.0±0.37% in PT and 82.4±0.20% in GBE ($p=.597$). Compliance for lower body resistance exercise was 80.2±0.23% in PT and 87.9±0.21% in GBE ($p=.40$).

CONCLUSION: Exercise session attendance was higher in PT. Overall ExRx compliance was >70% for aerobic, >80% for resistance, and similar in PT and GBE. With growing support for establishing exercise programs for cancer survivors, it is important to determine sustainable and scalable delivery modalities. GBE may be more resource conscientious than PT, and this study suggests GBE can achieve comparable ExRx compliance to PT. Future exercise intervention studies in breast cancer survivors should examine how ExRx compliance affects health and/or fitness outcomes.

925 Board #159 May 29 3:30 PM - 5:00 PM

Higher Perceived Colorectal Cancer Risk is Associated with Greater Aerobic Physical Activity in Adults

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(No relevant relationships reported)

PURPOSE: To examine the association between perceived colorectal cancer risk and aerobic physical activity among US adults.

METHODS: We used cross-sectional 2015 National Health Interview Survey (NHIS) data on participants 18 years of age and older (n=16,711). Perceived colorectal cancer risk was assessed based on measures to which participants responded whether they considered themselves at less than average risk, average risk, or higher than average risk. Aerobic physical activity was measured based on self-reported minutes of moderate-to-vigorous aerobic activity per week, which were categorized into none (0 min/week), some aerobic physical activity (>0 min/week of activity but less than recommendation), and meeting the aerobic activity guideline (≥150 min of moderate-vigorous physical activity or ≥75 min of vigorous physical activity or 150 min of moderate physical activity/week). Multinomial logistic regression models that accounted for NHIS' complex survey design were used to estimate associations

between perceived risk of colorectal cancer (ref= less than average risk) with activity (ref= none). All models were adjusted for age, sex, education, race/ethnicity, and insurance.

RESULTS: After adjusting for covariates, compared with individuals who perceived themselves at less than average risk, those who perceived themselves at higher than average risk for colorectal cancer had 22% higher odds of engaging in some activity and 60% higher odds of meeting the aerobic activity guideline (Odds Ratio [OR]: 1.22, 95% Confidence Interval [CI]: 1.01-1.48; OR 1.60, 95% CI 1.37-1.86, respectively). In addition, those who perceived themselves at average risk for colorectal cancer had 25% higher odds of meeting the guideline (OR 1.25, 95% CI 1.07-1.47).

CONCLUSIONS: These findings suggest that perceived colorectal cancer risk may contribute to aerobic activity levels among adults. Although causal relations could not be established from these data, aerobic activity is known to aid in colorectal cancer prevention; therefore, adults who are aerobically active may be accurately perceiving their risk relative to those who are inactive. Future studies should use longitudinal designs to examine mechanisms that underlie this link.

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926 Board #160 May 29 3:30 PM - 5:00 PM

The Effect of Familiarization on the Reliability of Isokinetic Assessment in Breast Cancer Survivors

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(No relevant relationships reported)

Muscle function plays an important role in quality of life of breast cancer survivors (BCS). Hence, several interventions have been proposed to improve muscle function during and after treatment. Thus, the assessment of muscular strength is essential for understanding the performance capacity of a BCS. Isokinetic dynamometer has been considered a gold standard method for assessing muscle strength in different populations. However, many internal and external factors in the isokinetic testing procedures can have an undesirable effect on the test results on BCS. **PURPOSE:** To assess the number of familiarization sessions required to test knee extensors strength and to state isokinetic dynamometer test-retest reliability to assess muscle function in BCS.

METHODS: Eleven breast cancer survivors (48.00 ± 6.25 years, 71.91 ± 11.55kg, 1.61 ± 0.06m) performed three isokinetic knee extension tests, separated by, at least, 72 hours. The isokinetic tests were composed by one warm-up set of 10 submaximal knee extensions at 120°/s, followed by two sets of four maximal knee extensions at 60°/s. All volunteers rested two minutes between sets. Muscle strength was determined as the greatest peak torque (PT) of each session. PT achieved in each session were compared with one-way ANOVA and Bonferroni adjustment. Typical error and intraclass correlation coefficients (ICC3.1) between non-different measures were calculated to determine test-retest reliability. **RESULTS:** Peak torque on the second session (119.18 ± 30.83 N.m) was significantly greater than first session (105.66 ± 30.21 N.m, p = 0.002). However, there was no difference between second and third sessions (121.30 ± 30.21 N.m, p = 0.885). Typical error and ICC_{3.1} between second and third sessions were 3.08 and 0.97, respectively (95% ICC confidence interval: 0.92 to 0.99).

CONCLUSIONS: Isokinetic dynamometer is a reliable device to assess muscle function on BCS. However, to assess knee extensors strength on the isokinetic dynamometer, BCS require one familiarization session.

927 Board #161 May 29 3:30 PM - 5:00 PM

Effects of a Smartphone Based Exercise Intervention on Quality of Life in Breast Cancer Survivors

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A physically inactive lifestyle in breast cancer survivors elevates risk for recurrence, morbidity, and co-occurring chronic diseases. Exercise interventions, particularly those that combine both aerobic and resistance exercise, can help mitigate these risks and serve as an important pathway for promoting health and quality of life in breast cancer survivors. However, barriers to exercise may prevent adherence to recommended levels of activity. Smartphone based exercise programs may promote improvements in quality of life via a method that is both scalable and widely feasible for breast cancer survivors. **PURPOSE:** To determine the effects of a 6-week smartphone based aerobic and resistance exercise intervention on quality of life in breast cancer survivors.

METHODS: 34 women (age = 57.5 y.o) 6.7 years since diagnosis (YSD) were recruited through Army of Women, a national non-profit breast cancer organization,

to complete a 6-week intervention remotely. They were provided with a Fitbit and a mobile application that provided prompts to complete aerobic and resistance exercise. Additionally, written and video instructions were provided for each resistance exercise workout on the app. Surveys on depression and quality of life (Center for Epidemiologic Studies Depression, Short Form Health Survey, and Functional Assessment of Cancer Therapy - Breast Cancer) were completed pre and post the 6-week intervention. **RESULTS:** Regression analyses examined effects of aerobic and resistance exercise completed during the intervention on quality of life, controlling for YSD, race, stage, and BMI. Only resistance exercise was significantly associated with improvements in depression ($\beta = 0.431$, $t = 2.79$, $p = 0.01$), social functioning as measured by the SF-36 ($\beta = -0.378$, $t = -2.25$, $p = 0.03$) and social well-being as measured by the FACT-B ($\beta = -0.361$, $t = -1.95$, $p = 0.06$). **CONCLUSIONS:** These findings demonstrate the unique effects of a brief resistance exercise program delivered via a mobile application in improving quality of life in breast cancer survivors. Mobile application based exercise interventions offer significant scalability and improved feasibility for breast cancer survivors who may have limited access to a supervised exercise program.

928 Board #162 May 29 3:30 PM - 5:00 PM
The Long-term Effects Of A Physical Activity Behaviour Change Intervention On Cancer Survivors' Levels Of Depression, Fatigue And Mental Well-being

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PURPOSE: Exercise is known to increase cancer survivors' cardiorespiratory fitness and strength, assist in the management of treatment related side effects and reduce the risk of cancer recurrence and mortality. The aim of this study was to determine the long-term effects of the MedEx IMPACT (Improve Physical Activity after Cancer Treatment) trial, a patient centred, evidenced-based and theoretically informed physical activity behaviour change intervention, on cancer survivors' long-term levels of depression, fatigue and mental well-being (MWB).

METHODS: Adults with an established diagnosis of cancer, who had completed their adjunctive therapy, were referred to a community-based exercise rehabilitation programme (CBERP) for survivors of cancer known as 'MedEx Move On'. Participants in the control group (CG) and intervention group (IG) attended two 60-min supervised exercise classes each week for 12 weeks. In addition, participants in the IG also received: i) a home-based exercise programme, ii) 4 PA information sessions and iii) a 1:1 exercise consultation. At baseline, programme completion (week 12) and 3-month follow-up, depression, fatigue and MWB were measured using the Patient Health Questionnaire (PHQ-8), Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-Fatigue) and the short Warwick-Edinburgh mental well-being scale (SWEMWBS), respectively.

RESULTS: One-hundred and ninety-one survivors of cancer were recruited (CG, n=87; IG, n=104; mean age 56 ± 10 yrs, 73% female). Cancer diagnoses were breast (60%), colorectal (16%), prostate (13%) and other (11%). On average, participants attended 66% of the supervised exercise classes (CG=67±22%; IG=65±27%). 97 participants (51%) completed the trial. Depression, fatigue and MWB significantly improved in both groups from baseline to week 12, and 3 month follow-up (p<.001). There were no statistically significant differences between the CG and IG.

CONCLUSIONS: Participation in a 12-week CBERP has a positive long-term effect on cancer survivors' levels of depression, fatigue and MWB. The inclusion of additional behaviour change strategies to the supervised exercise classes did not augment the benefits achieved.

929 Board #163 May 29 3:30 PM - 5:00 PM
Cancer Survivorship Fitness Program: College and Community Connect

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Evidence confirms that exercise has positive effects on physical functioning (PF) and quality of life (QOL) in cancer survivors after treatment. Long term medical complications may impact exercise ability and precautions need to be taken to ensure safety. Exercise scientists (ES) and physical therapists (PT) are ideal providers suited to prescribe exercise in this population. An educational clinic where ES and PT students work together may be a beneficial environment to provide fitness support to cancer survivors.

PURPOSE: To examine the effects of an interdisciplinary 8-week supervised exercise program in post-treatment cancer survivors on a college campus, hypothesizing that participants would improve in QOL and PF.

METHODS: Nine participants with various types of cancer, stages II-III, within 3 years of treatment were included in this pilot-study. QOL was measured using the Short Form-36 (SF-36). PF was measured using grip strength, 30 second sit to stand (30s STS), single limb stance, 6 minute walk test (6MWT), and sit and reach flexibility test. Measurements were taken at baseline and at the end of the 8 week program. Participants worked with ES and PT students at the campus fitness facility on an individualized program created by the pair with faculty oversight. Participants were encouraged to meet American College of Sports Medicine guidelines for cardiorespiratory endurance, muscular fitness, and flexibility. Results were analyzed using descriptive statistics.

RESULTS: Seven participants completed the study. The greatest gains in PF were demonstrated in the 6MWT, flexibility, 30s STS, and grip strength. Overall, 86% of participants improved in the majority of PF tests. QOL improved in 71% of participants for physical function but only in 43% of participants for general health subscales.

CONCLUSIONS: This is the first known study design to combine an interdisciplinary approach (ES and PT) to exercise care for cancer survivors in an academic setting. This supportive and collaborative environment allowed for an individualized program and participant monitoring from both disciplines. Furthermore, it permitted learning opportunities for students and fitness opportunities for cancer survivors to enhance the continuum of care.

930 Board #164 May 29 3:30 PM - 5:00 PM
Body Composition, Strength, and Physical Function Following Two Training Interventions for Breast Cancer Survivors

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Cancer treatments including surgery, chemotherapy, radiation, and hormone suppressant therapy have greatly improved the survival of breast cancer patients. Although these treatments have been successful in reducing breast cancer mortality, they are accompanied by long-term side effects that include accelerated losses in muscle mass and gains in fat mass. These changes lead to losses in strength and physical function. While resistance training programs have been shown to attenuate these negative changes in body composition, strength, and physical function, there is a lack of research examining the effects of resistance training combined with high impact training or a low impact yoga program to maintain or improve these measures. **PURPOSE:** To examine the effects of functional impact training (FIT) and yin yoga (YY) on body composition, strength, and physical function in breast cancer survivors (BCS). **METHODS:** Forty-four BCS (60.3 ± 8.3 yrs) were assigned to a 24-week FIT (resistance+high impact exercises) or YY intervention (stretching+relaxation) 2x/wk. Pre- and post-body composition measurements were assessed via dual energy X-ray absorptiometry. Upper body strength was measured by a one-repetition maximum chest press test. Lower body strength was assessed by Biodex isokinetic knee extension and flexion at 60, 120 and 180°/s. The Continuous Scale-Physical Functional Performance (CS-PFP) test assessed physical function. Data were analyzed using a repeated measures analysis of variance. Significance was accepted at p≤0.05. **RESULTS:** Body composition did not change. FIT improved upper body strength (73 ± 18 to 83 ± 22 kg) compared to YY (60 ± 15 to 59 ± 16 kg). Main time effects occurred for lower body strength with a mean extension and flexion improvement of 13% and 16%, respectively. A main time effect occurred for CS-PFP (68.53 ± 12.87 to 73.66 ± 12.62 U). **CONCLUSION:** Our findings suggest that FIT and YY are beneficial for strength and physical function in BCS. FIT may be a high impact alternative to traditional weight training for BCS while YY may be a viable option for BCS who require a program of lower intensity. Supported by: ACSM Doctoral Student Grant; NSCA Graduate Student Research Grant.

931 Board #165 May 29 3:30 PM - 5:00 PM
Cross-sectional Correlates of Physical Activity and Sedentary Time among Young Adult Cancer Survivors

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(No relevant relationships reported)

Cancer survivors are less active than the general population. Previous research has examined predictors of physical activity among cancer survivors; however, few studies have focused on adolescent and young adult (AYA) survivors.

Purpose: To examine cross-sectional relationships between demographic, psychosocial, disease-related characteristics, and measures of physical activity (steps, MVPA, and sedentary time) among AYA cancer survivors.

Methods: Eligible participants were diagnosed with cancer between 18-39y, >6 months post-treatment, and engaged in <60 min/wk of exercise. Participants wore an activPAL monitor for 7-days to obtain estimates of physical activity and sedentary time. Participants self-reported their health history (e.g., cancer type and treatment), demographics, psychosocial correlates (e.g., self-efficacy), and symptoms (e.g., fatigue). We used Pearson correlations to assess bivariate relationships. For variables with significant correlations, we used linear regression models to assess the relationship between activity variables, demographics, and psychosocial factors.

Results: Fifty-four participants were eligible and provided informed consent; of those, 51 completed the baseline assessments and 48 had valid baseline data. Fatigue was significantly correlated with steps per day (R = -0.39), minutes of MVPA (R = -0.38), and percent of time sedentary (R = 0.40). There were no other significant correlations between psychosocial variables and steps, MVPA, or sedentary time. After adjusting for age and gender, breast cancer survivors had significantly higher steps per day than other cancer types (1,651 steps), more minutes of MVPA (13.7 min/day) and less sedentary time (-8.4%, p<0.05). The relationship between higher levels of fatigue, less physical activity, and more sedentary time remained significant after adjusting for age, gender, and cancer type (p<0.05).

Conclusions: Preliminary results indicate a significant relationship between higher levels of fatigue, more sitting time, and less daily physical activity. Future research is needed to determine if increasing physical activity will reduce fatigue in AYA cancer survivors. Supported by Frost Fund and Cal Poly RSCA Grant.

932 Board #166 May 29 3:30 PM - 5:00 PM
Social Representations About Physical Activity In A Group Of Women With Breast Cancer In Bogota

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Abstract. The social representations are systems with an own logic and language with the function to establish an order both in the material and social world, which give explanations and generate codes to name and signify a lot of the experiences that accompany them. In the case of Physical Activity (PA) representation in patients with cancer, his meaning can be of vital importance for the illness coping. This investigation pretended identify the social representations of the physical activity (understanding P.A. as a mediator of all activity that generate pleasure, integration and identity to a group), in a group of women that live with breast cancer in Bogotá city. From a hermeneutic historical paradigm, a qualitative approach and a narrative design, we inquired 11 women that live with breast cancer about their representations of physical activity, using ATLAS TI as tool. A content analysis was developed, in which 65 codes and 18 emerging categories associated with the concepts of information, attitude and representational field were identified. According to this analysis physical activity is represented as a way to be more conscientious about their health and a mechanism that generates well being, favoring the quality of life. Likewise, it was recognized that physical activity is seen as an aspect that favors family relationships and a tool for strengthening networks generating attitudinal changes, a feeling of overcoming and the desire to help other people who live with the disease. The body and human movement in this disease is a mediator of the daily activities of women that gives a new meaning to cancer and the beliefs about the disease by making possible new alternatives of intervention in addition to the medical ones for management and treatment.

933 Board #167 May 29 3:30 PM - 5:00 PM
Assessment of Physical Activity Levels and Quality of Life in Women Suffering from Breast Cancer

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A wealth of evidence suggests exercise as a complementary therapy for breast cancer (BC), by reducing the expression of oncogenes and atrophy genes, inducing antioxidant defense pathways and helping combat chronic inflammation. However, exercise appears not to be adequately incorporated in the therapeutic strategy of cancer.

PURPOSE: This study assessed the physical activity (PA) levels and quality of life (QoL) of women under different BC treatment strategies and compared them with those of age-matched healthy females.

METHODS: 141 women were recruited, 76 women with BC under chemotherapy or radiotherapy (age: 53.3 yrs, height: 1.61m, mass: 71.3kg, BMI: 26.7 kg/m²) and 65 healthy women who served as control group (age: 49.6 yrs, height: 1.65m, mass: 69.0kg, BMI: 25.3 kg/m²). Levels of PA were self-estimated with the International Physical Activity Questionnaire (IPAQ) and QoL with the SF-36 Health Survey questionnaire.

RESULTS: All BC women refrained from high-intensity PA, while 49.30% of the control group participated in high-intensity PA. However, 50.55% of women under radiotherapy, 44.43% under chemotherapy and 35.70% of women subjected to both therapies participated in moderate-intensity PA. They selected brisk walking as the preferred form of PA by 87.33%, 90% and 83.50%, respectively. In the control group, 50.70% of the individuals participated in moderate-intensity PA and 98.40% of them used to walk. Moreover, BC patients accumulated 8-10.3 h per day of sedentary lifestyle in contrast with the control group that spent 2 h per day sitting. When BC patients estimated their QoL, 15.30% of them assessed it as excellent, 60% as very good, 23.07% as average and 1.50% as poor. Similarly, 10.30%, 55.17%, 29.30% and 3.40% of the control group evaluated their QoL as excellent, very good, average and poor, respectively. **CONCLUSIONS:** Our findings revealed that BC patients didn't engage in high-intensity PA, however they estimated their QoL as very good. PA levels of moderate-intensity were similar in the two groups, indicating that BC patients were willing to exercise but refrained from doing more intense activities, possibly because of their cancer-related fatigue. Moreover, patients subjected to both therapies exhibited lower rates of PA, potentially due to the overall burden of the therapeutic intervention.

934 Board #168 May 29 3:30 PM - 5:00 PM
Effects of a Lifestyle Intervention on Self-Efficacy Outcomes in Prostate Cancer Patients Undergoing Androgen Deprivation

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Self-efficacy (SE) beliefs in one's ability to successfully satisfy the demands of planning and engaging in health behaviors are integral to successful exercise and dietary (EX+D) behavior change. Emerging evidence suggests lifestyle EX+D interventions result in improvements in a variety of clinically relevant outcomes in prostate cancer (PCa) patients undergoing androgen deprivation therapy (ADT). However, studies delineating the effects of EX+D interventions upon changes in key SE outcomes remain limited. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of a combined exercise and dietary (EX+D) intervention, implementing a group-mediated cognitive behavioral (GMCB) approach, relative to standard of care (SC) treatment among PCa patients undergoing ADT. In the current study, we evaluated the effects of the EX+D intervention on select SCT outcomes at the end of the intensive phase of the intervention. **METHODS:** A total of 32 PCa patients (*M* age = 65 years) on ADT were randomly assigned to the EX+D (*n* = 16) or SC (*n* = 16) interventions. Measures of select SE outcomes were obtained at baseline and 2 and 3-month follow-up assessments. **RESULTS:** Results of intention to treat ANCOVA analysis of residualized change scores yielded a significant treatment main effects for (*p* < 0.05) for multiple SE outcomes. Post hoc analysis revealed that the EX+D intervention resulted in superior improvements in exercise (*d* = .62), coping (*d* = .68), and scheduling (*d* = .68) SE relative to the SC intervention at 3 months. Partial correlation analyses also revealed that scheduling and coping SE were significantly correlated with mobility performance (*p* < 0.01) and exercise participation

(*p* < 0.01) at 3 months. **CONCLUSIONS:** Findings from the IDEA-P trial suggest that the EX+D intervention, implementing a GMCB approach, resulted in superior changes in select SE outcomes relative to SC approach. Additionally, greater SE was related to superior mobility performance and exercise participation across the trial. These results underscore the utility of a GMCB-based EX+D intervention for promoting meaningful improvement in key SE outcomes among PCa patients undergoing ADT.

935 Board #169 May 29 3:30 PM - 5:00 PM
Relationship Between Perceived Fatigue & Muscular Performance Fatigability in Cancer Survivors

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BACKGROUND: Cancer related fatigue (CRF) is the most prevalent treatment-related side-effect in cancer survivors (CS). Few studies have verified the relationship between CRF to biochemical, psychological and behavioral factors. However, to date, the relationship between perceived fatigue (PF) and muscular performance fatigability (MPF) has not been evaluated in CS.

PURPOSE: To evaluate the relationship between PF and muscular performance fatigability in CS, after treatment.

METHODS: Nineteen CS participated on this preliminary/exploratory study. To evaluate MPF, the CS performed an unilateral isokinetic right knee extension, consisting of one set of 30 repetitions either at 90°.s-1 or 120°.s-1. MPF was defined as the decline in force during the 30 reps and was expressed as a percentage of the decline on knee torque. CS performed a warm-up consisting of one set of 10 reps at 120°.s-1 prior to testing. The PF was evaluated by the Multidimensional Fatigue Inventory (MFI-20), that comprises five subscales: general fatigue, physical fatigue, mental fatigue, reduced activity, and reduced motivation, with scores on each subscale ranging from 4 to 20, with higher scores indicating greater fatigue. The relationship between PF and MPF was analyzed using Pearson correlations. A significance level of *p* < 0.05 was used for all analyses.

RESULTS: Nineteen hematological CS, 32.9±2.0 years weight 72±11.57 kg, height 1.71±0.08 m participated in the study. CS reported an average general fatigue score of 12.3±3.3, physical fatigue of 10.9±3.8, mental fatigue of 11.4±3.8, reduced activity of 11.0±2.9 and reduced motivation of 8.1±2.8. MPF score was 56.9±8.9. There were significant moderate positive correlations between muscular performance fatigability and physical fatigue (*r*=0.45, *p*<0.04) and mental fatigue (*r*=0.57, *p*<0.01).

CONCLUSIONS: A significant correlation between MPF and the MFI physical fatigue and mental fatigue domains were observed. The results of this preliminary investigation warrants the need for further research necessary for a better understanding of mechanisms associated with physical and mental influences on muscular performance. The understanding of potential mechanisms are paramount for the development of exercise training interventions aimed to maximize muscle performance in CS.

936 Board #170 May 29 3:30 PM - 5:00 PM
Effects Of Exercise Dose And Type During Breast Cancer Chemotherapy On Longer-term Body Composition Outcomes

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(No relevant relationships reported)

PURPOSE: To examine the effects of different doses and types of exercise during breast cancer chemotherapy on body composition outcomes and the associations between self-reported physical activity and body composition outcomes at 1-year follow-up.

METHODS: The Combined Aerobic and Resistance Exercise (CARE) Trial randomized a total of 301 breast cancer patients during chemotherapy either to standard-dose (20-30 min/session) aerobic exercise (STAN; *n*=96), higher-dose (50-60 min/session) aerobic exercise (HIGH; *n*=101), or aerobic and resistance-combined (50-60 min/session) exercise (COMB; *n*=104). Each exercise program consisted of three sessions/week in supervised settings for one year. Body composition including lean body mass, whole body fat, and percent body fat was measured using dual x-ray absorptiometry. Physical activity levels were assessed by self-reported questionnaire

and categorized into meeting physical activity guidelines (aerobic only; strength only; combined; and neither). Assessment was conducted at baseline, post-intervention, and 12-month follow-up.

RESULTS: Of 301 patients, 284 (94.4%) and 263 (87.4%) completed body composition and self-reported physical activity assessment at 12-month follow-up, respectively. There were no significant effects of the randomized interventions on body weight, lean body mass, body fat mass, and percent body fat at 12-month follow-up; and no significant changes within each group. Meeting the combined physical activity guideline at 1-year follow-up was significantly associated with higher lean body mass compared to meeting neither guideline (+0.9 kg; $p = 0.017$). Moreover, meeting the aerobic guideline only was significantly associated with a lower body fat percent compared to meeting the combined guideline (-1.3%; $p = 0.049$) and with a higher lean body mass compared to meeting neither guideline (+0.8 kg; $p = 0.037$).

CONCLUSIONS: Combined or higher dose aerobic exercise during breast cancer chemotherapy was not superior to a standard dose of aerobic exercise for body composition outcomes at 1-year follow-up. Meeting the combined or aerobic guidelines during follow-up, however, was associated with higher lean body mass and lower percent body fat, respectively which can have implications for breast cancer outcomes.

937 Board #171 May 29 3:30 PM - 5:00 PM
A Modified Participatory Action Research Process To Enhance Utilization Of a Co-located Exercise Oncology Clinic

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Exercise offers great potential as an adjunct therapy to reverse treatment-related side-effects and increase quality and quantity of life in people with cancer. Regardless, most patients do not exercise during treatment and it is often overlooked by clinicians as an important component of cancer care. Innovative implementation strategies are needed to overcome these barriers. A 5+ year partnership between the Exercise Medicine Research Institute at Edith Cowan University (ECU) and GenesisCare has demonstrated that co-locating an exercise clinic within a cancer treatment facility is a feasible solution, yet referrals and program uptake have been suboptimal.

PURPOSE: To investigate the barriers and facilitators to program referral and uptake and provide recommendations to optimize program utilization.

METHODS: A variation of participatory action research methodology was employed to understand the factors impacting exercise program referral and uptake, and to design solutions to improve both. A stakeholder advisory group (SAG) was convened to guide the process. Key stakeholders were identified as SAG members and a comprehensive mixed methods approach was used to gain feedback from all program users. Utilization and financial data were collected via clinic records.

RESULTS: This 6-month process successfully engaged key partner organizations and individuals, and led to the development of an implementation-ready program model. Multiple barriers and facilitators within and across the domains of the social-ecological model were revealed and accounted for in the model's development. Logistics (e.g., finances, hours of operation, referral pathways), programming options, and issues around clear communication within the system were targeted as major areas for improvement. Leadership's commitment to change and strong belief in the value and potential of the program were key to success.

CONCLUSION: The successful operation of a co-located exercise and cancer treatment facility requires leadership buy-in supported by a robust implementation plan that considers all domains of the social-ecological model. Stakeholders should be engaged throughout the process, using their input to create a clear vision that can be effectively communicated to all program users.

938 Board #172 May 29 3:30 PM - 5:00 PM
Feasibility And Adherence For Exercise During All Chemotherapy: EnACT

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Several national and international agencies recommend exercise following a cancer diagnosis. Current research suggests that exercise is safe and effective during adjuvant therapy and has been shown to improve fatigue, pain, physical function, symptom management, quality of life, depression and anxiety. Despite the evidence in favor

of exercising during chemotherapy, the acceptability and feasibility of an exercise intervention among cancer patients receiving chemotherapy remains unknown.

PURPOSE: To determine if an individualized exercise intervention is accepted by cancer patients receiving chemotherapy and is feasible for them to complete.

METHODS: One hundred sixty-eight patients diagnosed with cancer actively receiving chemotherapy were recruited for an out-patient exercise intervention. Participants were prescribed an individualized home-based exercise program that included resistance, aerobic, flexibility and balance exercises. Exercise equipment included resistance bands, and adjustable dumbbells. Participants were in the study either the length of their chemotherapy regimen or for six months, whichever came first. An exercise physiologist followed-up with participants during their regularly scheduled infusions to document the progress of their exercises and make any necessary adjustments to the exercise prescription. **RESULTS:** Seventy four participants (47F, 27M; 58.2 ± 11.9 years) completed the entirety of the exercise intervention. Feasibility was defined as completing one third of prescribed exercises and adherence was defined as the number of completed exercise sessions divided by the number of prescribed sessions. Overall 86.5% of participants reached the feasibility threshold. Patients with non-metastatic cancer had higher feasibility at 89.4% compared to patients with metastatic cancer at 81.5%. The adherence rate for aerobic, balance and flexibility training was 75%, while the resistance training adherence rate was 60%. Adherence rates were higher in the metastatic group, 76%, compared to the non-metastatic group, 70%. **CONCLUSION:** An exercise intervention for cancer patients receiving chemotherapy is feasible and the adherence rates are comparable to and even higher than those seen in previous exercise studies done with cancer patients.

939 Board #173 May 29 3:30 PM - 5:00 PM
Moving Medicine: Development Of An Exercise Oncology Tool For Clinical Practice

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The Moving Medicine Cancer resource translates exercise oncology evidence into a tool for everyday practice in healthcare. It was created by the Faculty of Sport and Exercise Medicine in partnership with Public Health England and Sport England.

PURPOSE

Evidence that Physical Activity (PA) can mitigate cancer-related fatigue, deconditioning and late effects, positively impacting physical function, quality of life and survivorship continues to grow. However most people living with cancer do not attain recommended PA levels and under 10% of HCPs provide PA advice. The Moving Medicine digital resource is designed to overcome barriers and integrate PA into every healthcare contact.

METHOD

Created in a knowledge-into-action framework, Moving Medicine Cancer is one of 9 themes promoting PA in non-communicable disease. Development comprised two phases:

1. Knowledge creation

A literature search yielding 34000 papers found 500 relevant for inclusion.

Evidence was graded and divided into pre, during and post treatment. An expert multidisciplinary panel was recruited for consultation. An iterative process refined and prioritized evidence into clinical context.

2. Action cycle

Delphi study and COM-B framework analysis drove action cycle creation. This enabled end-user driven design.

RESULTS

The online tool is a time-based framework with practical information reflecting clinical priorities and accessible embedded evidence. It presents infographics with a conversational guide to support patient-focused consultation using behavioural change techniques. Moving Medicine was developed in collaboration with over 25 medical organisations and charities. Its launch in October 2018 by the UK Health Secretary received positive feedback. Formal evaluation will follow the initial delivery phase.

CONCLUSION

This novel resource harnesses current knowledge to facilitate quality conversations about PA across cancer care. As exercise oncology evolves, the Cancer Moving Medicine tool has capacity to develop precision PA prescription for the growing population of people living with and after cancer. Its developers welcome future collaboration with the international Exercise Oncology community to optimise health and wellbeing for patients. Moving Medicine is open access and free to use at www.movingmedicine.ac.uk.

940 Board #174 May 29 3:30 PM - 5:00 PM

Exercise During Chemotherapy And Its Effects On Symptom Management: Enact: Exercise In All ChemotherapyErica Schleicher, Melanie Potiaumpai, Kelsey Taylor, Jessica Moyer, Natasha Burse, Kathryn Schmitz, FACSM. *Pennsylvania State University, Hershey, PA.* (Sponsor: Kathryn Schmitz, FACSM)

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(No relevant relationships reported)

Nearly half of all cancer patients undergo chemotherapy. Many patients experience chemotherapy-related side effects, including decreased quality of life. The American College of Sports Medicine recommends exercise following a cancer diagnosis and current research suggests that exercise is safe during chemotherapy and can be used as a complementary strategy to manage symptoms. **PURPOSE:** To examine whether an individualized exercise program delivered during chemotherapy can improve chemotherapy-related symptoms. **METHODS:** One hundred sixty-eight patients diagnosed with cancer actively receiving chemotherapy were recruited for a home-based exercise intervention. Participants were prescribed an individualized exercise program focusing on resistance, aerobic, flexibility, and balance training. Participants were in the study for the length of their chemotherapy regimen or up to six months, whichever came first. At baseline and completion of the study participants were asked to complete the following questionnaires: Brief Pain Index (BPI), European Organization for Research and Treatment of Cancer- Quality of Life (EORTC QLQ-C30), Patient-Reported Outcomes version of the Common Terminology Criteria for Adverse Events (PRO-CTCAE), and Fatigue Symptom Inventory (FSI). **RESULTS:** An interim analysis included seventy-four participants (47F, 27M; 58.2 ± 11.9 years). A Paired-Sample T-test analysis showed a significant increase in social functioning (MD=8.18, SD=27.38, p=.03) and a significant decrease in fatigue inference in regards to relations with others (MD= -0.38, SD=2.80, p=.01). Additionally, severity of headaches (MD= -0.31, SD= .60, p=.05) and frequency of nausea (MD=-0.47, SD=1.54, p=.02) significantly decreased with exercise. Severity of neuropathy significantly increased (MD=0.47, SD=1.24, p= .005), however, it did not significantly interfere with activities of daily living. Severity of pain and overall fatigue did not significantly change with exercise. **CONCLUSION:** These preliminary findings show that an individualized exercise program can improve some chemotherapy related symptoms and may help manage others.

941 Board #175 May 29 3:30 PM - 5:00 PM

The Effects of Different Intensity Exercise on Lactate Metabolism of DEN-induced Hepatocellular Carcinoma.Lu Cao, Zhengtang Qi, Shuzhe Ding. *East China Normal University, Shanghai, China.*

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(No relevant relationships reported)

PURPOSE: Lactate is not only a waste product of glycolysis, but also an important signaling molecule regulating tumorigenesis. Lactate also is produced during exercise, but exercise can enhance body function to eliminate lactate. Whether exercise suppress tumorigenesis by regulating lactate metabolism? So the primary purpose of our investigation to compare the anti-tumor effect between different intensity exercise from the perspective of lactate metabolism.

METHODS: From 8 to 26 weeks of age, mice with DEN treatment run on the treadmill at different intensity. NC: injection saline only. DEN: injection DEN only. HIT: treatment DEN, running on the treadmill at 1.5km/h, alternating run 2 minutes and rest 2 minutes for 40 minutes once a day, 5 days a week. ET: treatment DEN, running on the treadmill at 0.8 km/h for 40 minutes once a day, 5 days a week. ELISA, RT-PCR and WB were used to evaluate relative serum, relative mRNA and protein expression. **RESULTS:** We found that tumor incidence was similar between DEN and HIT (66.7% vs. 62.5%); however, it was significantly smaller in ET compared to DEN and HIT (20% vs. 66.7%, 20% vs. 62.5%). The lactate in serum was significantly higher in HIT compared to DEN (25.817±2.696 vs. 18.668±1.086mmol/l, p<0.05). The pyruvate in serum was also significantly higher in HIT compared to DEN (17.136±1.354 vs 13.545±0.545mmol/l, p<0.05). The lactate in mitochondria was significantly lower in ET compared to NC (0.453±0.047 vs. 0.703±0.066mmol/l, p<0.01), but there was no significant change in cytoplasm lactate dehydrogenase between each groups. Most importantly, we found that endurance exercise significantly increased the mRNA levels of COX1 in ET in liver, compared to NC, DEN and HIT (2.629±0.5 vs. 1.0±0.107, p<0.001, 2.629±0.5 vs. 0.884±0.154, p<0.01, 2.629±0.5 vs. 1.172±0.288, p<0.05). The mRNA levels of CYTb in ET in liver was significantly higher than NC and DEN (1.964±0.452 vs. 1.0±0.122, p<0.05, 1.964±0.452 vs. 0.829±0.140, p<0.05). The mRNA levels of ND1 in ET in liver was also significantly higher than NC and DEN (1.894±0.433 vs. 1.0±0.176, p<0.05, 1.894±0.433 vs. 0.654±0.069, p<0.01).

CONCLUSIONS: Long-term endurance exercise decreased the hepatic tumor incidence and improved the mitochondrial function. But high-intensity interval exercise increased the lactate production.

942 Board #176 May 29 3:30 PM - 5:00 PM

Exercise during Chemotherapy Improves Physical Function: Findings from EnACT: Exercise in All ChemotherapyMelanie Potiaumpai, Erica Schleicher, Kelsey G. Taylor, Jessica Moyer, Natasha Burse, Kathryn Schmitz, FACSM. *Penn State University College of Medicine, Hershey, PA.* (Sponsor: Kathryn Schmitz, FACSM)

(No relevant relationships reported)

Current research shows that exercise during chemotherapy is safe, feasible, and effective at improving physical function and managing symptom severity and interference in a number of different cancer types. Despite the positive findings of exercise during chemotherapy, referral for exercise during treatment has not yet become standard of care. Additionally, there is a lack of information on the effectiveness of an institute-wide exercise program for patients receiving chemotherapy. **Purpose:** To evaluate changes in objectively-measured physical function in patients receiving chemotherapy after receiving a personalized exercise prescription. **Methods:** One hundred sixty eight subjects (65M, 103F; 59.32 ± 11.83 years) actively receiving chemotherapy enrolled in an out-patient exercise intervention. Participants were given home-based exercises that included resistance, aerobic, flexibility, and balance exercises. Exercise equipment included resistance bands and adjustable dumbbells. Physical function (PF), was measured using the 30-second chair stand (30CST), Timed-Up-and-Go (TUG), Hand-Grip Strength (HGS), and the 4-Stage Balance test (BAL). Data collection was performed prior to beginning the exercise program and following completion of their chemotherapy regimen (non-metastatic patients) or 6 months after starting EnACT (metastatic patients). **Results:** Eighty two subjects completed physical function testing. A Paired-Samples T-test analysis showed a significant increase in the 30CST (MD= .74, SE= .34, p= .03) and a significant decrease in TUG (MD= -0.42, SE= .19, p= .03). There were no significant changes in HGS for either right or left hand. While the BAL also showed no significant changes after the exercise intervention, the Instep balance test showed a trend towards significant increases in performance time (MD= 0.31, SE= .17, p= .06). **Conclusion:** These preliminary results indicate that integrating a personalized exercise prescription into standard of care is efficacious in improving physical function despite the rigorous burden of receiving chemotherapy. Improving the physical function of patients during chemotherapy may prevent future treatment-related decrements in functional capacity and the need for rehabilitative measures.

943 Board #177 May 29 3:30 PM - 5:00 PM

Communicating Exercise Oncology Research in the Digital Age: Presenting the Exercise Oncology Twitter ConferenceKeith M. Thraen-Borowski¹, Sarah Weller², Ciaran Fairman³. ¹Loras College, Dubuque, IA. ²University of British Columbia, Vancouver, BC, Canada. ³Edith Cowan University, Joondalup, Australia.

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Scientists and healthcare professionals are utilizing social media to amplify their scientific impact, acquire and share information, and communicate research to a broader audience. As such, researchers are looking for ways to engage this medium to promote scientific findings while also providing networking opportunities, particularly when costs associated with conference travel are high. **Purpose:** To examine the use of a Twitter Conference as a means to effectively communicate advances in the field of exercise oncology. **Methods:** The Exercise Oncology Twitter Conference (ExOncTC) occurred in October, 2018. Each presentation consisted of six tweets over 15 minutes, each using the official conference hashtag (#ExOncTC). Attendees were able to interact during a presentation via the conference hashtag. Website registration data was used to descriptively characterize presenters and registered participants while Twitter Analytics (twitter.com) and Union Metrics (unionmetrics.com) were used to aggregate data to determine engagement and reach. **Results:** The ExOncTC featured 68 presenters from 13 countries and 48 unique institutions. Presenters varied in academic background, ranging from undergraduate students (1.5%) to terminal degree holders (46%), and profession (inc. professors/researchers (42.5%) and M.D.s (6%)). Participants, including researchers, physicians, students, patients, and cancer organizations, could officially register via the website (n=231), follow the @ExOncTC Twitter handle (n=805), or search the conference hashtag (#ExOncTC). During the conference, #ExOncTC was tweeted 1,501 times by 483 unique users for 4,943 total engagements (number of times a user interacts with a tweet). Collectively, these tweets reached 453,900 unique users and 145,000 impressions (number of times users saw a tweet) with potential impressions equaling 1.8 million (total number of

views possible). **Conclusions:** Total reach of the ExOneTC demonstrates the potential effectiveness of utilizing a Twitter conference as a platform to communicate the field of exercise oncology. When considering the low financial and environmental costs, as well as the opportunity to increase scientific communication across populations, Twitter conferencing should be explored as a tool for scientific dissemination.

- 944** Board #178 May 29 3:30 PM - 5:00 PM
Effects of Taichi-Qigong Exercise On QoL of Nasopharyngeal Carcinoma Survivors
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The incidence of nasopharyngeal carcinoma (NPC) in endemic areas is high. The long-term chemotherapy and radiotherapy cause bodily dysfunction and low quality of life (QoL) in NPC survivors. Complementary therapy especially mind-body exercise such as Taichi-Qigong becomes an option for NPC survivors to improve the QoL. **Purpose:** To examine the effects of 10 weeks Taichi-Qigong training and health education lectures on QoL of NPC survivors. **Methods:** Thirty eligible participants were recruited and randomly assigned into either intervention or control group. 14 of NPC survivors (n=7 for intervention group; n=7 for control group) completed pre-post assessment of QoL satisfactory. The intervention group practiced the active, low-intensity 18-form internal Taichi-Qigong exercise for at least 3 times a week for 10 weeks plus three health education seminars during the 10-weeks intervention period. The control group engaged in the health education seminars only over the 10-weeks period. QoL was assessed by Functional assessment of cancer therapy - General (FACT-G) which included four subscales: physical well-being (PWB), social well-being (SWB), emotional well-being (EWB) and functional well-being (FWB). **Results:** Significant differences were found on subscales of EWB (p=0.011), and the effects of Taichi-Qigong on SWB is marginally significant (p=0.056). **Conclusion:** The results of this study provide preliminary data to support that Taichi-Qigong exercise, as a complementary therapy, may contribute to positive effects for NPC survivors in terms of improved QoL outcomes.

- 945** Board #179 May 29 3:30 PM - 5:00 PM
Objectively Assessed Physical Activity And Sedentary Behavior In Patients With Advanced Renal Cell Carcinoma
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 Reported Relationships: P. Zimmer: Consulting Fee; IPSEN Pharma GmbH. Industry contracted research; IPSEN Pharma GmbH.

PURPOSE: Increased levels of physical activity are associated with decreased cancer risk and mortality in many cancer types. Moreover, physical activity is known to reduce several side effects of cancer and its treatment thereby improving patients' quality of life. So far, most studies have focused on frequently observed types of cancer, such as breast-, prostate-, lung- and colorectal carcinoma. Recent data from epidemiological studies also reported such relationships for renal cell carcinoma (RCC). Observational studies have included heterogeneous populations in view of stage of disease and type of treatment. Further, collected data on physical activity have based on self-reported assessments, representing a major limitation of these trials. **METHODS:** Against this backdrop we have initialized the multicenter observational CABOCARE trial in Germany and Austria. Patients with advanced RCC (n=105) are recruited after treatment decision for cabozantinib has been made. Cabozantinib is an inhibitor of receptor tyrosine kinases c-MET, VEGFR and AXL, which has proven to prolong progression free survival (PFS) compared to standard care with sunitinib. Patient characteristics, state of disease, occurrence of adverse events, quality of life (FACT NFKSI-19), self-reported physical activity (newly developed visual analogue scales) as well as objective physical activity, sedentary behaviour and sleep data (Actigraph® GT9X Link device) are recorded at baseline, and each-three months thereafter. **RESULTS/ CONCLUSIONS:** Thereby, CABOCARE (NCT03647878) will be the first observational trial collecting objective physical activity and sleep data and their associations with PFS, adverse events and quality of life in patients with advanced RCC in a longitudinal fashion. The trial has opened in September 2018. Here we would like to present data of the first patients.

- 946** Board #180 May 29 3:30 PM - 5:00 PM
Effect of High Intensity Interval Training on Cardiorespiratory Fitness in Breast Cancer Patients Undergoing Anthracycline Chemotherapy
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PURPOSE: Anthracycline is a cardio-toxic chemotherapy regimen to treat breast cancer, however, breast cancer patients experience significantly impaired cardiorespiratory fitness (CRF) during and after anthracycline chemotherapy. Exercise, particularly, high-intensity interval training (HIIT), appears to be more effective than continuous steady-state exercise training for increasing CRF in patients with heart failure. It remains unclear whether HIIT improves CRF in breast cancer patients undergoing anthracycline chemotherapy. We sought to determine the effects of HIIT on CRF, measured by $\dot{V}O_{2max}$, in breast cancer patients undergoing anthracycline chemotherapy.

METHODS: Thirty breast cancer patients were randomized to either the HIIT (n=15) or delayed (DEL; n=15) groups. CRF was assessed at baseline and post-intervention using a maximal cycling protocol to obtain $\dot{V}O_{2max}$. Peak power output (PPO) was obtained at the last stage of testing to prescribe intensity of HIIT. The HIIT group participated in an 8-week HIIT intervention 3 times per week on a cycle ergometer. Each HIIT session included 7 alternating bouts of 90% PPO followed by 10% PPO. The DEL group was offered the same HIIT intervention after the 8 week study period. Paired t-test and repeated measures ANOVA were performed to assess changes in CRF. **RESULTS:** At baseline, the HIIT and DEL groups did not differ by age (46.9±9.8 yr), BMI (31.0±7.5 kg/m²), and $\dot{V}O_{2max}$ (18.8±5.9 ml/kg/min). At post-intervention, $\dot{V}O_{2max}$ significantly decreased (19.4±3.9 to 16.2±3.1; -16.5±7.9%) in the DEL group (P<.01). $\dot{V}O_{2max}$ did not change post-intervention in the HIIT group (18.2±7.6 to 18.3±7.7 ml/kg/min; 0.5±6.2%; P>.05). There was no group (HIIT vs DEL) x time interaction (Pre vs Post) following the 8-week intervention (P>.05). **CONCLUSIONS:** An 8-week HIIT intervention did not significantly improve CRF in breast cancer patients undergoing anthracycline chemotherapy, however HIIT may be an option to maintain CRF during anthracycline chemotherapy.

- B-60** Free Communication/Poster - Cancer
 Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

- 947** Board #181 May 29 3:30 PM - 5:00 PM
Physiological Fitness Efficiency of Breast Cancer Survivors Improves Despite Maintenance of Aerobic Capacity: Preliminary Analysis
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PURPOSE: To evaluate the ranges of physiological fitness responses of breast cancer survivors (BCS) following a 16-week community-based exercise intervention. **METHODS:** Cardiopulmonary exercise testing was used to evaluate aerobic capacity ($\dot{V}O_{2peak}$), time to exhaustion (TTE), Borg rating of perceived exertion (RPE), max power, and peak lactate. Brachial cuff tonometry was used to evaluate augmentation index (AIx@75) and subendocardial viability ratio (SEVR). Assessments were completed pre-post 16-weeks of progressive aerobic and strength training exercise at a community-based center. Specific attention was directed at evaluating the range of changes per outcome. Descriptive statistics were used to characterize the sample, paired t-tests to assess pre-post changes in study outcomes. **RESULTS:** Twenty BCS (mean±SD; 58±9.6ys, 166±8cm, 75±15kg) participated and were evaluated. Mean changes (min, max; p-value) revealed AIx@75= -3.4(-27, 18.5; p=0.17), SEVR=7(-11, 36; p<0.05), $\dot{V}O_{2peak}$ =0.5(-6.2, 6.8; p=0.5)ml/kg/min, TTE=60(-6, 132; p<0.001) sec, RPE=0(-5, 4; p=0.9), peak power=15(-1, 34; p<0.001)Watts, lactate=1.1(-1.1, 4.7; p<0.01)mmol. **CONCLUSION:** All 20 patients produced the same or significantly more work at post testing despite no change in aerobic capacity, demonstrating greater physiological efficiency. The heterogeneity of responses observed support the notion that tailored training programs are likely necessary to maximally benefit individual patients. Means to significantly improve or prevent declines in $\dot{V}O_{2peak}$ like those observed in some patients within our study, are critical as $\dot{V}O_{2peak}$ relates to

comorbidity and mortality. However, community-based exercise programs can be a powerful tool for improving other physiological outcomes related to cardiovascular health and physical fitness. Supported by funding from Breast Cancer Research Foundation of New York.

948 Board #182 May 29 3:30 PM - 5:00 PM
Acute Effect of Aerobic Exercise on Arterial Stiffness in Breast Cancer Survivors: Preliminary Results

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(No relevant relationships reported)

Breast cancer survivors (BCS) who underwent chemotherapy treatment have increased risk of cardiovascular disease (CVD). Chemotherapy contributes to increased arterial stiffness. Acute aerobic exercise has been demonstrated to be effective in improving arterial stiffness in healthy individuals, however, it is unknown if BCS have a similar response to aerobic exercise. **PURPOSE:** To determine if arterial stiffness is different between BCS and healthy controls following acute aerobic exercise. **METHODS:** Seven BCS (48 ± 4 yrs; 26.0 ± 2.8 kg/m²) and seven female controls (43 ± 9 yrs; 22.7 ± 3.5 kg/m²) completed a 30-min bout of aerobic cycling exercise at 65% of their maximal aerobic capacity. Central arterial stiffness was evaluated by pulse wave velocity (PWV) via applanation tonometry at baseline, 5 and 30-min post exercise. Hemodynamic variables [cardiac output (Q), heart rate (HR), and mean arterial blood pressure (MAP)] were acquired with an automated ambulatory blood pressure monitor. Carotid arterial stiffness was determined using ultrasonography [β-stiffness index, pressure-strain elasticity modulus (Ep) and arterial compliance (AC)]. **RESULTS:** See Table. Both groups had similar increases in AC at 30-min compared to 5 min post-exercise ($p < 0.05$). HR increased in both groups post exercise ($p < 0.05$); however, BCS had an overall higher HR compared to the control group ($p < 0.05$). There were no differences in PWV, β-stiffness, Ep and AC responses following exercise between the groups. **CONCLUSIONS:** These results suggest that BCS have similar arterial stiffness responses compared to a healthy control group. Interestingly, PWV decreased (approached significance), while AC decreased following exercise, showing a possible differential response between the aorta and carotid artery, suggesting more investigation in this area.

	Group	Baseline	5-min	30-min
PWV (m/s)	BCS	7.0 ± 1.5	6.6 ± 0.7	6.6 ± 0.9
	Control	6.8 ± 1.6	6.4 ± 1.1	6.4 ± 1.0
β-stiffness index	BCS	5.9 ± 3.0	7.3 ± 3.4	7.1 ± 4.0
	Control	5.1 ± 1.1	5.7 ± 1.7	5.2 ± 1.1
Ep (kPa)	BCS	74 ± 33	87 ± 32	79 ± 39
	Control	62 ± 14	72 ± 25	63 ± 18
AC (mm ² /kPa)*	BCS	1.06 ± 0.31	0.76 ± 0.24	0.93 ± 0.34
	Control	1.16 ± 0.34	0.93 ± 0.21	1.12 ± 0.17
Q (L/min)	BCS	4.5 ± 0.6	4.6 ± 0.6	4.5 ± 0.6
	Control	4.7 ± 0.8	4.9 ± 0.5	4.9 ± 1.0
HR (bpm)*#	BCS	70 ± 7	107 ± 6	86 ± 7
	Control	63 ± 10	92 ± 17	73 ± 10
MAP(mmHg)	BCS	97 ± 5	94 ± 9	93 ± 7
	Control	95 ± 9	98 ± 7	95 ± 8

Mean ± SD, *Time Effect, #Group Effect, $p < 0.05$

949 Board #183 May 29 3:30 PM - 5:00 PM
Do Taxane Based Chemotherapies Impair Improvements in VO₂ in Female Cancer Survivors

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(No relevant relationships reported)

Purpose: To determine if female cancer patients who underwent taxane-based chemotherapies benefited from exercise as compared to those who received non-taxane based treatments. **Methods:** Retrospectively, 101 females (57.88 ± 11.59), with female cancers (Breast (79), Ovarian (10), Endometrial (4), Uterine (2), and Cervical (1)) enrolled in a cancer rehabilitation program underwent a variety of fitness assessments, but only measures of VO₂ are reported here. Each subject was provided an individualized mixed home (2 days) and facility based (1 day) 12 week exercise intervention. **Results:** A strong positive correlation between VO₂₁-VO₂₂

($r = 0.802$, $p = 0.000$), a low to moderate negative correlation between VO₂₁+age ($r = -0.365$, $p = 0.000$), a low negative correlation between VO₂₂+age ($r = -0.215$, $p = 0.036$) were found. A significant change from VO₂₁ to VO₂₂ ($t = -5.372$, $p = 0.000$) was determined. While there were no differences between Taxane and Non-Taxane measures of VO₂, there was a trend in percent change in VO₂ ($F = 3.306$, $p = 0.073$). There were also no differences in any measure of VO₂ between taxane and non-taxane treatments by cancer type. Regression analysis indicated only age ($t = 2.775$, $p = 0.007$) predicted percent change in VO₂ values and VO₂ 1 values ($t = -3.606$, $p = 0.001$), while age and cancer type predicted VO₂₂ values ($t = -2.117$, $p = 0.037$; $t = -2.217$, $p = 0.029$ respectively). **Conclusion:** The data does not support the hypothesis that taxane based chemotherapies result in lower VO₂ values, as both age and cancer type had greater overall effects on VO₂. Additionally, significant improvements in VO₂ after the 12-week exercise intervention, regardless of treatment type, age, or cancer type supports the effectiveness of exercise-based cancer rehabilitation program to improve VO₂ in a female cancer population.

950 Board #184 May 29 3:30 PM - 5:00 PM
Taxane Based Chemotherapies Impact on Balance and VO₂ in Female Cancer Survivors.

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(No relevant relationships reported)

Purpose: The purpose of this study was to determine if taxane based chemotherapies have an impact on VO₂ and or balance versus non-taxane based chemotherapies in female cancer survivors. **Methods:** Twenty-six females (Avg. 58.11 years 29-72), enrolled in a cancer rehabilitation program underwent a treadmill assessment of VO₂ and four measures of balance (TUG, 4stage, sitstand, 6MWT). **Results:** No differences were found in measures of balance or VO₂ between those who received taxane based chemotherapies vs. non-taxane based chemotherapies ($p > 0.05$). Significant increases in HR ($t = 10.71$, $p = 0.000$) and Dyspnea ($t = 5.96$, $p = 0.000$) occurred with significant correlations between pre-exercise ($r = -0.605$, $p = 0.001$) and post-exercise ($r = 0.729$, $p = 0.001$) Dyspnea and RPE. Trends in associations between TUG and 6MWT ($p = 0.073$), 4stage and VO₂ ($p = 0.057$), 6MWT and 4stage ($p = 0.08$) were also observed. Significant positive correlation between 6MWT and VO₂ ($r = 0.487$, $p = 0.012$) and a negative correlation between %change in Dyspnea and VO₂ ($r = -0.474$, $p = 0.014$) were found. A negative correlation between pre-exercise HR and 6MWT speed ($r = -0.441$, $p = 0.027$) and strong positive correlation between 6MWT distance and 6MWT Speed ($r = 0.968$, $p = 0.000$). 6MWT distance moderately predicted VO₂ ($r = 0.487$, $F = 7.461$, $p = 0.012$). **Conclusion:** The data does not support the hypothesis that taxane based chemotherapies affect VO₂ values, or measures of balance. However, trends suggest a larger population might detect an association among the balance measures and VO₂ and therefore perhaps detect a difference. Expected changes and associations between RPE and Dyspnea were found, with lower scores likely associated with higher fitness as evidenced by negative correlation between %change in Dyspnea, 6MWT speed and pre-exercise HR and 6MWT speed and distance.

951 Board #185 May 29 3:30 PM - 5:00 PM
The Effect Of Doxorubicin On Myocardial Extracellular Matrix Degradation

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Doxorubicin (DOX) is an effective anthracycline chemotherapy agent associated with several adverse side effects including cardiotoxicity. Although the mechanism responsible for the cardiotoxic effects of DOX has yet to be fully elucidated, the leading theory is that the generation of reactive oxygen species (ROS) damages cardiomyocytes and leads to cell death. ROS play a role in the expression and activation of matrix metalloproteinases (MMPs), a family of enzymes involved in extracellular matrix (ECM) degradation. Normally, MMP activity is regulated by tissue inhibitors of metalloproteinases (TIMPs). We hypothesized that DOX treatment would lead to overexpression of MMPs or underexpression of TIMPs, which would compromise the integrity of the myocardial ECM and disrupt cardiac function.

PURPOSE: To investigate the effects of DOX on MMP-2, MMP-9, and TIMP-2 expression in rat cardiac tissue. **METHODS:** At 20 weeks of age, Sprague Dawley rats received a bolus injection of DOX (12 mg/kg; $n = 6$) or saline (0.9%; $n = 8$) as a control. Five days post-injection, cardiac tissue was collected from each animal, homogenized, and standardized for protein content. Samples were analyzed for expression of MMP-2, MMP-9, and TIMP-2 using western blotting with enhanced chemiluminescence. All results were normalized to GAPDH. Data were analyzed using a Student's T-Test ($\alpha = 0.05$). **RESULTS:** Results showed significantly lower expression of MMP-9 in

cardiac tissue from animals treated with DOX relative to the control ($p = 0.0068$). There was no significant difference in expression of MMP-2 ($p = 0.8757$) or TIMP-2 ($p = 0.2266$) between groups. **CONCLUSIONS:** These findings suggest that treatment with DOX significantly reduced the expression of MMP-9, contradicting our hypothesis. A potential explanation for these findings is that there is an intermediate factor affecting MMP-9 expression. Future studies should profile all components of MMP/TIMP signaling during DOX treatment.

B-61 Free Communication/Poster - Acute Exercise

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

952 Board #186 May 29 2:00 PM - 3:30 PM Evaluating Physiological Stress Response in Junior LevelTrack and Field Athletes

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Exercise and competition function as stress factors and may result in dysregulation in the neuroendocrine and cardiovascular systems. **PURPOSE:** The intent of the study was to evaluate neuroendocrine and cardiovascular response using salivary cortisol and heart rate/ blood pressure respectively in junior track and field athletes across a season. **METHOD:** Fifty-One Jamaican junior level track and field athletes (26 females, 25 males) participated in the study. Data was collected throughout the athletic season over two main periods: (1) a preparation period and (2) a competition period which was further subdivided into two stages: development game stage and major game stage. Athletes delivered a saliva sample prior to bedtime (8 pm - 10 pm) during each phase of the season. Resting blood pressure and heart rate were monitored throughout the season. Data collected during the preparation and competition periods were compared using Friedman's test and Wilcoxon signed-rank test. **RESULTS:** There were significant changes in salivary cortisol across the season $p < 0.05$. The concentration of cortisol increased during the development game stage (42%), then further increased in the major game stage (53%). With regard to cardiovascular response, there were significant differences in heart rate across the season $p < 0.05$. However, there was no significant change in blood pressure across the season in the athletes. **CONCLUSION:** Overall, there was an increase in cortisol across the season. This could possibly be due to the accumulation of stress factors over the competitive season which might be due to improper training regimens. Resting heart rate and blood pressure may not be good indicators of stress in athletes.

953 Board #187 May 29 2:00 PM - 3:30 PM The Acute Cardiovascular And Respiratory Responses To Isotonic Versus Isometric Whole Body Resistance Exercises

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PURPOSE: Aerobic exercise is recommended for blood pressure control rather than resistance exercise. However, resistance exercise is gaining prominence, particularly isometric exercise. The purpose was to compare the cardiorespiratory responses to whole body isotonic (IT) and isometric (IM) resistance exercises.

METHODS: 8 normotensive males (21 ± 2 years) completed one familiarisation session, then an IM and IT session in a counter-balanced order, each separated by at least 72 hours. 10-repetition maximum (10-RM) for each exercise was determined in the familiarisation session. IM were held in the mid-range for 40 seconds and IT were performed for 10 repetitions with 2 seconds concentric and 2 seconds eccentric. Single sets of dumbbell lunge, barbell bench press, barbell squat, bent-over barbell row, and dumbbell shoulder press were performed, with 150 seconds rest between exercises. Oxygen uptake (VO_2) was collected continuously. Blood pressure (BP) and heart rate (HR) were recorded post-exercise. Rate-pressure product (RPP) was calculated from HR and BP. Energy expenditure (EE) was calculated from VO_2 . Repeated measures analyses were applied to the data.

RESULTS: Mean EE was significantly greater during IT (6.14 ± 0.65 kcal) than IM (4.52 ± 0.73 ; $p = 0.024$), with EE greater during IT compared to IM for lunge (6.86 ± 1.55 v 4.98 ± 0.92 kcal; $p = 0.033$), squat (8.32 ± 1.80 v 4.54 ± 1.14 kcal; $p = 0.002$), and row (6.66 ± 0.82 v 5.36 ± 0.77 kcal; $p = 0.001$). Mean systolic BP (137 ± 12 v 134 ± 11 mmHg; $p = 0.609$) and diastolic BP (73 ± 13 v 73 ± 4 mmHg; $p = 0.923$) were not significantly different between IT and IM for the five exercises. Mean RPP was not

significantly different between IT (18086 ± 2764) and IM (16879 ± 2386 ; $p = 0.300$), but was significantly greater during squat in IM (18668 ± 2217) and IT (20080 ± 4017) compared to bench press in IM (15023 ± 2324 ; $p = 0.025$) and IT (15858 ± 2379 ; $p = 0.003$). Systolic BP was not significantly reduced 60 minutes following IT (-8 ± 9 mmHg; $p = 0.053$) and IM (-10 ± 15 mmHg; $p = 1.05$) or diastolic BP (-0 ± 9 mmHg; $p = 1.000$) following IT, however diastolic BP significantly reduced following IM (-10 ± 11 mmHg; $p = 0.028$).

CONCLUSIONS: An IT resistance exercise session induced significantly greater energy expenditure while an IM resistance exercise session induced significantly greater post-exercise diastolic hypotension.

954 Board #188 May 29 2:00 PM - 3:30 PM Effects of Acute Moderate Exercise on Nitric Oxide and Endothelial Microparticles in Patients with Hypertension

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(No relevant relationships reported)

PURPOSE: Nitric oxide (NO) is a strong vasodilator released by endothelial cells, and endothelial microparticles (EMP) are membranous vesicles released into the circulation from activated or apoptotic endothelial cells, both of whose level can reflect the endothelial function. But few research explored the effect of exercise on nitric oxide and endothelial microparticles. The purpose of the study was to evaluate the effects of acute moderate exercise with different duration on NO and EMP in young male patients with grade 1 hypertension.

METHODS: Seventeen young male patients with grade 1 essential hypertension (SBP between 140-159 and/or DBP between 90-99 mmHg) who did not take antihypertensive drugs were recruited in this study. They randomly performed twice exercises on a bicycle ergometer at a moderate intensity of 40%-50% of their HR reserve; one was 20 min (E20 group), the other one was 40 min (E40 group); there was one week break between two exercises. The level of NO (nitrate/nitrite reduction) and EMP (flow cytometry) in plasma were detected before and immediately after exercise. CD31⁺/CD42⁺ events were defined as EMP and were expressed as events per ml plasma.

RESULTS: Mean age of patients was 34.8 ± 3.5 yrs, and BMI was 27.6 ± 2.7 kg/m². The plasma NO level of E20 and E40 increased significantly after exercise (65.75 ± 23.97 umol/L vs. 71.37 ± 25.18 umol/L and 64.08 ± 23.13 umol/L vs. 77.94 ± 23.73 umol/L, $P < 0.01$ for both). There was no difference in plasma NO level between the two groups before and after exercise, but the increase of NO level in E40 was greater than that in E20 (24.47% vs. 9.24% , $P < 0.01$). The plasma EMP level of E20 and E40 decreased significantly after exercise (1968.38 ± 399.40 vs. 1814.99 ± 388.25 and 1891.43 ± 334.15 vs. 1604.61 ± 351.61 , $P < 0.01$ for both). There were no difference in plasma EMP level between the two groups before and after exercise, but the decrease of EMP level in E40 was greater than that in E20 (15.66% vs. 8.00% , $P < 0.01$).

CONCLUSION: Both 20-min and 40-min acute moderate exercise can improve endothelial function by increasing nitric oxide and decreasing endothelial microparticles level in patients with hypertension, and the effect of 40-min is better than that of 20-min. Supported by Research on Prevention and Control of Major Chronic Non-communicable Diseases (2016YFC1300202).

955 Board #189 May 29 2:00 PM - 3:30 PM Changes in Oxygen Uptake, Blood Acidosis, and Muscle Oxygenation During Maximal Interval Exercise

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PURPOSE: We investigated whether changes in oxygen uptake (VO_2), blood acidosis, or peripheral muscle oxygenation became limiting factors when interval exercise increases above the maximal intensity. **METHODS:** A group of nine active but not specifically trained male volunteer subjects participated in our study (age: 23 ± 3 yrs., body mass: 72 ± 7 kg, height: 177 ± 5 cm and $\text{VO}_{2\text{max}} = 57 \pm 5$ ml.kg⁻¹.min⁻¹). The exercise was conducted on an electronically braked cycle ergometer and consisted of two tests. The first test (T1) consisted of initial warmup, followed by 10 x 1 min maximal intensity and 1 min recovery intervals to determine if all subjects were able to complete the required 10 intervals. Several days later, subjects conducted a second test (T2) that was identical to the T1 with the exception that the workload was increased by 40 W above the workload conducted in T1. During tests, we determined individual maximal intensities, VO_2 and the resulting $\text{VO}_{2\text{max}}$. The respiratory gas exchange

measures, blood acid-base, muscle oxygenation and heart rate (HR) were determined. Exercise values and recovery intervals from 3rd to final repetition were compared between T1 and T2 intensity using two-way repeated measures ANOVA. **RESULTS.** Subjects reached 9 ± 1 intervals during T1 (350 ± 40 W) compared to 5 ± 2 during T2 (390 ± 40 W) due to fatigue. $\dot{V}O_2$ increased from 3.33 ± 0.34 in T1 to 3.83 ± 0.53 l·min⁻¹ in T2 ($p=0.006$). Pulmonary ventilation (\dot{V}_E) increased from 77 ± 31 in T1 to 117 ± 27 l·min⁻¹ in T2 ($p=0.04$). HR increased from 171 ± 12 beats per minute (bpm) in T1 to 178 ± 9 bpm in T2 ($p=0.03$). Although, blood lactate concentration (LA) increased and blood pH values decreased considerably during T2, they were similar to values at exhaustion in T1 test. None of the muscle oxygenation variables: oxyhemoglobin (HbO₂), deoxyhemoglobin (HHb) and total hemoglobin (Hb_{tot}) changed significantly. **CONCLUSION.** The results of our study revealed that changes in blood acidosis and muscle oxygenation during tests were the limiting factors and not the $\dot{V}O_2$ uptake.

956 Board #190 May 29 2:00 PM - 3:30 PM
Sodium Induced Volume Loading and the Exercise Pressor Reflex

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The average American consumes far more sodium than is recommended. Consuming high amounts of sodium may augment blood pressure (BP) responses to physical stress like exercise. Exaggerated BP responses to exercise are thought to be an early symptom of some cardiovascular diseases like hypertension. **PURPOSE:** This analysis contains two studies. The purpose of study one was to determine at what time point both blood plasma and serum sodium would be consistently elevated following sodium and water consumption. The purpose of study two was to examine if elevated plasma and serum sodium result in an elevated BP response to handgrip (HG) exercise and the cold pressor test (CPT). **METHODS:** Study 1: Eight participants drank 423mL of normal saline (sodium 154mmol/L) and had repeat blood draws every 30min for 3hr. Study 2: Sixteen different participants underwent two randomized data collection visits; an experimental (EXP) visit 90min following normal saline consumption and a control (CON) without saline consumption. At each visit beat-by-beat BP and heart rate were recorded during a 5min rest period followed by 2min of isometric HG at 30% maximal voluntary contraction. Two minutes of post exercise ischemia (PEI) were performed immediately following HG. After a ≥ 10 min rest, participants underwent a 2min CPT. **RESULTS:** Study 1: Both plasma volume ($+6.8 \pm 1.3$ %Δ) and serum sodium ($+3.5 \pm 1.3$ %Δ) were elevated ($p < 0.05$) at or before the 90min time point and remained elevated throughout the 3hr follow-up period. Study 2: There were no significant differences in mean arterial pressure (MAP) during HG (EXP: 17.4 ± 2.1 mmHg; CON: 19.1 ± 1.5 mmHg), PEI (EXP: 16.9 ± 2.9 mmHg; CON: 16.9 ± 1.9 mmHg), or the CPT (EXP: 20.3 ± 2.7 mmHg; CON: 20.9 ± 2.9 mmHg) between conditions ($P > 0.05$). MAP recovery from the CPT was significantly slower in the saline condition (1min recovery: EXP: 15.7 ± 2.0 mmHg, CON: 12.3 ± 2.2 mmHg, $P < 0.05$). **CONCLUSIONS:** The current data found no significant differences in cardiovascular responses during handgrip or the cold pressor test between conditions. However, a modest delay in the recovery of blood pressure was found following the cold pressor test during sodium and volume loading. This suggests acute salt and water consumption increases cardiovascular strain following an intense physical stressor.

957 Board #191 May 29 2:00 PM - 3:30 PM
Recovery Pattern of Cardiac Autonomic Control Following Aerobic Exercise with Different Volumes in Hypertensive Men

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The recovery pattern of cardiac autonomic control to acute aerobic exercise (AE) is a robust index of individual ability to recruit vagal tone and may provide further evidence of the risks and benefits of a typical AE bout to promote health. However, the extent to which postexercise autonomic control, as assessed by heart rate variability (HRV), depends on exercise volume remains unclear in hypertensive individuals. **PURPOSE:** The present study investigated the effect of cycling bouts with different volumes on HRV markers in hypertensive men. **METHODS:** Ten unmedicated men [age: 39 ± 7 yr; body mass index: 29.3 ± 1.0 kg/m²; maximal oxygen uptake ($\dot{V}O_{2max}$): 26.7 ± 0.8 mL·kg⁻¹·min⁻¹; 24-h ambulatory systolic/diastolic BP (SBP/DBP): $139 \pm 8/86 \pm 7$ mmHg] visited the laboratory four times to undertake the following procedures: a) assessment of resting and maximal $\dot{V}O_2$; b) perform a non-exercise control session (CTL) and two AE expending 150 (AE150) and 300 kcal (AE300) at 50% $\dot{V}O_{2reserve}$ in a randomized, counter-balanced order. The root mean square of successive R-R differences calculated for consecutive 30-s windows (rMSSD 30s) was calculated to assess the vagal reactivation during the first 5 min of recovery in a supine

position via cardiotaehometer (RS800cx, Polar TM, Finland). Prolonged HRV analysis [i.e. low-frequency band (LF), high-frequency band (HF), and sympatho-vagal balance (LF:HF ratio)] was performed during the subsequent 21-h under ambulatory conditions using a three-channel Holter (CardioLight, Cardios Ltda, Brazil). Marginal models were used to compare HRV changes between trials. **RESULTS:** Significant differences for rMSSD 30s were only detected between CTL vs. AE150 [Δ - 38.8 ms ($P < 0.001$)] and CTL vs. AE300 [Δ - 40.0 ($P < 0.001$)]. Within the subsequent 21-h of recovery, no significant differences were observed among CTL, AE150 and AE300 for LF, HF and LF:HF ratio.

CONCLUSIONS: These findings suggest that exercise volume is not a major determinant of exercise prescription when considering the recovery pattern of cardiac autonomic control in hypertensive men, at least when AE is performed at moderate-intensity.

958 Board #192 May 29 2:00 PM - 3:30 PM
Pulse Wave Reflection Responses After Aerobic Exercise with Different Volumes in Normotensive and Hypertensive Men

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Although aerobic exercise (AE) has been established as effective for lowering blood pressure (BP), little is known about the alterations in aortic BP after exercise. **PURPOSE:** To investigate the acute pulse wave reflection responses after moderate AE with different volumes in normotensive (NT) and hypertensive (HT) men. **METHODS:** We included 14 normotensives [age: 40.7 ± 2.8 yr; body mass index (BMI): 25.7 ± 0.9 kg/m²; maximal oxygen uptake ($\dot{V}O_{2max}$): 31.3 ± 1.8 mL·kg⁻¹·min⁻¹; 24-h ambulatory systolic/diastolic BP (SBP/DBP): 120.6 ± 1.6 / 73.9 ± 1.2 mmHg] and 10 hypertensive men [age: 39.2 ± 2.3 yr; BMI: 29.3 ± 1.0 kg/m²; $\dot{V}O_{2max}$: 26.7 ± 0.8 mL·kg⁻¹·min⁻¹; 24-h ambulatory SBP/DBP: 139.3 ± 2.6 / 86.4 ± 2.1 mmHg]. Participants undertook a maximal cardiopulmonary exercise test, a non-exercise control session (CTL), and two cycling bouts at 50% $\dot{V}O_{2reserve}$ (150 vs. 300 kcal) in a randomized order. Aortic systolic blood pressure (SBPa), aortic pulse pressure (PPa), augmentation pressure, and augmentation index were determined using applanation tonometry 10 min before, and 30- and 70-min after CTL and the two exercise bouts (SphygmoCor v7). **RESULTS:** In NT, AE50%-150kcal decreased SBPa in comparison with CTL, until 30 min of recovery [CTL: $\&\#91$ 7.5 ± 3.3 mmHg; AE50%-150cal: $\&\#91$ -0.5 ± 2.8 mmHg ($p < 0.05$)]. However, in HT men, only AE50%-300kcal attenuated the SBPa increase observed in the CTL (CTL: $\&\#91$ 9.2 ± 0.9 mmHg ($p < 0.001$); AE50%-300cal, $\&\#91$ 4.9 ± 2.3 mmHg ($p = 0.07$)). In addition, NT men showed a decrease in PPa after all AE bouts, without differences between conditions. In the HT group, both AE bouts attenuated the PPa increase observed in CTL (CTL: $\&\#91$ 4.3 ± 0.1 mmHg ($p < 0.05$); AE50%-150cal, $\&\#91$ 1.6 ± 1.4 mmHg ($p = 0.41$); AE50%-300cal, $\&\#91$ 2.6 ± 3.9 mmHg ($p = 0.18$)). Lastly, only AE50%-150kcal was able to reduce pulse wave reflection until 30 min of recovery in NT men. **CONCLUSION:** In NT, lower AE volume was able to reduce pulse wave reflection and central BP until 30 min of recovery. However, only the greater AE volume attenuated the increase in central aortic BP and PPa, with no difference in pulse wave reflection after any experimental protocol in the HT group.

959 Board #193 May 29 2:00 PM - 3:30 PM
Peak Physiological Responses In Cycling And A New Underwater Swimming Test In Highly Trained Artistic Swimmers

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PURPOSE: The purpose of this study was to compare peak oxygen uptake ($\dot{V}O_{2peak}$) measured in an underwater swim test (UWST) and during a maximal aerobic capacity test on a cycle ergometer (Velotron Pro, Seattle, WA, USA). **METHODS:** Highly trained artistic swimmers ($n=14$, 14.9 ± 1.9 yrs) completed a synchronised swimming specific test (275m UWST) in a 25m pool an incremental exercise test to volitional fatigue (15 W every 30 sec to exhaustion) on a cycle ergometer to determine $\dot{V}O_{2peak}$. The UWST and maximal aerobic capacity testing occurred on consecutive days. The 275m UWST comprised 50m freestyle followed by 25m underwater breast stroke three times, with an additional 50m freestyle. During the UWST participants wore water-resistant HR monitors (Polar OH1) and had expired gases collected (Cosmed K4 b²) in the 20 sec immediately upon completion of the UWST to determine $\dot{V}O_{2peak}$. During the cycle test, HR (Polar Electro, Kempele,

Finland) and expired gases were collected using a MOXUS metabolic cart (AEI Technologies, Pittsburgh, PA, USA). Peak physical work capacity (PWC) (W) was measured as the highest completed 30 sec stage of the test.

RESULTS: $\dot{V}O_{2peak}$ achieved after the UWST (44.3 ± 8.0 mL/kg/min) and cycle ergometer (42.3 ± 7.2 mL/kg/min) did not differ significantly from each other ($t=-0.59$, $df=13$, $p=0.563$, $d=0.21$). HR_{peak} was significantly lower during the UWST (162.5 ± 18.4 bpm) ($t=7.812$, $df=12$, $p<0.00$, $d=2.10$) when compared to the cycle test (194.6 ± 11.6 bpm). The UWST time and PWC during the bike test were not significantly correlated to each other ($r=-0.25$, $p=0.393$). There was no significant correlation between the $\dot{V}O_{2peak}$ achieved during the UWST and the duration of the UWST ($r=-0.39$, $p=0.17$). HR_{peak} during the UWST was significantly correlated with the $\dot{V}O_{2peak}$ ($r=0.62$, $p=0.03$, $CI_{95} [38.93, 46.44]$) and HR_{peak} achieved on the cycle ergometer ($r=0.59$, $p=0.04$, $CI_{95} [188.79, 200.92]$).

CONCLUSIONS: The similarities in $\dot{V}O_2$ data during the UWST and $\dot{V}O_{2peak}$ protocol suggest the UWST is a valid method of determining $\dot{V}O_{2peak}$ in highly trained artistic swimmers. A goal when selecting a $\dot{V}O_2$ protocol is to mimic the demands of the sport. In this population, the UWST is likely better than the cycle ergometer, as the modality of swimming with breath holding more closely matches the demands of an artistic swim routine.

960 Board #194 May 29 2:00 PM - 3:30 PM

Sex Differences in Autonomic Function Following Aerobic Exercise

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Heart rate variability (HRV), blood pressure variability (BPV) and baroreceptor sensitivity (BRS) provides insight into cardiovascular regulation in different physiological settings. Pre-menopausal females have been shown to exhibit a cardioprotective autonomic profile compared to males following maximal exercise, but it is unknown if there are sex differences in autonomic recovery following submaximal aerobic exercise.

PURPOSE: To determine the effects of sex on autonomic function at rest and following an acute bout of submaximal aerobic exercise.

METHODS: Forty-three (males $n=22$, age = 22 ± 1 yrs, BMI = 25.9 ± 0.7 kg/m²; females $n=21$, age = 22 ± 1 yrs, BMI = 23.7 ± 0.5 kg/m²) healthy, normotensive participants completed a 45-min moderate intensity aerobic exercise session. Beat-to-beat BP was recorded using finger plethysmography for 5 min prior to exercise (REST), at 30 min (P30), 60 min (P60) and 90 min (P90) following exercise. Frequency domain measurements of HRV and BRV were calculated. The low frequency power of BPV (BPV_LF) was used as an estimation of sympathetic vasomotor tone and the ratio of low- (LF) and high-frequency (HF) bands in HRV (LF/HF) has been used to quantify the degree of sympathovagal balance. BRS was estimated by the alpha coefficient method (Alpha_LF). Repeated measures analysis of variance (ANOVA) (2 x 4; sex x time-point) was performed.

RESULTS: Data were presented in Table 1 as mean \pm standard error.

CONCLUSION: Forty-five min of submaximal aerobic exercise results in sustained disturbance of cardiovascular homeostasis as manifested by elevated sympathovagal balance and increased cardiovascular baroreceptor sensitivity 90 min after exercise. In addition, young, healthy women exhibited lower sympathetic tone at rest and during recovery from aerobic exercise compared to age-matched males.

Table 1. Autonomic function variables at rest and 30,60, and 90 mins following aerobic exercise

	Male (n=22)				Female (n=21)			
	REST	P30	P60	P90	REST	P30	P60	P90
HRV_LF/HF [#]	4.87 \pm 0.16	5.10 \pm 0.18	5.10 \pm 0.18	4.93 \pm 0.12	4.44 \pm 0.17	4.28 \pm 0.19	4.55 \pm 0.19	4.65 \pm 0.18
HRV_HF (ms ²)	6.92 \pm 0.23	6.55 \pm 0.29	6.97 \pm 0.27	7.00 \pm 0.23	7.07 \pm 0.23	6.94 \pm 0.20	6.95 \pm 0.27	7.34 \pm 0.24
HRV_LF (mmHg ²) [#]	7.19 \pm 0.21	7.05 \pm 0.22	7.47 \pm 0.19	7.63 \pm 0.23	6.90 \pm 0.21	6.62 \pm 0.23	6.89 \pm 0.10	7.38 \pm 0.23
BPV_LF (mmHg ²) ^{\$*}	1.91 \pm 0.17	2.14 \pm 0.18	1.99 \pm 0.17	1.98 \pm 0.19	1.48 \pm 0.17	1.54 \pm 0.19	1.31 \pm 0.18	1.42 \pm 0.19
BPV_HF (mmHg ²)	0.15 \pm 0.14	0.10 \pm 0.16	0.19 \pm 0.18	0.41 \pm 0.19	0.42 \pm 0.15	0.40 \pm 0.16	0.16 \pm 0.18	0.43 \pm 0.19
Alpha_LF (ms/mmHg) [#]	2.75 \pm 0.13	2.57 \pm 0.11	2.80 \pm 0.10	3.01 \pm 0.11	2.63 \pm 0.15	2.59 \pm 0.13	2.78 \pm 0.12	2.80 \pm 0.12

* P<0.05 Significant sex differences at rest for T-test; \$ P<0.05 Significant main effect of sex for 2-way ANOVA; # P<0.05 Significant main effect of time for 2-way ANOVA

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Augmentation of Oxygen Uptake Response through Inhalation of Molecular Hydrogen during an Incremental Exercise Test

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It has recently been shown that molecular hydrogen (H₂) ameliorates oxidative stress-induced tissue damage by scavenging reactive oxygen species and modifies mitochondrial function. However, studies on the effects of H₂ during exercise in healthy humans are limited. **PURPOSE:** To investigate the effects of H₂ gas inhalation on oxygen uptake ($\dot{V}O_2$) response during an incremental exercise test performed on a cycle ergometer. **METHODS:** This study was designed as a single-blind, randomized, controlled trial. Eight men and a woman (height, 169.4 ± 8.0 cm; age, 22.4 ± 5.54 years; weight, 64.9 ± 9.8 kg [means \pm SD]) volunteered to perform an incremental cycling exercise test while inhaling two kinds of gases: 1% H₂ gas (H₂ trial) and air (control trial). The workload was gradually increased by 20 W every 1 min until volitional fatigue. Respiratory parameters were measured during the test using a metabolic gas analyzer. The peak $\dot{V}O_2$ ($\dot{V}O_{2peak}$) was defined as a 20-s averaged peak value of $\dot{V}O_2$ during exercise. Blood samples were collected from the subjects' fingertips before, during, and immediately after exercise to evaluate the systemic redox status by measuring biological antioxidant potential (BAP) and diacron-reactive oxygen metabolites (d-ROMs). **RESULTS:** The result of repeated-measure two-way analysis of variance showed no significant trial-by-work rate interaction in carbon dioxide production ($P = 0.64$), respiratory exchange ratio ($P = 1.00$), minute ventilation ($P = 0.81$), and heart rate ($P = 1.00$) responses to the exercise. However, the H₂ trial showed a significantly augmented $\dot{V}O_2$ response to exercise compared with that observed in the control trial ($P < 0.05$). Furthermore, the H₂ trial showed a significantly increased $\dot{V}O_{2peak}$ compared to the control trial (3705.4 ± 285.9 vs. 3398.7 ± 249.9 mL/min, means \pm SE, $P < 0.01$, paired t-test). BAP/d-ROM responses, indicative of systemic redox status, tended to increase in the H₂ trial compared to the response in the control trial ($P = 0.05$), suggesting that the H₂ trial reduced oxidative stress or increased antioxidative activity. **CONCLUSIONS:** H₂ gas inhalation significantly increased the $\dot{V}O_2$ response and $\dot{V}O_{2peak}$ during incremental exercise, suggesting that H₂ gas might affect mitochondrial function during exercise.

962 Board #196 May 29 2:00 PM - 3:30 PM
Heavy Rope Exercise on Cardiovascular Hemodynamics and Arterial Stiffness in Resistance-Trained Individuals

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 (No relevant relationships reported)

Heavy rope exercise is utilized as a means to increase power, muscle hypertrophy and maximal strength. However, the effects of heavy rope exercise on cardiovascular hemodynamics and arterial stiffness is not known. **PURPOSE:** To evaluate the effects of an acute bout of heavy rope exercise on cardiovascular hemodynamics and arterial stiffness. **METHODS:** Fifteen resistance-trained individuals volunteered to participate. Cardiovascular hemodynamics and arterial stiffness were collected at rest, 15 (Rec1), 30 (Rec2) and 60 (Rec3) minutes after an acute bout of heavy rope exercise. Cardiovascular hemodynamics were determined through the use of photoplethysmography, and included heart rate (HR), mean arterial pressure (MAP), cardiac output (CO), stroke volume (SV), and total peripheral resistance (TPR). Arterial stiffness was measured via carotid-femoral pulse wave velocity (cfPWV). The acute heavy rope exercise consisted of six, 15-second exercise bouts, using a double wave pattern, separated by 30-second passive recovery intervals; the pace of the exercise was set at 180bpm. One-way repeated measures analysis of variance were used to evaluate the main effect of time (rest, Rec1, Rec2, and Rec3) on all variables. Paired t-tests, with a Bonferroni correction, were used for post-hoc comparisons. **RESULTS:** There were no significant main effects of time for MAP or SV. There were significant ($p=0.0001$) main effects of time for HR (rest: 64 ± 11 bpm; Rec1: 86 ± 10 bpm; Rec2: 78 ± 10 bpm; Rec3: 72 ± 9 bpm), CO (rest: 6.8 ± 0.7 L/min; Rec1: 8.3 ± 1.1 L/min; Rec2: 7.9 ± 0.9 L/min; Rec3: 7.5 ± 0.9 L/min) and TPR (rest: 12 ± 1.2 mmHg/mL/min; Rec1: 9.8 ± 1.1 mmHg/mL/min; Rec2: 10.6 ± 1.1 mmHg/mL/min; Rec3: 11.3 ± 1.1 mmHg/mL/min). HR, and CO were elevated at all times post-exercise, and were higher at Rec1 compared to Rec2, and Rec3, and were lower at Rec3 compared to Rec1 and Rec2. TPR was reduced at Rec1, Rec2 and Rec3 compared to rest. There was also a significant main effect of time ($p=0.003$) for cfPWV (rest: 5.6 ± 0.8 m/s; Rec1: 5.9 ± 0.7 m/s; Rec2: 5.7 ± 0.8 m/s; Rec3: 5.5 ± 0.7 m/s) such that it was attenuated at Rec3 compared to Rec1 and Rec2. **CONCLUSIONS:** These data demonstrate that acute heavy rope exercise increases cardiovascular workload for at least 60 minutes, as demonstrated by the augmentation of HR and CO for up to one-hour post-exercise.

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Hemodynamic and Pressor Responses to Combination of Yoga and Blood Flow Restriction

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Blood flow restriction (BFR) training has been increasingly incorporated into a more common activity of daily exercise (e.g., yoga). However, BFR may increase blood pressure and myocardial oxygen demand by augmenting vascular resistance. Yoga is characterized by systemic isometric exercises and accompanied by marked pressor responses. This raises the concern of exaggerated cardiovascular responses when yoga is performed with BFR. **Purpose:** To determine the impact of a combination of yoga and BFR on cardiovascular responses. **Methods:** Twenty young healthy participants ($M=10$, $F=10$) performed 20 yoga poses with and without BFR bands placed on both legs. Beat by beat blood pressure and heart rate were measured using finger plethysmography during the yoga exercise. Blood lactate concentration, flow-mediated dilation (endothelium-dependent vasodilation), and cardioankle vascular index (arterial stiffness) were measured before and after the yoga exercise. **Results:** At baseline, there were no significant differences in any of the variables between the BFR and non-BFR conditions. Systolic and diastolic blood pressure and heart rate increased significantly in response to the various yoga poses ($p<0.01$). However, there were no significant differences between the BFR and non-BFR conditions. In general, hemodynamic responses were more pronounced during more difficult yoga postures (e.g., Crescent Lunge, Half Moon, Chair Pose, and Downward Facing Dog). Rate-pressure products increased significantly during yoga exercises with no differences between the two conditions. Rating of perceived exertion (RPE) was not different between the conditions. Blood lactate concentration was significantly greater after performing yoga with BFR bands ($p=0.007$). Cardioankle vascular index decreased similarly after yoga exercise in both conditions while flow-mediated dilation remained unchanged. **Conclusion:** The use of blood flow restriction bands in combination with systemic isometric exercise like yoga did not result in marked hemodynamic and pressor responses.

964 Board #198 May 29 2:00 PM - 3:30 PM
Cardiac Autonomic and Blood Pressure Responses to an Acute Session of Battling Ropes Exercise

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Increased blood pressure (BP) and autonomic dysfunction are independent risk factors for cardiovascular disease. Heart rate variability (HRV) is used as a measure of cardiac autonomic function in many research settings, including the evaluation of the autonomic control during and after physical activity. A prolonged sympathetic predominance and a slow parasympathetic reactivation contribute to a delayed BP and heart rate (HR) recovery after exercise which is thought to be associated with increased risk of acute cardiac events. Therefore, understanding the impact of various exercise modalities on the post-exercise autonomic modulation of HR and BP would allow for appropriate exercise prescription in susceptible populations. Battling ropes exercise (BRE) has become an extremely popular training modality for improving both anaerobic and aerobic fitness. However, the HRV and BP responses induced by an acute BRE bout are currently unknown. **PURPOSE:** To evaluate the effects of an acute session of BRE on HRV and BP responses in healthy young males. **METHODS:** 8 young healthy males [age (23 ± 1 years)] completed a BRE or a no-exercise control trial in a randomized order. During the BRE trial, participants completed ten-30s sets of battling ropes waves followed by 1 min of rest. Low-frequency power (LF), high-frequency power (HF), the LF to HF ratio (LF/HF), HR, and BP were collected in the supine position at baseline, 3, 10 and 30 min after each trial. LF and HF were normalized to total power resulting in nLF, nHF and nLF/nHF. **RESULTS:** There were significant group-by-time interactions ($P<0.05$) for nLF (sympathetic activity), nHF (vagal tone), nLF/nHF (sympathovagal balance), HR, systolic and diastolic BP. There were significant increases ($P<0.05$) in nLF, nLF/nHF, and HR as well as significant decreases ($P<0.01$) in nHF, systolic (~6mmHg) and diastolic (~4mmHg) BP for 30 min after BRE compared to no changes after control. **CONCLUSIONS:** Our findings indicate that BRE increases sympathovagal balance 30 min post-exercise which is concurrent with a sustained hypotensive effect in young healthy males. Further research is warranted to evaluate the potential clinical application of BRE in populations that might benefit from post-exercise hypotension.

965 Board #199 May 29 2:00 PM - 3:30 PM
Renal Vascular Responsiveness to Sympathetic Activation is Not Affected by Prior High Intensity Anaerobic Exercise

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 (No relevant relationships reported)

Purpose: Orthostatic hypotension is common following high intensity anaerobic exercise. The renal vasculature contributes to blood pressure regulation during orthostasis. Renal blood flow decreases during anaerobic exercise and remains depressed for up to 60 min following exercise cessation. The responsiveness of the renal vasculature to sympathetic stimulation, such as during orthostasis, following anaerobic exercise is unknown. We hypothesize that prior high intensity exercise attenuates increases in renal vascular resistance (RVR) during sympathetic activation. **Methods:** Ten healthy adults (23 ± 3 y) completed two 2 min cold pressor tests (CPT). The CPT stimulates the sympathetic nervous system. A CPT was completed before and after a Wingate Anaerobic Test that consisted of 30 s of maximal effort cycling exercise at a resistance equal to 7.5% body mass. In both instances, the CPT was administered following 10 min supine rest. Heart rate (ECG), mean arterial pressure (Penaz method, MAP), and renal blood velocity (RBV) were measured pre-CPT, at 1 min and 2 min of the CPT, and 1 min post-CPT. RBV was measured via the coronal approach at the distal segment of the right renal artery with Doppler ultrasound. RVR was calculated as MAP/RBV . Data are presented as mean \pm SD. **Results:** Pre-CPT, heart rate was elevated after exercise (61 ± 5 vs. 87 ± 13 bpm, $P<0.01$) and RBV was lower (34 ± 7 vs. 32 ± 7 cm/s, $P=0.02$). However, MAP (85 ± 13 vs. 82 ± 13 mmHg, $P=0.50$) and RVR (2.4 ± 0.5 vs. 2.6 ± 0.7 mmHg/cm/s, $P=0.08$) were not different between before and after exercise. Before exercise, heart rate (at 2 min CPT: 66 ± 9 bpm, $P=0.02$) and MAP (at 2 min CPT: 108 ± 21 mmHg, $P=0.05$) increased during the CPT, returning to pre- levels 1 min post-CPT ($P=0.22$). Before exercise, RBV decreased during the CPT (at 2 min: 29 ± 7 cm/s, $P=0.03$), returning to pre- levels 1 min post-CPT ($P=0.61$). RVR increased during the CPT (at 2 min: 4.0 ± 0.7 mmHg/cm/s, $P<0.01$), returning to pre- levels 1 min post-CPT ($P=0.28$). Changes in heart rate, MAP, RBV, and RVR during the CPT did differ between before and after exercise (interaction: all $P\geq 0.74$). **Conclusion:** Increases in RVR invoked by sympathetic activation are not affected by prior high intensity anaerobic exercise. Therefore, the renal vasculature does not likely contribute to post- anaerobic exercise orthostatic hypotension.

- 966** Board #200 May 29 2:00 PM - 3:30 PM
Autonomic Nervous System and its Relevance in the Regulation of Heart Rate Recovery Post Exercise
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The recording of heart rate variability (HRV) is a strategy for the rapid and non-invasive evaluation of the Autonomic Nervous System (ANS) activity. Previous studies have shown a rapid activation of the parasympathetic nervous system at the end of a physical effort and the association of this with the likelihood of developing cardiovascular disease. **PURPOSE:** Establish the relationship between recovery heart rate (RHR) after exercise and HRV at rest in apparently healthy men and women. **METHODS:** Quantitative, cross-sectional, exploratory research conducted in 50 subjects (25 men and 25 women) of 19 ± 2.34 years. Subjects were monitored by continuous electrocardiographic reading all throughout the different activities. The HRV was evaluated at rest for 5 minutes, using time, frequency and non-linear analyzes, cardiac vagal index (CVI) was calculated using $\text{Log}_{10}(\text{SD1} \times \text{SD2})$. Subsequently, a physical test of 6 minutes on the bike was performed between 50 and 60% of the maximum reserve heart rate. In the end, the RHR was evaluated every 10 seconds during the first minute. Subsequently, the relationship between HRV and RHR was analyzed using the Pearson correlation coefficient (r). **RESULTS:** In all population, mean HR at rest and RHR had an inverse effect, finding the following correlations: 10s ($r = -0.35$ $p = 0.01$), 20s ($r = -0.37$ $p = 0.007$), 40s ($r = -0.40$ $p = 0.004$) and 60s ($r = -0.53$ $p = 0.000$). Additionally, in women exist a direct correlation between RHR and CVI been more significant in the following correlations: 40s ($r = 0.41$ $p = 0.044$), 50s ($r = 0.52$ $p = 0.008$) and 60s ($r = 0.59$ $p = 0.002$); however, in men this correlation was not significant. **CONCLUSIONS:** When performing stress tests in apparently healthy people, the decrease of the HR after exercise could be used to evaluate the activity of the ANS, specifically the activation of parasympathetic system demonstrated by the significant correlations between RHR and HR at rest, as well as the correlation between RHR and CVI. Therefore, the activity in the first minute after ceasing the exercise shows that the evaluation of the parasympathetic nervous system could be implemented in the early diagnosis and prognosis of chronic diseases including cardiovascular disease.

- 967** Board #201 May 29 2:00 PM - 3:30 PM
Effects of Electronic and Conventional Cigarette Smoking on Post-exercise Autonomic Recovery
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Since nicotine-bearing cigarette smoking can induce acute cardiac autonomic imbalance, it may cause to persist sympathetic excitatory, and delay vagal reactivation during post-exercise recovery. However, the effects of post-exercise cigarette smoking on cardiac autonomic nervous system is still uncertain; especially the difference between *e*-cigarettes and conventional cigarette smoking on cardiac autonomic recovery after exercise is unknown. **PURPOSE:** this study was aimed at investigating the influence of cigarette smoking on heart rate variability, and the difference between *e*-cigarettes and conventional cigarette smoking on autonomic balance after aerobic exercise. **METHODS:** Apparently healthy male smokers ($n=40$, 23.03 ± 30 yrs) were participated in a randomized crossover study where three experimental sessions (non-smoking condition, NS; *e*-cigarette smoking, ES; conventional cigarette smoking, CS) were applied after 30 min single bout treadmill running at 60% HR_{max} . Either *e*-cigarette or conventional cigarette smoking was performed for 5 min immediately after exercise. Heart rate variability (HRV) was monitored before, during, and after exercise. **RESULTS:** As results of HRV analysis, parasympathetic activity indices ($r\text{MSSD}$, $p\text{NN50}$, HF and SD1) were significantly decreased in both CS and ES compared to NS ($p < .001$, respectively). In particular, those parasympathetic indices at CS were significantly decreased at CS while smoking and post-exercise recovery ($p < .001$, respectively) whilst there was no significances at ES. In contrast, sympathetic activity index (LF/HF ratio) was significantly increased at both CS and ES compared to NS ($p < .001$). Especially CS had significantly greater LF/HF ratio than ES while smoking and post-exercise recovery ($p < .001$). **CONCLUSIONS:** This study had found that both *e*-cigarette and conventional cigarette smoking induce delayed parasympathetic reactivation and sympathetic withdrawal after aerobic exercise. In particular, conventional cigarette smoking had more sympathetic excitatory persisting responses than *e*-cigarette after aerobic exercise.

- 968** Board #202 May 29 2:00 PM - 3:30 PM
Hypotensive Effects of High Intensity Resistance Training to Muscle Failure in Hypertensive Postmenopausal Women
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PURPOSE: Moderate-intensity Resistance Training (RT) has been recommended for blood pressure (BP) control by the main guidelines. However hypotensive effects of high intensity RT using higher loads to muscle failure in hypertensive patients is little know. Therefore, the aim of the study was to verify the behavior of BP after the session of high intensity resistance training in hypertensive women. **METHODS:** A randomized crossover design clinical trial was conducted with 10 controlled hypertensive women with age equal to: 58.9 ± 6.8 , body mass index equal to: 27.1 ± 3.8 . The participants performed two experimental protocols: a control session and RT session with 6 repetition maximum (RM) to muscle failure. The order of execution of the sessions was performed randomly by lot. The sessions of 6RM was performed with three exercises (lat pulldown, barbell bench press and 45° leg press) in three sets to momentary concentric failure. During the control session the participants followed of rest in the laboratory. Systolic blood pressure (SBP), diastolic blood pressure (DBP) were collected pre, immediately post, 1 h post, and 24 h post each protocol. Repeated measures ANOVA were used. **RESULTS:** The SPB decrease in 1 h (124.3 ± 10.8) and 24 h (126.2 ± 13.6) after the 6RM session to muscle failure when compared to pre (135.7 ± 14.1), ($p < 0.05$). SBP was higher for 6RM (144.7 ± 16.4) than control (134.2 ± 18.1) immediately after session ($p < 0.05$). There were no differences for DBP among protocols ($p \geq 0.05$). **CONCLUSIONS:** The RT using higher loads to muscle failure promote SPB hypotension 1 h and 24 h after the session. No DPB changes were observed after the RT protocols. The high intensity resistance training can decrease the SPB acutely and help in control of blood pressure in hypertensive women.

- 969** Board #203 May 29 2:00 PM - 3:30 PM
Circulating Inflammatory And Oxidative Stress Responses To Steady-state Moderate-intensity And High-intensity Interval Exercise In Mid-spectrum Chronic Kidney Disease
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Inflammation and oxidative stress can be potent modulators of vascular function. These factors may transiently respond to moderate-intensity steady state exercise (SSE) in a manner that improves post-exercise vascular function in healthy adults. Whether exercise imparts similar effects in adults with Stage 3 or 4 chronic kidney disease (CKD) remains understudied. Moreover, a comparison of SSE and high-intensity interval exercise (HIIE) may add to clinically-relevant findings for improving vascular function in mid-spectrum CKD. **PURPOSE:** To determine the influence of SSE and a comparable amount of HIIE on post-exercise inflammation and oxidative stress in patients diagnosed with secondary Stage 3 or 4 CKD. **METHODS:** Twenty participants ($n = 6$ men; $n = 14$ women; age 62.0 ± 9.9 yr; weight 80.9 ± 16.2 kg; body fat $37.3 \pm 8.5\%$ of weight; $\text{VO}_{2\text{max}}$ 19.4 ± 4.7 ml/kg/min) completed 30 min of SSE at 65% $\text{VO}_{2\text{reserve}}$ or HIIE by treadmill walking (90% and 20% of $\text{VO}_{2\text{reserve}}$ in 3:2 min ratio) in a randomized crossover design. Both exercise conditions averaged $\sim 65\%$ $\text{VO}_{2\text{reserve}}$. Blood samples were obtained by the same technician under standardized conditions just before, 1hr and 24hrs after exercise. Total antioxidant capacity (TAC), paraoxonase1 (PON1), asymmetric dimethylarginine (ADMA), ³nitrotyrosine (³NT) and interleukin-6 (IL6) responses were analyzed using 2 (condition) by 3 (sample point) repeated measures ANOVAs. **RESULTS:** Relative to pre-exercise measures: TAC increased by 4.3% 24hr after exercise ($p = 0.012$). PON1 was maintained 1hr and elevated by 6.1% 24hr after SSE, but not HIIE ($p = 0.035$). When corrected for plasma volume shifts, ADMA increased 30 ng/ml at 1hr but was 58 ng/ml lower 24hrs after exercise ($p = 0.0006$). ³NT and IL6 remained stable in the hours after exercise ($p > 0.05$). **CONCLUSION:** Modest inflammatory and oxidative stress marker responses to either SSE and HIIE may contribute to improved vascular function in mid-spectrum CKD.

970 Board #204 May 29 2:00 PM - 3:30 PM
Arterial Stiffness Response to High Intensity Interval Training in Young Healthy Individuals
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PURPOSE: To assess arterial stiffness response to high-intensity interval training (HIIE) controlled by rating of perceived exertion (RPE) and heart rate (HR) in young healthy individuals. **METHODS:** Twelve young (21 ± 2 ys) sedentary or insufficiently active individuals were randomly assigned to perform HIIE prescribed and self-regulates by 6 to 20 RPE (HIIE_{RPE}, 25 min), HIIE prescribed and regulated by HR response to cardiopulmonary exercise testing (HIIE_{HR}, 25 min) and non exercise control (CON) session (25 min of seated resting). Arterial stiffness (carotid-femoral pulse wave velocity - PWV) were measured before (pre), immediately after (post) and 30 min after (recovery) each intervention with participants quietly in supine position. Two-way ANOVA with repeated measures (intervention vs. time) was used to indicate inter- and intra-interventions differences and the Bonferroni *post hoc* analysis was used to identify significant differences were indicated by two-way ANOVA. **RESULTS:** PWV was lower ($P < 0.05$) at post- than pre-intervention during both HIIE_{RPE} (0.28 ± 0.17 m/s) and HIIE_{HR} (0.27 ± 0.11 m/s). However, PWV remained lower at recovery only during HIIE_{RPE} (0.30 ± 0.10 m/s, $P < 0.05$), returning to pre-intervention levels during HIIE_{HR}. PWV did not change significantly during CON. **CONCLUSION:** These results suggests that HIIE promotes positive acute effects in arterial stiffness in young healthy individuals. Both exercise intervention reduced PWV at post-intervention, but only HIIE_{RPE} maintained the reduction at recovery, demonstrating that 6 to 20 RPE scale is an accessible, simple and useful tool for prescribing and self-regulating HIIE and promote cardiovascular benefits in young individuals.

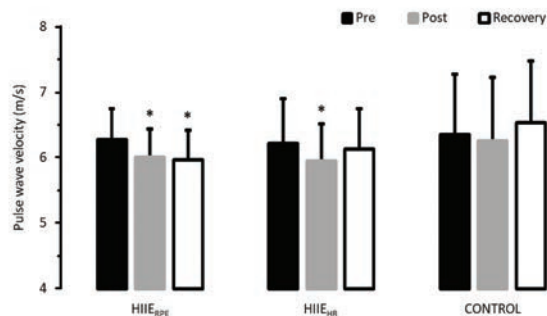


Figure. Pulse wave velocity during interventions. Data are expressed as mean ± SD. HIIE_{RPE}: high-intensity interval exercise prescribed and self-regulated by RPE; HIIE_{HR}: high-intensity interval exercise prescribed and regulated by heart rate response to cardiopulmonary exercise testing. Asterisk denotes significant difference from pre at same group (*: $P < 0.05$).

971 Board #205 May 29 2:00 PM - 3:30 PM
The Effect of Sodium Supplementation on Postexercise Hypotension Following Acute Submaximal Aerobic Exercise
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PURPOSE: Acute submaximal aerobic exercise confers cardiovascular benefits including a prolonged reduction in blood pressure (BP) termed postexercise hypotension (PEH). PEH is thought to contribute to the chronic BP-lowering effects of aerobic training. Chronic sodium (Na⁺) supplementation expands plasma volume (PV) and may attenuate PEH. Therefore, this study tested the hypothesis that Na⁺ supplementation attenuates PEH following acute aerobic exercise. **METHODS:** Healthy young adults (n=11, age 26 ± 4 years; body mass index 23.5 ± 2.4 kg/m²) consumed a recommended Na⁺ diet (2,300 mg Na⁺/d) for 10 days on two occasions;

participants also consumed pills containing a total of either 4,000 mg Na⁺ or a placebo in random order. Participants collected their urine for the final 24 hours of each intervention for quantification of urinary Na⁺ excretion. On day 10 of each intervention, participants completed 50 minutes of dynamic cycling exercise at 60% VO_{2peak}. Brachial BP was recorded via automated oscillometry before and every 10 minutes after exercise for one hour. The change in PV was estimated using hemoglobin and hematocrit following each intervention. BP responses following exercise were compared using a two-way repeated measures ANOVA. Urinary and blood measures and the nadir in BP after exercise were compared using paired t-tests. **RESULTS:** The mean VO_{2peak} of participants was 41.6 ± 8.8 ml/min/kg and mean power at 60% VO_{2peak} was 127 ± 40 W. Urinary Na⁺ excretion was increased following Na⁺ supplementation (277 ± 50 vs. 153 ± 73 mmol/24 hours, $p < 0.001$). Na⁺ supplementation expanded PV approximately 10.2 ± 8.9%. Despite significantly greater Na⁺ excretion, serum [Na⁺] (141.0 ± 1.8 vs. 141.7 ± 3.0 mEq/L, $p = 0.34$) and plasma osmolality (294 ± 4 vs. 295 ± 6 mOsm/kg H₂O, $p = 0.22$) were not different following Na⁺ supplementation compared to placebo. PEH was observed following both conditions (nadir systolic BP: -4.7 ± 3.8 vs. -4.6 ± 2.9 mmHg, $p = 0.91$ and mean BP: -6.1 ± 4.3 vs. -5.0 ± 3.4 mmHg, $p = 0.38$). However, when comparing Na⁺ supplementation to placebo, there was not a significant diet effect regarding reductions in systolic BP ($p = 0.93$) or mean BP ($p = 0.41$) following exercise. **CONCLUSIONS:** These preliminary data suggest that Na⁺ supplementation does not attenuate PEH following acute aerobic exercise despite increased PV.

972 Board #206 May 29 2:00 PM - 3:30 PM
Blood Chemistry Changes During an Ultra-marathon Competition
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PURPOSE: The purpose for this study is to assess venous electrolyte changes in ultra-marathon athletes. There are few studies on ultra-endurance activities reporting blood parameter changes and their potential effects, and those that are published have conflicting results. We speculate that plasma fluid shifts and the metabolic demands occurring during an ultramarathon will result in significant changes in metabolites, electrolytes, hemoglobin and hematocrit levels that could be of risk to the runner's health. **METHODS:** Consent was obtained from each participant the day before the Saint Sebastian 100, November 2017. The event was conducted over a repeated ten-mile loop in the Saint Sebastian Preserve, Florida. The environmental conditions were moderately warm and humid. Races consisted of 50 kilometers, 50 miles and 100-mile distances. Blood samples were collected from the antecubital vein with 1 cc insulin syringes. Blood was analyzed with an i-STAT Handheld blood analyzer with the CHEM8+ cartridge (© Abbot Point of Care, Princeton, NJ). Paired sample t-tests were used to compare pre and post-race values (mean ± SD), $p \leq 0.05$, number of participants n=12. **RESULTS:** Significant changes pre to post race were found in the following: Potassium (3.97 ± 0.19 , 4.27 ± 0.48 (mmol/L), $t(11) = -2.31$; $p = 0.04$); BUN (16.75 ± 8.18 , 25.25 ± 7.28 (mg/dl), $t(11) = -4.89$; $p < 0.001$); Creatinine (0.85 ± 0.13 , 1.48 ± 0.68 (mg/dl), $t(11) = -3.31$; $p = 0.007$); Hematocrit (44.75 ± 3.41 , 47.25 ± 3.67 (%), $t(11) = -4.38$; $p = 0.001$); Hemoglobin (15.21 ± 1.15 , 16.07 ± 1.24 (g/dl), $t(11) = -4.35$; $p = 0.001$); Sodium and glucose did not show significant changes pre to post race. Significant changes were not noted between different race distances. **CONCLUSION:** The results from this study show dehydration, muscle catabolism, and increased stress upon kidney function in the ultra-marathon athletes. These results demonstrate that electrolytes are altered post ultramarathon. The severity of these alteration is not known as various studies show opposing results. More research is needed to determine the extent of these changes and why some studies show changes when others do not. These changes could be of clinical significance to the runner's health or possibly through training they have adapted to these stressful alterations.

973 Board #207 May 29 2:00 PM - 3:30 PM
Electrocardiogram T-Wave Morphology and Amplitude Differences during an Ultramarathon Competition
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 (No relevant relationships reported)

PURPOSE: The goal of this research is to study the effect of ultramarathon competition on T-wave morphology and amplitude changes. T-wave changes can be an indication of a vast number of conditions with many being of critical nature. This makes understanding what changes ultrarunners are undergoing critical for monitoring and understanding physiological changes associated with ultramarathons. **METHODS:** In this study, volunteer subjects Male n=25, Female n=20 signed an informed consent, then completed their ultramarathon distance. 12 lead EKGs were measured pre and post-race. EKGs were recorded and analyzed with ECG

Synchronous V1.3.1 and statistics were performed in SPSS V21. Paired sample t-tests were used to compare pre and post-race T-wave amplitude values (Pre/Post mean \pm SD, $p \leq 0.05$). **RESULTS:** A total of 405 T-waves were analyzed. There was no change in t-wave morphology pre versus post-race for 83.95% ($n=340$), while 16.05% ($n=65$) changed morphology (upright, inverted, flat, camel hump and biphasic). Major changes observed were inverted to upright ($n=24$), upright to inverted ($n=9$), biphasic to upright ($n=9$) and camel hump to upright ($n=6$), other changes only occurred in 1 or 2 leads. Significant changes in T-wave amplitude (mv) pre- to post-race were found in the following leads: (Pre/Post mean \pm SD, $p \leq 0.05$): **lead I** (0.168 ± 0.114 , 0.254 ± 0.105 , $t(44) = -4.845$; $p < 0.001$); **lead II** (0.305 ± 0.124 , 0.398 ± 0.137 , $t(44) = -4.081$; $p < 0.001$); **lead aVR** (-0.24 ± 0.11 , -0.29 ± 0.15 , $t(44) = -0.04$); **lead aVF** (0.231 ± 0.0805 , 0.284 ± 0.117 , $t(44) = -3.666$; $p < 0.001$); **lead V1** (0.00333 ± 0.136 , 0.0973 ± 0.161 , $t(44) = -5.144$; $p < 0.001$); **lead V2** (0.358 ± 0.233 , 0.528 ± 0.346 , $t(44) = -5.462$; $p < 0.001$); **lead V3** (0.440 ± 0.215 , 0.590 ± 0.290 , $t(44) = -5.951$; $p < 0.001$); **lead V4** (0.480 ± 0.190 , 0.589 ± 0.254 , $t(44) = -3.899$; $p < 0.001$); **lead V5** (0.168 ± 0.114 , 0.254 ± 0.105 , $t(44) = -4.035$; $p < 0.001$), and **lead V6** (0.329 ± 0.103 , 0.398 ± 0.148 , $t(44) = -3.348$; $p < 0.001$); leads III and aVL showed no change in amplitude. **CONCLUSION:** From this study, the results show evidence that long-distance running can alter T-wave morphology and amplitude pre- to post-race. Possible causes of these changes include hyperkalemia, cardiac strain, long QT syndrome, Tachycardia Induced cardiomyopathy all in response to the ultramarathon.

974 Board #208 May 29 2:00 PM - 3:30 PM
Metabolic and Hemodynamic Efficiency of Identical Workloads Performed with Stable Supine vs Upright Cycle Ergometry

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(No relevant relationships reported)

Although differences among postural positions during cycle ergometry generally display a metabolic response favoring the upright posture, the use of identical workloads regardless of pedal frequency are scarce. Using an electromagnetically braked ergometer with a constant load that accommodates a range of pedal frequency of 155 rpm, provided an identical workload despite positional changes and/or variation in pedal frequency. In addition, a lack of subject stability during supine exercise may contribute to an increased energy cost. **Purpose:** To determine the metabolic efficiency between supine (S) versus upright (U) cycling at identical workloads with stable supine subject positioning. **Methods:** 15 healthy college students (age 20.9 ± 1.3 yr, ht. 172.3 ± 8.5 cm, body mass 76.9 ± 12.6 kg, 8 ± 6) volunteered to participate in two randomly assigned GXT trials preceded by 5 minutes of rest, followed by a progressive increase of 25 watts per 3 min stage, starting at 50 w. Open circuit spirometry measured metabolism and hemodynamics were assessed by cardiac impedance. The seat was located 12° posterior of vertical above the center crank (CC) for the U trial and the subject was supine with the CC elevated 33 cm above the platform for the S trial. **Results:** $\dot{V}O_2$ (L/min) were 1.12 ± 0.17 vs 1.06 ± 0.14 , 1.35 ± 0.18 vs 1.28 ± 0.13 , 1.55 ± 0.17 vs 1.52 ± 0.12 , and 1.76 ± 0.17 vs 1.78 ± 0.15 , and cardiac output [Q](L/min) were 13.6 ± 2.8 vs 12.0 ± 3.5 , 15.1 ± 3.1 vs 14.1 ± 3.5 , 16.4 ± 3.1 vs 16.6 ± 2.0 , and 18.3 ± 3.0 vs 19.1 ± 2.4 , for 50, 75, 100, and 125 watt workloads, for U vs S trials, respectively. NSD was found between $\dot{V}O_2$ or Q at all workloads, except $\dot{V}O_2$ at 75 w. **Conclusion:** Often extraneous subject supine mobility may impact cycling energy cost, however the subjects used a supine cycling platform, thus shoulder support prevented posterior body migration. At low to moderate intensity cycle exercise, with subjects in a stable position, the hemodynamic and metabolic response to supine vs upright cycling is virtually indistinguishable.

975 Board #209 May 29 2:00 PM - 3:30 PM
Acute Effects of a Vinyasa Flow Yoga DVD on Lipid Profile and Fasting Glucose

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(No relevant relationships reported)

Short- and long-term interventional trials have demonstrated the efficacy of various styles of hatha yoga in improving both lipid profile and fasting glucose concentrations; however, the acute effects of yoga on these measures are unknown. Vinyasa flow yoga is a style of hatha yoga characterized by continuous movement, smooth transitioning between postures, and a synchronization of breath and posture transitions. **Purpose:** The purpose of this study was to evaluate the acute effects of a Vinyasa yoga session on lipid profile and fasting glucose concentrations in yoga practitioners with a minimum of 3 months of yoga practice experience. **Methods:** Nine yoga practitioners (20 - 75) completed one 60-minute Vinyasa yoga DVD. Whole blood samples were obtained (after 8 hrs of fasting) and analyzed for

total- and HDL-cholesterol, triglyceride, and glucose concentrations via reflectance photometry. Briefly, 35 μ L blood samples were applied to test cassette sampling wells and color changes of the reagent pads were converted to concentration values. LDL-cholesterol was calculated using the Friedewald equation.

Results: After completion of the Vinyasa flow yoga session, a significant decrease in LDL-cholesterol ($p < 0.01$) was observed. Total cholesterol tended to decrease ($p = 0.128$) after the intervention, although not statistically significant. No changes occurred in fasting glucose ($p = 0.769$), HDL-cholesterol ($p = 0.431$), or triglyceride concentrations ($p = 0.328$).

Conclusions: These results illustrate that a 1-hour session of Vinyasa flow yoga can improve LDL-cholesterol concentrations. These acute changes in lipid measures could lend support for the potential efficacy of yoga, an alternative exercise mode, in inducing positive changes in lipid profile and producing favorable changes in cardiovascular disease risk profile. This study was funded in part by Pure Action, Inc. Austin, TX, USA.

976 Board #210 May 29 2:00 PM - 3:30 PM
Acute Handgrip Exercise Alters the Inter-arm Systolic Blood Pressure Difference in Young Males and Females

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A large inter-arm difference (IAD) in systolic blood pressure (BP) is linked to an increased likelihood of cardiovascular and peripheral vascular disease, hypertension, and premature mortality. An acute bout of aerobic exercise can alter IAD both during the activity and into post-exercise recovery. Isometric handgrip exercise (IHE) results in acute alterations in BP that differ from aerobic exercise. Further, sex differences in IHE-mediated BP exist, and cardiovagal modulation is a plausible mechanism. No prior investigations have examined IAD during IHE in males and females. **Purpose:** To characterize IAD and heart rate variability (HRV) to IHE in men and women.

Methods: On visit one, participants completed three maximal voluntary isometric contractions (MVIC) per arm using a handgrip dynamometer. During visit two, after a five-minute rest, resting HRV was assessed while each participant breathed at a rate of 12 breaths/minute. HRV analysis software was used to determine relative low- and high-frequency power for each participant. Subsequently, a series of three resting bilateral BP measures were collected and averaged (REST) utilizing an automatic oscillatory BP device. Following REST, participants maintained the handgrip dynamometer at 20% MVIC for two minutes (arm randomly assigned), at which time bilateral BP and HRV were again measured (IHE). An independent-samples t-test and repeated measures ANOVA were used to compare and track variables of interest. **Results:** IHE resulted in increased IAD in both males and females. Males demonstrated higher IAD at REST (7 ± 6 vs. 3 ± 3 mmHg) and during IHE (12 ± 9 vs. 5 ± 4 mmHg) than their female counterparts ($P < 0.05$), with males also expressing a lower high-frequency HRV at rest ($P < 0.05$). **Conclusions:** Isometric handgrip exercise altered IAD from rest to exercise, with males displaying increased IAD during both conditions. The attenuated exercise pressor response observed in female participants may be due, in part, to a higher observed baseline of cardiovagal modulation. Future studies should address potential responses following repeated bouts of IHE, which may have important implications in those with IAD.

977 Board #211 May 29 2:00 PM - 3:30 PM
The Acute Effects of Vinyasa Flow Yoga on Arterial Stiffness

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(No relevant relationships reported)

Arterial stiffness (AS) is a marker of subclinical atherosclerotic disease associated with reductions in the buffering capacity of the central, elastic arteries. Previous research has demonstrated reductions in AS with a relatively short-duration, 8-week Bikram (hot) yoga practice. However, the acute effects of yoga on this measure have not been investigated. Vinyasa flow yoga is a style of hatha yoga which involves a higher intensity sequence of postures compared to other yoga styles along with continuous movement. As yoga could potentially be as effective as aerobic exercise in treating co-morbidities associated with CVD, it is pertinent to clarify whether an acute bout of Vinyasa flow yoga could lead to meaningful changes in indices of AS.

Purpose: The aim of this study was to investigate the acute impact of one bout of Vinyasa flow yoga on indices of AS in healthy adults.

Methods: 11 apparently healthy adults ages 20-75 yrs with at least 3 months of yoga experience completed a one-hour Vinyasa flow yoga DVD. Seated blood pressure measures were obtained pre- and post-intervention. Augmentation index (AIx) and carotid-femoral pulse wave velocity (cfPWV) were measured before and after the yoga

session via Sphygmocor applanation tonometry. AIX recordings included crude AIX, AIX at a heart rate of 75 beats per minute (AIX@75), and peripheral AIX (P2/P1). Mood affect was assessed via PANAS 20-item survey.

RESULTS: After completion of the yoga DVD, significant reductions in AIX and peripheral AIX ($P < 0.05$ for both) were observed. Although not statistically significant, AIX@75 tended to decline ($p = 0.068$) while cPPWV ($P = 0.459$) was unaltered. No significant changes in positive or negative affect were observed although negative affect tended to decline ($P = 0.126$).

CONCLUSIONS: These results highlight the efficacy of a single bout of hatha yoga in improving central and peripheral arterial stiffness measures and provide insight into the potential effects of yoga in mediating CVD risk.

978 Board #212 May 29 2:00 PM - 3:30 PM
Walking With Leg Blood Flow Restriction: Wide-rigid Cuffs Vs. Narrow-elastic Bands

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Reported Relationships: S. Stray-Gundersen: Other (please describe); Received BFR bands from company as a gift for research.

Blood flow restriction (BFR) training has become a popular form of exercise. The concept is that light exercise with BFR would elicit similar adaptations achieved with intense exercise. Walking exercise in combination with pressurized wide-rigid (WR) cuffs has been shown to elicit higher cardiac workload and a vascular dysfunction due presumably to reperfusion injury to the endothelium. In contrast, narrow-elastic (NE) BFR bands, similar to the original Kaatsu bands, may elicit different hemodynamic effects, as the limb is able to increase in diameter with increased blood flow accompanying exercise. **Purpose:** To compare two distinct forms of BFR bands during light-intensity exercise on cardiovascular responses. **Methods:** Six young healthy participants ($M = 4$, $F = 2$) performed 5 bouts of 2-minute walking intervals at 3.2 kph with a 1-minute rest and deflation period between bouts with either WR or NE bands placed on both upper thighs. Cuff pressure was increased to 160 mmHg in WR cuffs and 300 mmHg in NE bands. Beat-by-beat blood pressure and heart rate were measured continuously using finger plethysmography. Blood lactate concentration, rating of perceived exertion (RPE), flow-mediated dilation (index of endothelium-dependent vasodilation), and cardio-ankle vascular index (measure of arterial stiffness) were assessed before and after the walking exercise. **Results:** At baseline, there were no significant differences in any of the variables between the WR and NE conditions. Heart rate increased similarly in both conditions. Increases in systolic and diastolic blood pressure were greater ($p < 0.01$) in the WR than the NE condition ($160 \pm 13 / 92 \pm 11$ mmHg vs. $127 \pm 9 / 71 \pm 16$ mmHg, respectively). Double product, a function of heart rate and systolic blood pressure, increased to a greater extent in the WR than in the NE condition. Increases in RPE and blood lactate concentration from baseline were greater in the WR compared with the NE condition ($p < 0.05$). **Conclusion:** Use of wide-rigid BFR cuffs resulted in a marked increase in pressor responses compared with narrow-elastic BFR bands, suggesting that narrow-elastic bands may present a safer alternative for at-risk populations to perform BFR exercise.

979 Board #213 May 29 2:00 PM - 3:30 PM
The Hemodynamic and Metabolic Response to Maximal Supine vs Upright Cycle Ergometry

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(No relevant relationships reported)

Performance comparisons between supine (S) and upright (U) cycling have been reported to range from similar responses to as much as 150% greater for U conditions. In part, differences in performance have been attributed to a greater muscle perfusion pressure in the upright position resulting from an enhanced hydrostatic pressure in the lower extremities. **Purpose:** The purpose was to determine the hemodynamic and metabolic response to a maximal workload performed in a supine and an upright cycling position. **Methods:** 15 healthy college students (age 20.9 ± 1.3 yr, ht. 172.3 ± 8.5 cm, body mass 76.9 ± 12.6 kg, 8 ± 1) volunteered to participate in two randomly assigned GXT trials preceded by 5 minutes of rest, and followed by a progressive increase of 25 watts per 3 min stage, starting at 50 w to volitional exhaustion. Open circuit spirometry measured metabolism and hemodynamics were assessed by cardiac impedance. The seat was located 12° posterior of vertical above the center crank (CC) for the U trial and each subject was supine with the CC elevated 33 cm above the platform for the S trial. **Results:** The following variables were measured during the final minute of exercise: workload 216 ± 41 vs 175 ± 39 watts*, $\dot{V}O_2$ 2.68 ± 0.52 vs 2.32 ± 0.60 (L/min)*, $\dot{V}E$ 95.2 ± 17.8 vs 75.9 ± 19.0 (L/min)*, RER $1.15 \pm .04$ vs $1.12 \pm .05$, $\dot{V}E/\dot{V}O_2$ 42.9 ± 5.8 vs 36.7 ± 6.1 *, RPE 9.9 ± 0.3 vs 9.9 ± 0.6 , HR 193 ± 6.6 vs 177 ± 11 b/min*, cardiac output (Q) 23.6 ± 7.2 vs 22.4 ± 2.7 (L/min), and SV 121 ± 33 vs 126 ± 10 (mL/beat), for U vs S, respectively (* $p < .05$). Workload, $\dot{V}E$, $\dot{V}O_2$, and HR were 23, 27, 15, 11, and 9% higher for U vs S trials, respectively ($P < .05$).

Conclusion: Attainment of a greater workload in the U trial (+23%), may, in part, be attributed to enhanced peripheral perfusion, familiarity with the U testing, and greater sympathetic drive. Despite a theoretical advantage for venous return in the S position, Q and SV did not differ between positions. Energy requirements of 12.4 vs 13.3 mL \dot{O}_2 /watt for U vs S, respectively, confirms S to be less efficient than U.

980 Board #214 May 29 2:00 PM - 3:30 PM
Menstrual Phase Differences In The Physiological Resolution Of Periodic Breath-holding During Heavy Intensity Fartlek Exercise

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(No relevant relationships reported)

PURPOSE: Fluctuations in ovarian hormones have been shown to affect the physiological responses to heavy-intensity exercise. These responses may be exacerbated during backstroke swimming during the underwater push-off phase where swimmers are required to perform breath holds (~5 s) while kicking to the surface. The purpose of this study was to compare the singular and combined effects of repeated cycles of 5 s breath holds (BH) and hi-power output (HPO), every 30 s, during heavy-intensity (HVY) exercise during follicular (FOL) and luteal (LUT) phases.

METHODS: Eight eumenorrheic women (22 ± 1 yr, $\dot{V}O_{2max}$ 2.36 ± 0.4 L \cdot min⁻¹) performed four 6-min exercise bouts on a cycle ergometer at a power output of 50 % of the difference between ventilatory threshold and $\dot{V}O_{2max}$ ($\alpha 50\%$) in the FOL and LUT. A continuous HVY (CONT) with free breathing, and 3 intermittent conditions including, repeated cycles of 25 s free breathing and 5 s BH (BH), repeated cycles of 25s at $\alpha 50\%$ and 5s at peak aerobic power (HPO) and combining the BH and HPO (BH-HPO) perturbations were performed. Gas exchange and vastus lateralis deoxygenation (HHb) were recorded during all trials.

RESULTS: Mean Ventilation (\dot{V}_E) and total [hemoglobin] were higher in all conditions during LUT vs FOL (LUT 78.0 ± 10.7 ; FOL 75.1 ± 10.7 L \cdot min⁻¹ and FOL: 2.0 ± 2.2 μ Mol; LUT: 2.9 ± 1.9 μ Mol respectively $p < 0.05$). Carbon dioxide production ($\dot{V}CO_2$) was higher during LUT BH-HPO (LUT: 2.41 ± 0.18 L \cdot min⁻¹; FOL: 2.19 ± 0.24 L \cdot min⁻¹ $p < 0.05$). Whereas % α HHb was greater during the 5s BH vs the 25s free-breathing period in both LUT (25s: $87 \pm 9\%$; 5s: $89 \pm 8\%$ $p < 0.05$) and FOL (25s: $86 \pm 15\%$; 5s: $89 \pm 13\%$ $p < 0.05$) phases. Further, % α HHb/ α $\dot{V}O_2$ was greater during BH (6%) and HPO-BH (7%) during the 5s BH vs the 25s free-breathing in both phases (FOL: $46.0 \pm 18\%$; LUT: $45 \pm 14\%$ and FOL: $44 \pm 18\%$; LUT: $44 \pm 15\%$ respectively $p < 0.05$).

CONCLUSION: Low PO_2 in the area of investigation (i.e. vastus lateralis) during heavy intensity exercise has been shown to increase \dot{CO}_2 transport by increasing the affinity of \dot{CO}_2 to Hb (Haldane effect). Moreover, the increased pulmonary diffusion capacity during the LUT phase suggested elsewhere would facilitate the observed increase in $\dot{V}CO_2$ and \dot{V}_E during the BH-HPO protocol of the present study. Finally, females show increased local muscle deoxygenation in both BH conditions during both the FOL and LUT phases.

981 Board #215 May 29 2:00 PM - 3:30 PM
Integrative Physiological Responses To A 25-day Ultra-endurance Exercise Challenge

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(No relevant relationships reported)

Purpose. This case-report characterised the respiratory, cardiovascular, and nutritional/gastrointestinal (GI) responses of a trained individual to a novel ultra-endurance exercise challenge. **Methods.** A male athlete (age 45 y, mass 80.7 kg, stature 1.71 m, $\dot{V}O_{2max}$ 54.8 mL \cdot kg⁻¹ \cdot min⁻¹) summited 100 mountains on foot (all elevations >600 m) in 25 consecutive days, and cycled between five base-camps throughout the UK. Laboratory measures of pulmonary function (spirometry, whole-body plethysmography, single-breath rebreath), respiratory muscle strength (maximum static mouth-pressures), and cardiovascular structure and function (echocardiography, electrocardiography, large vessel ultrasound, flow-mediated dilatation) were assessed at baseline and at 48 h post-challenge. Dietary intake (4-d food diary), self-reported GI symptoms, and plasma endotoxin concentrations were assessed at baseline, pre/post mid-point (day 13), pre/post penultimate point (day 24), and at 48 h post-challenge. **Results.** The participant completed the challenge with a total exercise time of 142 h (5.3 ± 2.8 h \cdot d⁻¹), distance of 1141 km (42.3 ± 43.9 km \cdot d⁻¹), ascent of 33804 m (1252 ± 807 m \cdot d⁻¹), and energy expenditure of 80460 kcal (2980 ± 1451 kcal \cdot d⁻¹). Relative to

baseline, there were post-challenge decreases in pulmonary volumes and capacities (6 - 32%), expiratory flows (9 - 28%), maximum expiratory mouth-pressure (19%), and maximum voluntary ventilation (29%). Heart rate variability had deteriorated, manifesting in a 48% decrease in the root mean square of successive differences (RMSSD) and a 70% increase in the low-frequency/high-frequency ratio (LF/HF). There were no notable changes in any other index of cardiovascular structure or function. Pre- to post-challenge endotoxin concentrations were elevated by 60%, with a maximum increase of 130% after a given stage, congruent with an increased frequency and severity of GI symptoms. **Conclusions.** This is the first study of the integrative physiological responses to an ultra-endurance exercise challenge. The findings extend our understanding of the limits of physiological function and may inform medical best-practice for personnel supporting ultra-endurance events.

- 982** Board #216 May 29 2:00 PM - 3:30 PM
Genetic, Physiologic, And Behavioral Predictors Of Cardiorespiratory Fitness In Specialized Military Men
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 (No relevant relationships reported)

Cardiorespiratory fitness (CRF) is a crucial performance requirement of specialized military occupations. Age and physical activity (PA) are established predictors of CRF, but it is not clear how these predictors combine with each other and/or with genetic predisposition. **PURPOSE:** To derive inclusive explanatory models of CRF in U.S. Navy Explosive Ordnance Disposal (EOD) operators, synthesizing conventional (e.g., age, body composition, and PA) and novel influences (e.g., genetic variance), was performed. **METHODS:** Forty male, active duty EOD operators completed a graded exercise test to assess maximal oxygen consumption and ventilatory threshold (VT) using the Bruce protocol. Aerobic performance was further quantified via time of test termination and time at which VT was achieved. Body composition was determined via dual-energy x-ray absorptiometry, and PA was assessed by self-report. Genetic variants underlying human stress systems (5HTTLPR, BclII, -2C/G, and COMT) were assayed. **RESULTS:** In univariate regression models, age, body composition, PA, and 5HTTLPR consistently predicted CRF and/or aerobic performance (R^2 range .07-.55). Multivariate regression models routinely outperformed the univariate models, explaining 36%-62% of variance. **CONCLUSIONS:** This study signifies a shift toward inclusive explanatory models of CRF and aerobic performance, accounting for combined roles of genetic, physiologic, and behavioral influences. These findings have implications for assessment, selection, and training of specialized military members, and may also impact mission success and survivability.

- 983** Board #217 May 29 2:00 PM - 3:30 PM
Influence of Menstrual Cycle Phase on Cardiovascular Drift and Maximal Oxygen Uptake During Heat Stress
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Cardiovascular drift (CV drift) is related to reduced maximal oxygen uptake ($\dot{V}O_{2max}$) during heat stress. Whether this relationship is modified by elevated core temperature during the luteal phase (LP) of the menstrual cycle remains unknown. **PURPOSE:** To test the hypothesis that the magnitude of CV drift and accompanying decrement in $\dot{V}O_{2max}$ is greater during the LP of the menstrual cycle vs. the follicular phase (FP). **METHODS:** Seven women (mean±SD; age=24±5 y) completed a graded exercise test in ~22 °C to determine $\dot{V}O_{2max}$, followed by one 15-min and one 45-min trial at 60% $\dot{V}O_{2max}$ in 35 °C—each immediately followed by measurement of $\dot{V}O_{2max}$ —in the FP and LP. CV drift was measured between 15 and 45 min during the 45-min trials. The purpose of the separate 15- and 45-min trials was to measure CV drift and $\dot{V}O_{2max}$ over the same time interval. **RESULTS:** Rectal temperature (T_{re}) at rest and during exercise was higher in the LP ($p<0.05$). Heart rate increased 9% between 15 and 45 min in both phases ($p=0.71$), while stroke volume decreased more in the LP (-18%) compared to the FP (-11%; $p<0.001$). $\dot{V}O_{2max}$ decreased significantly over time ($p=0.002$), but menstrual cycle phases were not different (16% and 13% for LP and FP, respectively, $p=0.28$). **CONCLUSION:** Greater thermal strain in the LP compared to the FP did not modulate the relationship between CV drift and $\dot{V}O_{2max}$ during exercise in the heat.

- 984** Board #218 May 29 2:00 PM - 3:30 PM
Should $\dot{V}O_2$ Be Normalized By Fat-free Mass In Recreationally Active Adolescent Males And Females?
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PURPOSE: This research aims to observe sex difference in oxygen consumption ($\dot{V}O_2$) expressed in absolute terms and relative to body weight and to fat-free mass in adolescent children while exercising at submaximal and maximal intensity. **METHODS:** Body composition (Bod Pod, COSMED) and cardiorespiratory fitness (K5, COSMED) were assessed on twenty-two recreationally active, healthy adolescents (age 16-17 years; 9 males, fat mas% 16.8 ± 8.0; 13 females, fat mas% 27.4 ± 5.4). A 15 watts/min incremental test to exhaustion was performed on a cycle ergometer to measure $\dot{V}O_2$ at the aerobic threshold (AerT) and at peak exercise ($\dot{V}O_{2peak}$) using breath-by-breath gas analysis. Values were expressed in both absolute terms and normalized by body mass and fat-free mass. The AerT was identified using the V-slope technique and as the lowest respiratory equivalent for oxygen. **RESULTS:** The $\dot{V}O_2$ at the AerT was higher in males than females when expressed in absolute terms (1184 ± 222 vs 942 ± 202 ml/min, $p = 0.015$) and normalized by body weight (16.9 ± 2.2 vs 16.4 ± 3.1 ml/kg/min) but the trend was inverted when $\dot{V}O_2$ was normalized by FFM (20.43 ± 2.92 vs 21.57 ± 2.86 ml/kg/min). The same trend was observed at peak exercise. Males reported higher $\dot{V}O_{2peak}$ than females when expressed in absolute terms (1792 ± 250 ml/min vs 2344 ± 554 ml/min, $p < 0.01$) and normalized by body weight (33.5 ± 6.1 vs 30.6 ± 5.5 ml/kg/min) but lower when normalized by FFM (40.1 ± 5.7 vs 41.4 ± 8.0 ml/kg/min). Male adolescents exerted higher power than females both at the AerT (63 ± 13 vs 57 ± 20 watts) and peak effort (198 ± 40 vs 160 ± 20 watts, $P < 0.01$). **CONCLUSIONS:** This study provides reflection on whether $\dot{V}O_2$ should be normalized by total mass or FFM in adolescent males and females.

- 985** Board #219 May 29 2:00 PM - 3:30 PM
Cardiovascular Drift and Maximal Oxygen Uptake in Men Versus Women During Heat Stress
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It has been well demonstrated that biophysical factors, such as rate of metabolic heat production (\dot{H}_{prod}) and body size, are of primary importance in explaining variability of thermoregulatory responses during exercise in a compensable environment. It is unknown whether these same factors influence cardiovascular (CV) drift and a concomitant reduction in maximal oxygen uptake ($\dot{V}O_{2max}$) during prolonged exercise in the heat. **PURPOSE:** To test the hypothesis that men experience a greater increase in heart rate (HR) and decrease in stroke volume (SV) accompanied by a greater reduction in $\dot{V}O_{2max}$ during prolonged exercise in a hot environment compared to women at the same relative metabolic intensity. **METHODS:** Seven men [(mean±SD); mass=76.2±8.8 kg, $\dot{V}O_{2max}$ =54.7±5.5 mL/kg/min] and 7 women (mass=58.9±9.4 kg, $\dot{V}O_{2max}$ =42.0±9.2 mL/kg/min) performed a graded exercise test in ~22 °C to determine $\dot{V}O_{2max}$. Then on separate, counterbalanced occasions participants cycled at 60% $\dot{V}O_{2max}$ for either 15 or 45 min in 35 °C, immediately followed by graded exercise to elicit $\dot{V}O_{2max}$. CV drift was measured between 15 and 45 min during the 45-min trials. The separate 15- and 45-min trials were necessary to measure $\dot{V}O_{2max}$ during the same time interval that CV drift occurred. Women were tested during the follicular phase of the menstrual cycle. **RESULTS:** Because of differences in aerobic fitness and body size, \dot{H}_{prod} was higher ($p<0.05$) for men (666 W, 8.8 W/kg) than women (402 W, 7.1 W/kg), but the increase in rectal temperature from 15 to 45 min was not different (men=1.0±0.4 °C; women=0.7±0.2 °C; $p=0.25$). Likewise, CV drift was not different between groups (men: 14% increase in HR and 12% decrease in SV; women: 9% increase in HR and 11% decrease in SV; all $p>0.05$). $\dot{V}O_{2max}$ decreased between 15 and 45 min, but men (-13%) and women (-13%) were not different ($p=0.95$). **CONCLUSION:** Despite exercising at a higher \dot{H}_{prod} , larger, more aerobically fit men did not experience greater CV drift and concomitant reductions in $\dot{V}O_{2max}$ during heat stress compared to smaller, less fit women.

986 Board #220 May 29 2:00 PM - 3:30 PM

Sedentary Behaviors Modulates Metabolic and Inflammatory Biomarkers in Healthy Males

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PURPOSE: Sedentary behavior (SB) has emerged rapidly as a serious health problem globally. The purpose of this study was to assess the association between the increased time spent in SBs and metabolic and inflammatory biomarkers in healthy males.

METHODS: Thirty-five healthy male adults participated in this cross-sectional study (age, 21.8 ± 2.8 yr; body height, 171.9 ± 6.4 cm; body weight, 61.7 ± 5.6 kg; % body fat, 15.6 ± 4.3 %; body mass index (BMI) 20.9 ± 1.5 kg/m²; waist circumference 75.5 ± 5.2 cm; heart rate (HR) 69.4 ± 7.8 bpm; systolic blood pressure (SBP) 108.7 ± 9.4 mmHg; diastolic blood pressure (DBP) 69.7 ± 8.3 mmHg). Subjects were required to wear the activPAL™ to continuously monitor their 24-hour activities for 7 days without any removal. Based on their SB, subjects were divided into high SB group (HSB, N=18) and low SB group (LSB, N=17). Blood samples were collected in the morning after overnight fast and no exercise was performed over the past 24 hours. Serum inflammatory biomarkers, including tumor necrosis factor alpha (TNF α), interferon- γ (IFN γ), interleukin 1 β (IL-1 β), monocyte chemoattractant protein 1 (MCP1) were measured by Flow Cytometry, while total cholesterol (TC), triglycerides (TRG), high-density lipoprotein (HDL), low-density lipoprotein (LDL) were analysed by xMark™ Microplate Absorbance Spectrophotometer at 500nm. Blood glucose (GLU) was measured by Alere Cholestech LDX® Analyzer. Independent-Samples T test and bivariate correlate were applied to analyze the differences between two groups and correlations among various biomarkers using SPSS version 23. **RESULTS:** Sedentary time of subjects in HSB group was higher than LSB group (19.9 ± 0.9 vs 17.3 ± 1.2 hr, $p < 0.01$). No difference was found between two groups in MVPA and anthropometric results. An inverse relationship was observed between IFN- γ and sedentary time ($r = -0.342$, $p < 0.05$). TNF- α was negatively associated with TC ($r = -0.343$, $p < 0.05$), whereas IL-1 β was negatively associated with TRG ($r = -0.395$, $p < 0.05$). In addition, TRG and GLU were higher in the HSB group ($p < 0.05$), while HDL was lower in the LSB group ($p < 0.01$). **CONCLUSIONS:** The results suggest that a close relationship exists between sedentary time and inflammatory and metabolic biomarkers.

987 Board #221 May 29 2:00 PM - 3:30 PM

Prevalence Of Fluctuated Heart Rate Recovery In Healthy Adults Undergoing Repeated Exercise Stress Tests

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Background: Heart rate (HR) at 1 minute during the recovery from an exercise stress test (EST) of less than 18 beats per minute (b/min) is regarded as “pathologic” and is associated with poor prognosis. We previously showed the inconsistency of HR recovery (HRR) in patients referred for diagnostic EST.

Purpose: To investigate the prevalence of HRR in healthy individuals undergoing routine ESTs. In addition, we examined the autonomic function of HR variability measures prospectively in “Normal”, “Pathological” and inconsistency / “Fluctuated” HRR subjects undergoing EST.

Methods: We collected ESTs data from healthy subjects (n=66) undergoing annual checkups at the Institute for Medical Screening, Sheba Medical Center. We also examined the autonomic function prospectively in individuals (n=29) undergoing EST. Autonomic function was calculated using power spectral analysis. Independent T-Test and analysis of variance with repeated measures (ANOVA) were performed and a p-value ≤ 0.05 was considered significant.

Results: 40% of individuals demonstrated “fluctuated” HRR, 57% demonstrated “normal” HRR (> 18 b/min), and 3% demonstrated “pathological” HRR (≤ 18 b/min) during 17 years (average of 5.39 ± 1.65 tests). HRV indices showed no significant differences between the 3 groups either at rest, peak exercise or during the recovery period.

Conclusion: Our results demonstrate that HRR is not a constant value, and fluctuate between “normal” to “pathologic” among individuals undergoing routine and repeated ESTs. No differences were found in autonomic function indices. These data may question the clinical significance of HRR post exercise.

B-62 Free Communication/Poster - Oxygen Uptake Kinetics

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

988 Board #222 May 29 2:00 PM - 3:30 PM

Ventilatory Variability is Not Associated with Differences in $\dot{V}_{O_{2peak}}$ Between Gas Sampling Intervals

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Scientific literature suggests that oxygen consumption (\dot{V}_{O_2}) variability during cardiopulmonary exercise tests results mainly from ventilation (VE) irregularities. Gas sampling intervals (GSI) reduce irregularities to unveil the underlying metabolic rate, however, large GSIs may obscure the true maximal rate. Despite the many used GSIs, few studies have investigated the simultaneous effect of altering GSI on ventilation and $\dot{V}_{O_{2peak}}$. **PURPOSE:** The purpose of this study was to determine the degree to which GSIs alter VE variability and the correlation with simultaneous changes in $\dot{V}_{O_{2peak}}$. **METHODS:** Recreational to well-trained subjects (12 male, 2 female, 23.9 ± 7.9 years) completed a Bruce treadmill test. Eight GSIs from previous literature were chosen. VE data was taken from the last minute of the last full stage completed by the participant. VE variability was reported as standard deviation (VESD) and normalized standard deviation (VENS $\dot{V}_{O_{2peak}}$), SD divided by number of values used to determine SD). $\dot{V}_{O_{2peak}}$ for each GSI was defined as the single highest \dot{V}_{O_2} value. One-way, repeated measures ANOVAs were used to determine GSI differences in VE variability and $\dot{V}_{O_{2peak}}$. Pearson's correlations were used to determine the strength of relationship between VESD and VENS $\dot{V}_{O_{2peak}}$ for each subject, then averaged for the group. **RESULTS:** ANOVAs showed significant differences for VESD (max: 15-sec block, $5.5 \text{ L} \cdot \text{min}^{-1}$; min: 15-breath block, $3.1 \text{ L} \cdot \text{min}^{-1}$) between ($p < 0.001$, $\eta^2 = 0.841$) and within subjects ($p < 0.005$, $\eta^2 = 0.337$). ANOVAs showed significant differences for VENS $\dot{V}_{O_{2peak}}$ (max: 30-sec block, $2.3 \text{ L} \cdot \text{min}^{-1}$; min: 15-breath moving, $0.1 \text{ L} \cdot \text{min}^{-1}$) between ($p < 0.001$, $\eta^2 = 0.827$) and within subjects ($p < 0.001$, $\eta^2 = 0.644$). $\dot{V}_{O_{2peak}}$ was significantly different between GSIs (max 7-breath median $62.7 \pm 10.6 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, min 30-sec block $58.7 \pm 11.7 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $p < 0.001$, $\eta^2 = 0.577$). The average individual Pearson's correlations for $\dot{V}_{O_{2peak}}$ vs VESD and VENS $\dot{V}_{O_{2peak}}$ were 0.083 and -0.484, respectively, with only one individual reaching significance in VESD ($p < .05$) and three reaching significance in VENS $\dot{V}_{O_{2peak}}$ ($p < .05$). **CONCLUSIONS:** VE variability appears to be subject dependent. Within-subject VE variability did not correlate well with $\dot{V}_{O_{2peak}}$. VE variability does not appear to play a role in the change in $\dot{V}_{O_{2peak}}$ that occurs with a change in GSI.

989 Board #223 May 29 2:00 PM - 3:30 PM

Chronic Adaptations On The Oxygen Uptake Kinetics In Trained Older Adults With Coronary Artery Disease

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Previous studies have reported that slower \dot{V}_{O_2} kinetics typically observed in healthy older individuals can be prevented by long-term endurance training interventions. However, the chronic adaptations on the \dot{V}_{O_2} kinetics and muscle deoxygenation ([HHb]) kinetics response in trained older adults with coronary artery disease (CAD) remains unknown.

PURPOSE: To compare \dot{V}_{O_2} and [HHb] kinetics response in moderate exercise in older adults with CAD and a control group (CG) of healthy active age- and gender-matched individuals. Both groups did at least 6 months the following exercise training (ET) prescription, 3 d.wk⁻¹ x 60-min: 30 min at 60-70% heart rate reserve + 2 x 8-12 repetitions in 6 major muscle groups.

METHODS: thirty-two male participants (age: 63.5 ± 8.3 years; $n = 17$ CAD and $n = 15$ CG) completed the following assessments: 1) incremental symptom-limited cycling cardiopulmonary exercise test; 2) square-wave transitions from rest to moderate-intensity exercise. Pulmonary VO_2 was collected breath-by-breath and [HHb] data of the vastus lateralis was determined by near-infrared spectroscopy. The parameters of the VO_2 and [HHb] kinetics were determined using a monoexponential model. Differences between groups was assessed with the independent-samples t-test.

RESULTS: Peak oxygen consumption and peak work load were lower in CAD compared to CG (CAD: 23.2 ± 6.2 , CG: 30.4 ± 7.5 ml/kg/min, $p < 0.05$; and CAD: 158 ± 47 , CG: 193 ± 50 W, $p < 0.05$). For the square-wave transition, VO_2 amplitude was significantly lower in CAD patients than CG group (10.1 ± 2.9 vs 13.1 ± 3.8 ml/kg/min, $p < 0.05$). In contrast, VO_2 baseline, time constant of the primary phase, gain and mean response time were not significant ($p > 0.05$). The effective deoxy-[Hb+Mb] was not statistically different between groups ($p > 0.05$).

CONCLUSIONS: Long term ET in CAD participants had lower measured $\text{VO}_{2\text{peak}}$ and work load compared to age- and gender matched. However, both pulmonary and muscular oxygen kinetics were not slower in older adults with CAD compared to their training-matched counterparts. These findings support the importance on the referral of elderly patients to community-based cardiac rehabilitation ET program to maintain their submaximal pulmonary and muscle [HHb] kinetics to continue their ability to perform daily activities.

990 Board #224 May 29 2:00 PM - 3:30 PM
Dynamic Adjustment Of Beat-by-beat Cardiac Output And VO_2 Kinetics During Moderate Intensity Exercise Transitions

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(No relevant relationships reported)

The kinetic adjustment of oxygen utilization (VO_2) to exercise transitions of higher metabolic demands is proposed to be affected by central and peripheral alterations within the O_2 transport system and/or intracellular mechanisms of control. Although limitations in O_2 availability within the microcirculation but not at the conduit artery level have been proposed, knowledge is limited in relation to the contribution of the dynamic adjustment of cardiac output (Q) to the VO_2 kinetics response, and how training status might modify this response. **PURPOSE:** This study aimed to compare the adjustment of muscle VO_2 (i.e., Phase II VO_2) to that of central O_2 delivery as examined by the adjustment of Q during step transitions to moderate intensity exercise. **METHODS:** Sixteen young healthy male participants (35 ± 6 yrs) performed 3 step transitions from 20W to moderate-intensity cycling on a cycle ergometer to determine the breath-by-breath VO_2 and the beat-by-beat Q responses. Participants were separated into two groups: trained ($n = 9$, $\text{VO}_{2\text{max}}$ 4.54 ± 0.40 L/min) and untrained ($n = 7$, $\text{VO}_{2\text{max}}$ 3.49 ± 0.68 L/min). Phase II VO_2 and Q were modeled with a monoexponential model. Paired and unpaired t-tests and Pearson product moment correlations were used to compare the time constants of VO_2 (τVO_2) and Q (τQ). Statistical significance was set at $P < 0.05$. **RESULTS:** Mean τVO_2 was faster in the trained (13.9 ± 2.7 s) compared to untrained (24.4 ± 6.4 s). τQ was slower than τVO_2 in the trained (18.5 ± 6.0 s) but not untrained (20.2 ± 9.2 s). No difference was found between τQ between groups. Overall mean data showed no difference between τVO_2 (18.5 ± 7.1 s) and τQ (19.3 ± 7.3 s). No significant correlations were found between τVO_2 and τQ in trained ($r = 0.34$), untrained ($r = 0.47$), or when considering the two conditions together ($r = 0.37$). **CONCLUSION:** This study demonstrated the dynamic adjustment of Q to exercise transition within the moderate intensity domain does not differ amongst trained and untrained individuals, even in the presence of training induced speeding of the VO_2 kinetics. These data support the notion that mechanisms other than central delivery of O_2 , such as improved blood flow redistribution within the active tissues and/or intracellular components are responsible for controlling the rate of adjustment of VO_2 .

991 Board #225 May 29 2:00 PM - 3:30 PM
Case Study of Physiological Measurements during Yoga Asana Practice

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(No relevant relationships reported)

PURPOSE: To conduct a preliminary case study to evaluate real time physiological changes and responses to mediation, Hatha yoga, inversion (experimental) and standing postures (control) and to determine the feasibility, reliability and validity of oxygen consumption and rate pressure product measured by a wearable metabolic device.

METHODS: A 500-hour registered yoga teacher (RYT) volunteered for this study and informed consent was obtained from the subject. A wearable metabolic device, calibrated to according to manufacturer's specifications, was worn for the duration

of each session. We conducted three sessions for this study. Blood pressure (BP), Heart Rate (HR), Oxygen Consumption (VO_2) and Respiratory Quotient (RQ) were monitored. Each session began with a two minute meditation in a cross leg pose, followed by a warm up consisting of Sun Salutations and ended with a cool down. In addition, the first session included Mountain Pose then Chair Pose held for two minutes each. For the third session, supported shoulder stand and headstand were performed in place of the standing postures, each for two minutes. Heart Rate and VO_2 were recorded every minute. We obtained BP during the last 30 seconds of each posture.

RESULTS: Over the trials, mean VO_2 was 3.1 ± 0.08 ml·kg⁻¹·min⁻¹ for the meditative pose, while the inverted pose yielded a mean VO_2 of 19.5 ± 1.5 ml·kg⁻¹·min⁻¹. A t-test between meditation and inversion for VO_2 and HR was significant ($p < 0.05$).

CONCLUSIONS: These results will be put into the broader aspects of yoga and physiological measurements discussed above with further trials and additional subjects. This will assist in the implementation of yoga and other meditative movement technologies to be implemented into exergame software applications that can be hosted on personal computers and smartphones.

Trial	Meditation			Inversions		
	VO_2	HR	RQ	VO_2	HR	RQ
1	2.3	60	0.72	20.2	106	0.87
2	3.1	47	0.72	17.8	87	0.68
3	3.9	63	0.77	20.5	91	0.68
Mean	3.1	56.7	0.74	19.5	94.7	0.74
SD	0.80	8.5	0.03	1.48	10.0	0.11

992 Board #226 May 29 3:30 PM - 5:00 PM
Limb Stiffness Is Lower In Those Who Rupture Contralateral Non-ACLR Knee Post Primary ACL Surgery

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(No relevant relationships reported)

Purpose

The aim of this study was to identify biomechanical differences during jump and CoD testing 9 months after ACL reconstruction (ACLR) between those that went on to injure their non-ACLR limb and those that did not at 2 year follow up.

Methods

Nine months after ACLR, 105 males athletes who were returning to pre-injury sport participation (55 going on to suffer contralateral ACL injury/60 matched subjects with no second injury at 2 years post op) were prospectively assessed using isokinetic strength testing and 3D biomechanical analysis of double leg drop jump (DLJ), single leg drop jump (SLDJ) and planned and unplanned 90° change of direction (CoD) as well as an IKDC questionnaire. Differences in IKDC, strength and jump height measures on the non-ACLR side and in limb symmetry index between groups were analysed with statistical parametric mapping (SPM, 0D unpaired t-test). Biomechanical differences in the jump and CoD tests on the non-ACLR side and in symmetry between groups was analysed with SPM (1d, unpaired t-test). Effect size was calculated using Cohen's D for all analyses.

Results

There was no difference in IKDC score between groups. There was a small effect size difference in quadriceps strength on the non-ACLR side in the group that went on to injure that limb (ES 0.39) with no difference in LSI or across the hamstring strength and jump height tests. There was no difference in measures of biomechanical symmetry between groups for any of the tests and no difference on the non-ACLR side for the CoD tests. There were large effect size differences on the non-ACLR side in the SLDJ and DLJ for COM stiffness (ES 0.78 & 0.82), ground contact time (ES 0.73 & 0.85), lowering of COM to ankle and knee (ES 0.7 to 0.81), vertical ground reaction force (ES 0.63 to 0.78) representing less stiffness on the non-ACLR side in the group that went on to injure non-ACLR limb after return to sport.

Conclusion

This study demonstrated clear biomechanical differences on the non-ACLR side in those that went on to injure the ACL in the limb despite little difference in strength and jump measures and measures of symmetry. These results suggest plyometric exercises to improve limb stiffness may be important to reduced injury risk to the non-ACLR limb after primary ACLR.

993 Board #227 May 29 3:30 PM - 5:00 PM
Gait Asymmetry Can Predict Functional Performance Post ACL Reconstruction: A Pilot Study

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Wearable inertial sensors are practical and inexpensive technology that can be used to detect gait asymmetries following anterior cruciate ligament reconstruction (ACLR). Specifically, individuals after ACLR walk with asymmetries in shank angular velocity (SAV) during landing, which may be indicative of abnormal knee joint loading. However, it is unknown whether these asymmetries in SAV detected at early stage of rehabilitation can predict functional performance at 6 months after ACLR. **PURPOSE:** To investigate whether SAV asymmetries during walking at 4 months after surgery can predict return-to-activity criteria at 6 months in individuals with ACLR. **METHODS:** Fourteen individuals (8 females; age= 27.79±7.9 y) with primary unilateral ACLR participated in the study. Participants were instructed to walk at a self-selected speed along a 12-meter straight walkway at 4 months after surgery. SAV peak was calculated bilaterally during landing as the first negative peak value after heel strike in the sagittal plane. The average SAV peak was calculated for each limb. At 6 months after surgery, participants completed return-to-activity criteria testing (isometric quadriceps index, single-legged hop tests, Knee Outcome Survey-Activities of Daily Living Scale (KOS-ADLS), and Global Rating Score (GRS)). Inter-limb symmetry (ACLR limb/uninjured limb*100) was calculated for SAV peak and functional measures. Linear regression models were used to determine whether SAV peak at 4 months would predict functional performance at 6 months following surgery. **RESULTS:** Asymmetry in SAV at 4 months was a significant predictor for asymmetries in the isometric quadriceps strength ($r^2=0.39$, $p=.02$), single hop for distance ($r^2=0.36$, $p=.02$), triple hop for distance ($r^2=0.34$, $p=.03$), and triple-cross-over hop for distance ($r^2=0.51$, $p=.001$), but not for the 6-meter timed hop ($r^2=0.17$, $p=.14$) at 6 months. Greater SAV asymmetry was a significant predictor for worse scores on the KOS-ADLS ($r^2=0.49$, $p=.006$) and GRS ($r^2=0.46$, $p=.008$). **CONCLUSIONS:** This pilot study showed that gait asymmetry detected by inertial sensors at early stage of rehabilitation can predict functional performance at 6 months after ACLR. Implementing these sensors in clinical practice may help clinicians to monitor gait on a regular basis during rehabilitation.

994 Board #228 May 29 3:30 PM - 5:00 PM
Hip, Knee, And Ankle Contributions During Sloped Walking In Individuals With Aclr

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Reported Relationships: K. Corona: Other (please describe); This was sponsored by an undergraduate research fellowship from Auburn University.

PURPOSE: To compare joint moment contributions at the knee, ankle, and hip during flat, incline, and decline walking between limbs in individuals with ACL reconstructed (ACLR).

METHODS: We analyzed 8 participants with ACLR. Each participant walked flat, uphill, and downhill at 0, 10, and -10 degrees with pre-determined speeds (1.3 m/s, 1.0 m/s, 1.0 m/s). Kinematic and kinetic data were collected during the final 30 seconds of each condition using 17 cameras (Vicon) and an instrumented split-belt treadmill (Bertec). Joint moment contributions at the hip, knee, and ankle were determined by dividing the peak sagittal joint moments by the sum of all three peak moments during stance. A 2x3 (limb x condition) ANOVA was implemented to evaluate interlimb differences across conditions, with post-hoc bonferroni adjustments.

RESULTS: No significant main effect of limb or limb x condition interaction was found. Hip contributions were 13% greater during incline walking (28% contribution) compared to decline (15% contribution). During decline walking (57% contribution) knee contributions were 42% greater compared to incline (15% contribution) and 41% greater compared to flat walking (16% contribution). During flat walking (54% contributions) ankle contributions were 27% greater compared to decline (27% contributions) and 30% greater during incline walking (57% contributions) compared to decline.

CONCLUSIONS: These results suggest that individuals with ACLR are capable of maintaining lower extremity joint symmetry with respect to walking at an incline and decline. Future studies will investigate differences in lower extremity joint contributions between individuals with ACLR and a healthy, age-matched control group.

995 Board #229 May 29 3:30 PM - 5:00 PM
Post-Trial Feedback Alters Single and Dual Task Landing Performance in Healthy and ACL Reconstructed Athletes

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ACLR reconstructed (ACLR) individuals have unequal lower extremity loading during bilateral landing. Post-trial feedback may be used to alter landing mechanics in both healthy and ACLR populations. **PURPOSE:** Determine how post-trial feedback of vertical ground reaction force (vGRF), loading asymmetry (LA), and frontal-plane video (FPV) of control and ACLR groups can be used to alter these variables during single- and dual-task landing performances using a low-cost custom portable system in female athletes. **METHODS:** 24 female athletes were placed in a control (n=12) or ACLR (n=12) group. Single-task (ST) or dual-task (DT with/without jumping for a ball) drop landing trials were performed from a 50 cm height in blocks of 3 ST and 6 DT (pre-tests), 6 ST and 6 DT with post-trial visual feedback, and 3 ST and 6 DT post-tests. Peak vGRF, LA, and frontal plane knee-to-ankle ratio between task (ST or DT) and over time (pre-test, feedback, post-test) were compared using a three-way repeated measures ANOVA. **RESULTS:** Peak vGRF decreased (4.43±0.81 vs. 3.64±0.44 vs. 3.44±0.48 BW, $p<0.001$) and improved knee-to-ankle ratio (0.94±0.13 vs. 1.01±0.12 vs. 1.05±0.12, $p<0.001$) occurred over time (pre-test, feedback, post-test). ACLR group LA was larger compared to controls (0.16±0.08 vs. 0.09±0.08, $p=0.043$). **CONCLUSION:** Peak vGRF and knee-to-ankle ratio improved over time for both groups. The ACLR group had higher LA compared to controls. Post-trial feedback may produce immediate changes in peak vGRF and knee-to-ankle ratio, however more post-trial feedback in LA may be necessary to produce changes in asymmetry in ACLR populations.

996 Board #230 May 29 3:30 PM - 5:00 PM
Spatiotemporal Variables During Self-selected And Fastest-comfortable Walking Speeds In Individuals Following Acl Reconstruction

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PURPOSE: As a first step in translating the wealth of biomechanical gait studies following ACL reconstruction (ACLR), we conducted a study evaluating gait using more clinically applicable tool, the GAITRite portable walking system. Although this system has been used in a number of other populations (i.e., older adults, stroke), it has rarely been used in individuals following ACLR. The purpose was to describe spatiotemporal variables in individuals following ACL reconstruction. We hypothesized that individuals following ACLR would demonstrate between limb differences in spatiotemporal variables. **METHODS:** Participants walked over a portable walking system (GAITRite, CIR Systems, Inc., Franklin, NJ, USA) for three trials at their self-selected walking speed and three trials at their fastest-comfortable speed. They were not permitted to use any assistive devices during trials. Gait speed and spatiotemporal variables were collected and analyzed. Between limb differences in step length and percentage of gait cycle spent in single limb support were analyzed using paired samples t-tests. **RESULTS:** Data from 30 active individuals (23 years; 19 males; 9 mo. post-ACLR; IKDC score=80.5) are presented. Self-selected and fastest comfortable walking speeds were 1.22 and 1.89 m/s. Step length was significantly different between limbs at both self-selected (surgical limb=69.9±8.1; non-surgical limb=70.9±8.5; $p=0.029$) and fastest-comfortable walking speeds (surgical limb=86.7±10.0; non-surgical limb=88.4±10.0; $p<0.001$). There were no significant differences between limbs for percent of gait cycle spent in single limb support during self-selected walking (37.0±1.3 vs 37.3±1.5; $p=0.065$), however, there were significant differences during fastest-comfortable walking speed (40.1±1.6 vs 40.6±1.5; $p=0.003$). **CONCLUSIONS:** Although small, the observed shorter steps may be indicative of off-loading of the surgical limb. Further work is underway to include investigation of earlier time points following ACLR and relationship of spatiotemporal parameters to kinetic data.

997 Board #231 May 29 3:30 PM - 5:00 PM

Dexterity of the Lower Limb Coordination In ACL Injured Athletes

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(No relevant relationships reported)

PURPOSE: Regaining the “dexterity” in lower limb control is important for successful return to sports after ACL injury. The purpose of this pilot study is to evaluate the dexterity of the ACL-injured limb from the viewpoint of the complexity, smoothness, and accuracy of the inter-joint coordination. **METHODS:** Three male volunteers who had histories of ACL rupture participated in this study (One had already reconstructed, and the other had not reconstructed yet at the test day). The motor task was the lower limb target pursuing with the custom-made smart leg press device. As a target, the vertical bar, which sinusoidally up and down with the 0.5 Hz frequency, was presented on the PC screen. The volunteers were asked to control the vertical position of the mouse cursor with the leg press device and follow the target as precise as possible. The ankle, knee, and hip joint angles in the sagittal plane were calculated from 3D motion capture data. To quantify the complexity, the approximated entropies (ApEn) of those joint angles and cursor movement were calculated. The smoothness of the movement was evaluated with the root mean squared jerk (RMSJ), and the accuracy was quantified with the root mean squared error between target and cursor (RMSE). Those three performance variables were presented as the involved/uninvolved ratio. **RESULTS:** The ACL-reconstructed limb showed high complexity, less smooth, and moderately accurate pattern as compared to uninvolved limb. The non-reconstructed limb showed low complexity, less smooth, and not accurate patterns (Fig. 1). **CONCLUSIONS:** The complex and less smooth, but the accurate pattern in the reconstructed limb may suggest that the ACL reconstruction contributed on regaining fine inter-joint coordination which creates precise end-effector control based on the various combination of joint angles. The ACL reconstruction may help not only rebuilding the ligamentous structure but also regaining a dexterity of the movement.

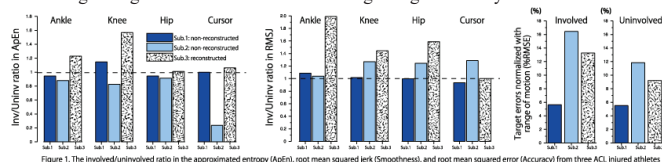


Figure 1. The involved/uninvolved ratio in the approximated entropy (ApEn), root mean squared jerk (Smoothness), and root mean squared error (Accuracy) from three ACL injured athletes

998 Board #232 May 29 3:30 PM - 5:00 PM

Altered Somatosensory Cortex Activation in ACLR Patients during Single-Legged Balance Task

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(No relevant relationships reported)

Recent studies have suggested that an anterior cruciate ligament reconstruction (ACLR) causes neuroplastic changes in the brain associated with muscle coordination. However, it remains unclear how an ACLR patients' brain responds during postural control, which is a good clinical indicator for muscle coordination, when compared to healthy controls. **PURPOSE:** To examine differences in brain activity during a single-legged postural control testing between ACLR patients and healthy controls. **METHODS:** In this preliminary data, four healthy controls (CONT; 21.8±2.2yrs, 84.8±28.3kg, 180.3±5.08cm) and four ACLR patients (ACLR; 28.5±10.7yrs, 83.9±23.3kg, 179.1±10.5cm) volunteered. Frontal theta (Fz, 4-8Hz) and Parietal alpha-2 (Pz, 10-12Hz) electrocortical activations (V^2/Hz) were quantified using a mobile electroencephalograph (EEG) during one-legged postural stability testing. Independent t-tests were used to determine electrocortical activation differences between groups.

RESULTS: The ACLR had a lower Alpha-2 power at Pz compared to the CONT (32.71±3.33, V^2/Hz vs. 38.76±3.24, V^2/Hz , $p=0.041$) during the single-legged postural control. No difference in frontal theta power (Fz) existed between the groups (38.46±1.02, V^2/Hz vs. 41.63±4.34, V^2/Hz , $p=0.205$).

CONCLUSIONS: Our findings reveal less parietal Alpha-2 power in the ACLR patients compared to the healthy controls, while no different frontal theta power between groups during the postural control. As less Alpha-2 power represents less inhibition of sensory and attention to or movement in space, our findings suggest that ACLR patients may have increased cortical activation in the somatosensory cortex to compensate for altered proprioception following a surgical repair, when compared to healthy controls. During critical decision making, such as high intensity athletics,

this heightened somatosensory cortex activation could disrupt the rapid response mechanisms, and it may explain why some ACLR patients suffer poor muscle coordination and are at higher incidence of re-tear.

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Manipulating Initial Peak vGRF During Walking Affects Loading Throughout Stance in Individuals with ACL Reconstruction

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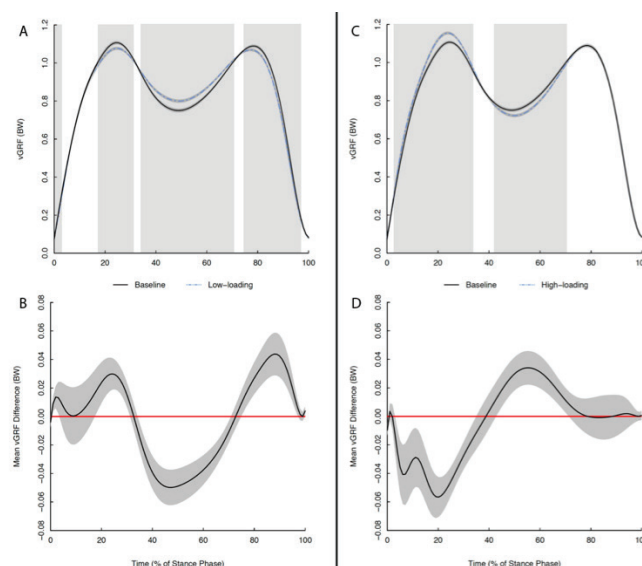
Gait alterations may be associated with osteoarthritis development following anterior cruciate ligament reconstruction (ACLR). Novel gait retraining paradigms are being developed to optimize peak vertical limb loading in the first half of stance; yet the effect of changing this single discrete variable on loading characteristics across the entire stance phase remain unknown.

PURPOSE: Determine the effect of increasing and decreasing the first peak of the vertical ground reaction force (vGRF) by 5% during walking using real-time biofeedback (RTBF) of vGRF throughout stance.

METHODS: 30 ACLR participants (21 females, 20.4±2.9 yrs, 172.7±10.8 cm, 73.2±16.1 kg, 47.8±4.2 months post-ACLR) completed one 20-minute control condition and two experimental conditions (high- and low-loading). For high- and low-load conditions, participants walked for 20 minutes on a force-measuring treadmill with RTBF displayed on a screen cuing a 5% increase (high) or decrease (low) in the first peak of the vGRF relative to vGRF collected in the control condition. vGRFs were collected at 1000 Hz throughout the 19th minute. Two functional analyses of variance were conducted to evaluate vGRF magnitude throughout stance.

RESULTS: Figures 1A and 1C depict mean vGRF, normalized to body weight (BW), throughout the stance phase. Figures 1B and 1D depict pairwise comparison functions (solid black lines) and associated 95% confidence intervals (gray bands), indicating mean differences between the two conditions. Significant between-condition differences existed in the high-loading condition between 42 and 74% of stance, and in the low-loading condition (between 38 and 70%, and 76 and 97% of stance).

CONCLUSION: RTBF, used to cue changes in the first vGRF peak, results in loading alterations throughout stance. Specifically, high loading results in lesser vGRF at midstance but a similar propulsive peak. Conversely, low loading increases vGRF during midstance and decreases vGRF during toe-off.



B-63 Free Communication/Poster - Anterior Cruciate Ligament Injury

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

**1000 Board #234 May 29 3:30 PM - 5:00 PM
Lower Extremity Kinematic Differences Between ACLR Limb and Non-Surgical Limb During a Cutting Task**

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(No relevant relationships reported)

Injury to the anterior cruciate ligament (ACL) is considered one of the most devastating injuries to the lower extremity. The gold standard treatment for ACL injury is surgical ACL reconstruction (ACLR) followed by 6-12 months of rehabilitation. Kinematic lower limb asymmetries in individuals post-ACLR have been identified during a variety of tasks such as walking, hopping and landing. However, there is limited understanding of whether limb kinematic asymmetries exist during a multi-directional high-risk task such as cutting. **PURPOSE:** To assess kinematic asymmetry between ACLR and non-surgical limbs during a cutting task. **METHODS:** Twelve participants (7 females, 5 males) who had undergone an ACLR and returned to full activity participated in this study. Twenty-one lower extremity markers and six marker clusters were placed on participants who ran down a 7-meter runway, planted their foot, and performed a 45° angle cutting task. Cutting tasks were performed to the right and the left of the runway. For left cutting tasks, the right limb was the planting limb and vice versa. Five successful trials were collected for each limb using an 8-camera 3D motion capture system. Joint kinematics were calculated and variables of interest included peak hip and knee flexion, ankle dorsiflexion, and combined sagittal-plane joint excursion. Differences in kinematics between limbs were calculated using paired *t*-tests with the alpha level set to 0.05. **RESULTS:** Peak hip flexion was greater in the non-surgical limb (non-surgical: $45.11 \pm 14.97^\circ$, ACLR: $41.68 \pm 16.62^\circ$, $p = 0.029$), and a trend for greater peak knee flexion was found in the non-surgical limb (non-surgical: $51.9 \pm 8.04^\circ$, $49.44 \pm 8.88^\circ$, $p = 0.068$). Combined sagittal-plane joint excursion was greater in the non-surgical limb during the cutting task (non-surgical: $146.28 \pm 15.90^\circ$, ACLR: $133.66 \pm 16.02^\circ$, $p < 0.01$). **CONCLUSION:** Subjects post-ACLR exhibited greater utilization of their non-surgical limb in the sagittal plane during a cutting task. This movement pattern suggests an avoidance behavior of their ACLR limb and suggests that further rehabilitation is necessary in these individuals post-ACLR in an effort to reduce their risk of re-injury.

**1001 Board #235 May 29 3:30 PM - 5:00 PM
Altered Brain Morphology In Women With History Of ACL Rupture: A Structural MRI Study**

Felix Proessel, Anne Z. Beethe, Adam J. Sterczala, Courtenay Dunn-Lewis, Christopher Connaboy, Bradley C. Nindl, FACSM, Shawn D. Flanagan. *University of Pittsburgh, Pittsburgh, PA.*
(No relevant relationships reported)

Anterior cruciate ligament ruptures (ACLR) are among the most common musculoskeletal injuries in young women. Despite the presence of supraspinal alterations after ACLR, the global and localized morphological underpinnings have yet to be elucidated.

PURPOSE: This study aimed to determine whether brain morphology differs in individuals with a history of ACLR compared to healthy controls with no history of injury.

METHODS: Twenty (10 ACLR, 10 controls) age- and physical activity-matched women (age: 20.9 ± 2.9 yr, weight: 65.9 ± 8.8 kg, height: 165.2 ± 6.2 cm) underwent 3T T1-weighted structural brain magnetic resonance imaging. Mean cortical thickness, grey matter and white matter volume were measured globally and within 70 and 95 anatomically defined regions of interest (ROIs), respectively. A two-way analysis of variance was used to determine differences in global and regional brain structure between ACLR and controls, while correcting for multiple comparisons by controlling the false discovery rate.

RESULTS: Mean duration since the completion of rehabilitation after ACLR was 3.1 ± 1.1 yr. Five injured the left leg and all but two participants were right foot dominant. Cortical thickness was significantly greater for controls in the left precentral gyrus (3.62 ± 0.22 vs. 3.19 ± 0.39 mm, respectively $P = 0.019$) and left paracentral lobule (3.70 ± 0.23 vs. 3.27 ± 0.26 mm respectively; $P = 0.025$). No differences in gray or white matter volume were seen for any of the ROIs between groups.

CONCLUSION: Three years after ACLR rupture, young women demonstrated persistent alterations in cortical thickness relative to individuals without a history of injury. Together with evidence of other supraspinal and neuromuscular deficits,

this suggests cortical involvement in the ACLR pathological process. Thus, neurophysiological assessments should be considered in addition to traditional musculoskeletal measurements.

Supported by a doctoral grant from the National Strength and Conditioning Association (SDF)

**1002 Board #236 May 29 3:30 PM - 5:00 PM
Persistent Reductions in Strength of Sensorimotor Circuits Governing Injured Leg After ACL Rupture**

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(No relevant relationships reported)

Traumatic peripheral injury, like ACL rupture, may alter neurobiological structure and function, with regional reductions in sensorimotor circuit excitability and altered activity patterns in the prefrontal cortex. **PURPOSE:** To examine the long-term neurobiological consequences of ACL rupture on cortical silent periods (CSPs) in the motor cortical (M1) representations of the vastus lateralis (VL). **METHODS:** Nine women with a history of unilateral ACL rupture, repair and rehabilitation (3.3 ± 1.2 years prior) participated in the study. Maximal voluntary isometric contraction force (MVIC) was obtained for each leg during a bilateral, closed kinetic chain movement. Active stimulus response curves were produced at 15% MVIC. Biphasic single pulse transcranial magnetic stimulation (TMS) was delivered to the left or right VL hotspot at 40, 50, 60, 70, 80, and 90% stimulator output (SO). Five pulses were delivered during each 25s contraction, with 30s rest between contractions. SO order and leg were randomized. Contralateral CSPs were measured from TMS stimulus onset to the visual resumption of muscle contractile activity. Responses to each leg-specific SO were averaged for each subject and analyzed via two-way repeated measures ANOVA with Fisher's LSD pairwise comparisons. **RESULTS:** Because CSPs were consistently produced above 70% SO, quantitative analysis was limited to 70, 80, and 90% SO. Significant main effects were observed for SO ($p = 0.001$) and Leg ($p = 0.026$). CSP duration increased in parallel with SO intensity (80% vs. 70% $\Delta = 32.1$ ms, $p = 0.002$; 90% vs. 70% $\Delta = 54.5$ ms, $p = 0.002$; 90% vs. 80% $\Delta = 22.4$ ms, $p = 0.015$). CSPs were generally longer in the injured leg ($\Delta = 21.6$ ms, $p = 0.026$). At 70 and 80% SO, CSPs were longer in the injured leg (70% SO: 25.8ms Δ , $p = 0.017$; 80% SO: 18.3ms Δ , $p = 0.026$; 90% SO: 20.6ms Δ , $p = 0.099$). A trend of increased CSP duration at 90% SO may reflect ceiling effects in the silent period of the injured leg. **CONCLUSIONS:** Injured-leg M1 representation stimulation increased CSP durations compared to the uninjured leg. These deficits persisted years after rehabilitation, and were reproducibly detected during bilateral closed kinetic chain movements at 15% MVIC and SOs above 70%. Our observations indicate long-term reductions in the strength of the sensorimotor circuits governing the injured leg.

**1003 Board #237 May 29 3:30 PM - 5:00 PM
Characterization Of Gender Differences In Kinematics And Surface Emg In ACLR**

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PURPOSE: The mechanism and specific characteristics of differences between sexes are not clear. Using three-dimensional motion capturing system in kinematics and surface electromyography (sEMG) to discuss the changes of hip and knee flexion angle and neuromuscular signals in ACLR.

METHODS: Eight MX-F20 motion-capture cameras were connected with a VICON Vgas CMOS sensor. 10 subjects (5 males and 5 females) were selected after ACLR within 1 year. Making sure model of lower limbs can be caught by cameras. Placing electrodes on subjects' lower limbs of gluteal muscle, vastus medialis, lateral femoral, rectus femoris, and biceps femoris respectively. The electrodes are connected with the NORAXON wireless sEMG signal collector to collect the surface myoelectric signal of 10 muscles during action process. Subjects to stand in a standing position by their feet, on a skip box with the height of 30cm, and landing in the feet. At the same time, collecting landing moments in the course of the operation, gathering flexion angles of hip joint and knee joint, and changing of the 10 muscular sEMG signal. Rate of contributing in these muscles of this motion and hip and knee flexion angles were analyzed. Using a separate T-test comparative analysis of gender was performed by SPSS19.0.

RESULTS: There is a significant difference in hip flexion angle of affected side (unaffected side: Mean = 17.01, SD = 9.28; affected side: Mean = 17.33, SD = 13.53; $t = 0.467$, $p = 0.034$), and knee flexion angle is not significantly different. (unaffected: Mean = 29.0, SD = 15.51; affected: Mean = 27.54, SD = 16.33; $t = -0.298$, $p = 0.404$). There is a significant difference in knee flexion angle of gender (male: Mean

= 376.56, SD = 156.86; female: Mean = 17.52, SD = 9.87; $p = 0.049$), and there is no significant gender difference in hip flexion angle in affected side. Among the Averaged mean amplitude of all periods, the gluteal muscle play an important role in this action.

CONCLUSIONS:

Changing about range of motion and stability of hip joint with affected side is greater than unaffected. The knee flexion angle is affected by gender in the presence of foot-landing-landing process, and knee flexion angle of female knees is smaller than that in males, but in muscle stimulation rate, women are more dependent on thigh muscle strength rather than gluteal muscle.

- 1004** Board #238 May 29 3:30 PM - 5:00 PM
Associations Between Knee Kinematics During Gait And Quadriceps Corticomotor Excitability Following Anterior Cruciate Ligament Reconstruction
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 (Sponsor: Brian Pietrosimone, FACSM)
 (No relevant relationships reported)

Impaired quadriceps function is associated with a more extended knee throughout the stance phase of gait in individuals with anterior cruciate ligament reconstruction (ACLR). This stiffened knee strategy may alter tibiofemoral loading and hasten joint breakdown and osteoarthritis development. Altered quadriceps corticomotor excitability may influence knee kinematic during gait; yet it is unknown if quadriceps corticomotor excitability associates with gait kinematics.

PURPOSE: To determine associations between quadriceps corticomotor excitability and sagittal plane knee kinematics during walking for ACLR individuals. **METHODS:** Thirty-three individuals with unilateral ACLR participated in this cross-sectional study (72% female, 22.2 ± 3.5 years; 72.5 ± 17.2 kg; 1.7 ± 0.1 m; 49.9 ± 40.4 months post-ACLR). Quadriceps corticomotor excitability was assessed as active motor threshold (AMT) from the vastus medialis of the ACLR limb using transcranial magnetic stimulation. Three dimensional biomechanics were collected during over ground walking at a self-selected speed and extracted from the first 50% of stance. We evaluated sagittal plane knee kinematics for the current study including (knee flexion angle at heel strike [HS]; peak knee flexion angle; knee flexion excursion [peak angle - HS angle]). Partial Pearson product-moment correlations were used to assess associations between kinematic variables and corticomotor variables in the ACLR limb controlling for gait speed ($\alpha = 0.05$).

RESULTS: AMT was not associated with sagittal plane knee kinematics in the ACLR limb during walking (angle at HS $r = -0.13$ $P = 0.47$; peak knee flexion angle $r = -0.22$ $P = 0.22$; knee flexion excursion $r = -0.19$ $P = 0.29$).

CONCLUSIONS: No associations were found between quadriceps corticomotor excitability and sagittal plane knee kinematics during gait in individuals with ACLR. Central pattern generators, and not cortical excitability, may more strongly influence gait kinematics. Further work is necessary to determine the influence of altered corticomotor excitability on other gait outcomes including kinetics and lower limb muscle activity patterns.

- 1005** Board #239 May 29 3:30 PM - 5:00 PM
Hyaluronate Injections after Anterior Cruciate Ligament Reconstruction Does Not Improve Running Mechanics
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 (No relevant relationships reported)

Mitigating inflammation early after anterior cruciate ligament reconstruction (ACLR) may help strength and biomechanical outcomes further in rehabilitation. **PURPOSE:** The purpose of this study was to determine if hyaluronate injections (HI) administered early after surgery improves strength and running mechanics six months after ACLR. **METHODS:** Nineteen individuals (Table 1) who suffered an ACL tear during sport participation were enrolled in a randomized double-blind controlled trial to test a post-operative intraarticular HI compared to a placebo one week after surgery (one patient screen failed, and one withdrew after surgery). Six months post-surgery individuals completed isokinetic quadriceps strength (IKQS) at 60°/second and a biomechanical analysis of overground running using 3D motion capture and force plates. Visual 3D was used to calculate bilateral lower extremity biomechanics including knee excursion (KEX) from initial contact to peak knee flexion, and peak vertical ground reaction forces (VGRF). Inverse dynamics were used to calculate internal peak knee abduction

moments (KAM), and peak knee extension moments (KEM). A repeated measures analysis of variance was used to determine differences between groups (injection vs control) and limb (involved and uninvolved). An alpha value of 0.05 was used.

RESULTS: There were no significant differences between the injection group and the control group in peak IKQS or running mechanics, and there was no significant group x limb interaction. In both the injection group and the control group, the involved limb exhibited significantly lower IKQS and KEM, less KEX, and lower peak VGRF (Table 1) compared to the uninvolved limb. **CONCLUSION:** The individuals who received the HI post-surgery did not present with improved strength or running mechanics six months post ACLR compared to control subjects. Future research should investigate further benefits of neuromuscular and physiological factors from a HI.

Table 1	Control Mean ± SD			Hyaluronan Injection Mean±SD		
Sex	Female = 4, Male = 4			Female = 6, Male = 3		
Age (yrs)	18.88± 3.78			18.40± 2.17		
Mass (kg)	87.41± 17.36			81.45± 24.41		
Height (m)	1.78± 0.09			1.74± 0.13		
	Un-involved	Involved	Within Group p-value	Un-involved	Involved	Between Group Involved limb p-value
Peak IKQS (Nm/kg)	217.20± 48.14	128.31± 35.33	<0.001	221.54± 61.28	143.05± 60.74	<0.001
KAM (Nm/kg)	-0.82± 0.52	-0.89± 0.48	0.725	-0.92± 0.67	-0.93± 0.46	0.725
KEM (Nm/kg)	4.08± 0.83	1.93± 0.75	<0.001	3.80± 0.36	2.48± 0.39	<0.001
KEX (°)	27.89± 6.28	18.36± 3.73	0.007	26.74± 0.82	21.93± 1.52	0.039
Peak VGRF (xBW)	3.32± 0.65	2.99± 0.57	0.001	3.13± 0.36	2.95± 0.35	0.007

- 1006** Board #240 May 29 3:30 PM - 5:00 PM
Somatosensory Function and Gait Biomechanics In Individuals With Anterior Cruciate Ligament Reconstruction
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Somatosensory function of the knee is reportedly altered following anterior cruciate ligament reconstruction (ACLR), potentially influencing the risk of osteoarthritis (OA). Poorer somatosensory function is associated with aberrant gait biomechanics in individuals diagnosed with knee OA, but this relationship has not been evaluated following ACLR. **PURPOSE:** To compare somatosensory function between limbs in individuals with ACLR and evaluate associations between somatosensory function of the ACLR limb and gait biomechanics. **METHODS:** Sixty-eight individuals with unilateral ACLR (72% females; age 21 ± 3 yr; time since ACLR 27 ± 15 mo) volunteered. Somatosensory function was assessed bilaterally as the ability to replicate a specified knee flexion angle during a joint position sense task (i.e. joint position sense error - JPSE). Gait outcomes were assessed during the first 50% of stance including vertical ground reaction force (vGRF), instantaneous loading rate, internal extension moment, and internal valgus moment. **RESULTS:** There was no difference in JPSE between the ACLR limb and the contralateral limb (2.9 ± 1.2° vs 2.8 ± 1.7°, $p = 0.71$). Additionally, there was no correlation between the ACLR limb JPSE and vGRF ($r = -0.095$, $p = 0.44$), instantaneous loading rate ($r = -0.121$, $p = 0.33$), internal extension moment ($r = -0.018$, $p = 0.88$), or internal valgus moment ($r = -0.073$, $p = 0.55$). **CONCLUSIONS:** JPSE did not differ between the ACLR and contralateral limbs, and JPSE in the ACLR limb was not associated with gait biomechanics. The mean time since ACLR in our sample was approximately 2 years, thus somatosensory adaptations may have occurred bilaterally at time of testing. Moreover, neuromuscular function of the contralateral limb is also influenced by ACLR, potentially confounding a comparison of JPSE between limbs that may have both undergone changes post-

operatively. These findings suggest the need to compare somatosensory function to a healthy cohort. Furthermore, the small magnitude and limited variability of JPSE likely minimized its ability to predict gait outcomes. Future research is necessary to determine whether somatosensory deficits emerge at later time points post-ACLR compared to a healthy cohort and if they influence knee OA risk.

1007 Board #241 May 29 3:30 PM - 5:00 PM
The Relationship Between Body Composition and Quadriceps Function Following Anterior Cruciate Ligament Reconstruction

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Anterior cruciate ligament reconstruction (ACLR) and obesity are primary risk factors for posttraumatic knee osteoarthritis (PTOA). ACLR leads to quadriceps dysfunction, and greater fat mass may exacerbate this dysfunction as adipose tissue negatively influences strength and muscle activation. Deficiencies in quadriceps function may result in reduced capacity to attenuate energy at the knee, potentially contributing to aberrant joint loading that contributes to PTOA.

Purpose: To determine the relationship between body composition and quadriceps function in individuals with ACLR.

Methods: Thirty-five (20 F, 15 M; 71±12 kg; 23.7±2.8 BMI; 48±35 months since ACLR) individuals at least 6 months removed from unilateral ACLR volunteered for the study. Total body fat percentage (BF%), limb fat mass (LFM), and limb lean mass (LLM) were obtained bilaterally using dual x-ray absorptiometry (DXA). LLM and LFM were normalized to total body mass. Quadriceps function was assessed bilaterally from maximal voluntary isometric contractions (MVIC) and a single limb hop (SLH) task. Peak torque (PT) was averaged from 2 MVIC trials and normalized to body mass. Maximum hop distance was averaged from 3 hop trials. Associations between measures of body composition and quadriceps function were analyzed via Pearson Product Moment correlations.

Results: In the ACLR limb, PT was associated with BF% ($r=-0.620$, $p<0.001$), LFM ($r=-0.525$, $p<0.001$), and LLM ($r=0.552$, $p<0.001$). Hop distance in the ACLR limb was also associated with BF% ($r=-0.656$, $p<0.001$), LFM ($r=-0.698$, $p<0.001$), and LLM ($r=0.441$, $p=0.008$). PT and SLH distances for the contralateral limb were also significantly related to BF%, LFM, and LLM. Body mass index (BMI) was not significantly related to PT or SLH distance in either limb.

Conclusion: BF%, LLM, and LFM are related to measures of quadriceps function following ACLR. The negative associations between functional outcomes (PT and SLH distance) and measure of adipose composition (BF% and FT) indicate that greater fat tissue may contribute to exacerbated quadriceps dysfunction after ACLR. Continued research is needed to evaluate body compositional changes following ACLR and how it influences other factors related to the development of PTOA.

1008 Board #242 May 29 3:30 PM - 5:00 PM
Landing Biomechanics Following Patellar And Hamstring Tendon Anterior Cruciate Ligament Reconstruction

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 (No relevant relationships reported)

Individuals with an ACL reconstruction (ACLR) have different landing adaptations depending if they received patellar (PG) or hamstring tendon (HG) graft reconstruction. No study has evaluated landing biomechanics following these procedures in soccer players.

Purpose: To compare landing biomechanics between soccer players following PG or HG ACLR during planned and unplanned landing tasks.

Methods: Six soccer players with a PG ACLR (age, 25.83 ± 4.44 years; height, 1.73 ± 0.04 m; weight, 70.91 ± 8.00 kg, BMI, 23.64 ± 3.29 kg/m², time since surgery, 4 ± 3.38 years) and 6 soccer players with a HG ACLR (age, 26.83 ± 3.25 years; height, 1.69 ± 0.08 m; weight, 67 ± 6.16 kg, BMI, 23.40 ± 2.08 kg/m² time since surgery, 5 ± 2.89 years) participated in the study. Planned landing (PL) included jumping forward and landing on two force plates, whereas unplanned landing (UL) included jumping forward to head a soccer ball and landing on the force plates. Participants performed 4 trials of each landing task. Outcome measures included peak flexion angles and extension moments of the hip, knee, and ankle joints, and electromyography of gluteus maximus, quadriceps, hamstrings, and gastrocnemius muscles. A 2×2 ANOVA (group × landing) was performed for each measure.

Results: There were no significant group × landing interactions for any of the outcomes. Significant main effects of landing were found. The UL showed smaller hip flexion ($F_{1,10} = 48.77$, $p < 0.001$), smaller knee flexion ($F_{1,10} = 28.02$, $p < 0.001$), and

lower ankle plantarflexion moments ($F_{1,10} = 26.48$, $p < 0.001$). Significant main effects for group for quadriceps muscle and hip extension moments were found showing that the PG group landed with reduced quadriceps activity ($F_{1,10} = 11.72$, $p = 0.007$), and greater hip extension moments ($F_{1,10} = 14.69$, $p = 0.003$).

CONCLUSION: The UL showed greater injury predisposing factors compared with the PL. Although the PG group showed nearly similar landing biomechanics to the HG group during both maneuvers, they (PG) demonstrated a protective landing pattern by reducing quadriceps activity and increasing the demand on the hip extensors. These findings reinforce the clinical emphasis on improving the use of hip and knee joints during landing to reduce the risk of consequent injuries in soccer players following PG ACLR.

1009 Board #243 May 29 3:30 PM - 5:00 PM
Improvements in Somatosensory Function with Vibration do not Influence Gait Biomechanics in Individuals with Anterior Cruciate Ligament Reconstruction

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Anterior cruciate ligament reconstruction (ACLR) incurs somatosensory deficits that potentially alter gait biomechanics and contribute to knee osteoarthritis (OA) risk. Individuals diagnosed with knee OA also display somatosensory deficits, and improving somatosensory function in this population improves gait biomechanics linked to OA progression. Vibratory stimuli potentially improve somatosensory function and may be an effective approach for reducing knee OA risk following ACLR. **Purpose:** To evaluate the effects of vibration on somatosensory function and determine if improving somatosensory function influences gait biomechanics in individuals with ACLR. **Methods:** Gait biomechanics and somatosensory function were assessed in 68 individuals with unilateral ACLR (72% females; age 21 ± 3 yr; time since ACLR 27 ± 15 mo) prior to and following one session of a whole body vibration (WBV), local muscle vibration (LMV), or control (CON) intervention. Gait outcomes included the peak vertical ground reaction force (vGRF) and its instantaneous loading rate, peak internal knee extension and valgus moments, and knee flexion displacement during the first 50% of stance. Somatosensory function was assessed as the ability to reproduce a specified knee angle (active joint position sense error - JPSE) by calculating the difference between the target and reproduced angles. **Results:** WBV ($3.0 \pm 0.3^\circ$ vs. $2.0 \pm 0.2^\circ$, $p = 0.010$) and LMV ($3.1 \pm 0.3^\circ$ vs. $2.2 \pm 0.2^\circ$, $p = 0.045$) decreased JPSE, but no effect was noted with CON ($2.8 \pm 0.3^\circ$ vs. $2.8 \pm 0.2^\circ$, $p = 0.927$). However, the change in JPSE was not correlated with changes in knee flexion displacement ($r = -0.169$, $p = 0.175$), vGRF ($r = -0.047$, $p = 0.706$), loading rate ($r = -0.058$, $p = 0.643$), or internal knee extension ($r = -0.194$, $p = 0.120$) or valgus ($r = -0.034$, $p = 0.789$) moments. **Conclusions:** Vibration improved somatosensory function, but this enhancement did not influence gait biomechanics. A ceiling effect potentially limited the influence on gait biomechanics as evidenced by the small magnitude and limited variability of JPSE. Additionally, a single exposure to vibration may be insufficient to permit somatosensory enhancement that manifests as improvements in gait biomechanics. Future work is necessary to evaluate the relevance of somatosensory deficits to knee OA risk following ACLR.

1010 Board #244 May 29 3:30 PM - 5:00 PM
Walking Biomechanics Six and Twelve Months Following Anterior Cruciate Ligament Reconstruction Compared to Healthy Controls

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Vertical ground reaction force (vGRF) during walking is associated with cartilage metabolism, cartilage composition, and patient symptoms in individuals with anterior cruciate ligament reconstruction (ACLR). However, it is unclear how vGRF changes throughout stance between 6- and 12-months following ACLR compared to an uninjured control group.

Purpose: Compare vGRF between the uninvolved and involved limbs 6- and 12-months following ACLR, as well as to a healthy control limb. **Methods:** vGRF normalized to body weight (BW) was collected at 6- and 12-months following surgery in individuals with ACLR and at one time point in healthy controls. 2 × 2 functional analyses of variance were used to evaluate the effects of limb (involved and uninvolved) and time (6- and 12-months) on time-normalized vGRF waveforms in

individuals with ACLR. Pairwise comparison functions were used to compare time-normalized vGRF waveforms in controls and the involved and uninvolved limbs at 6- and 12-months.

RESULTS: Thirty individuals with ACLR (50% female, 21.6±3.4 years, body mass index (BMI)=24.2±3.2 kg/m²) and 48 controls (67% female, 20.3±1.6 years, BMI=23.1±3.3 kg/m²) completed the current study. At 12-months, both the involved and uninvolved limbs demonstrated lesser vGRF (-3% BW) during the first peak (13-28% of stance) and greater vGRF (+2% BW) during mid-stance (46-66% of stance) compared to 6-months. Over time, the involved limb demonstrated lesser vGRF (-2 to -4% BW) at the first (13-28% of stance) and second (77-87% of stance) peaks compared to the uninvolved limb. Healthy controls demonstrated greater vGRF at the first (6-months: +8% BW, 1-32% of stance; 12-months: +10% BW, 1-33% of stance) and second peaks (6-months: +5% BW, 69-91% of stance; 12-months: +4% BW, 72-92% of stance) and lesser vGRF in mid-stance (6-months: -2% BW, 39-54% of stance; 12-months: -3% BW, 38-64% of stance) compared to the involved limb at both 6- and 12-months. **CONCLUSIONS:** Individuals may achieve more symmetrical loading over time by lowering vGRF of the uninvolved limb between 6- and 12-months following ACLR. Future gait retraining programs may seek to achieve optimal loading in both the involved and uninvolved limbs, as well as symmetrical loading between limbs in individuals with an ACLR.

B-64 Free Communication/Poster - Jumping and Landing

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1011 Board #245 May 29 3:30 PM - 5:00 PM Effects of Arch Type of the Propulsion Mechanics of Jumping and Hopping Tasks

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The structural alignment of the medial longitudinal arch has an influential role in generating the locomotive mechanisms in bipedalism. Evidence suggests healthy arch types exhibit foot function advantageous in forward propulsion. Further, studies indicate that any compositional alterations may result in accessory motion and dysfunction of the foot. However, recent anecdotal assumptions propose that such compromised foot architecture may develop biomechanical characteristics beneficial for propulsive patterns in the medial and lateral directions. The purpose of this study was to examine the influence normal arch (NA) and low (LA) arch types have on propulsive mechanics during directional-specific locomotive tasks. **METHODS:** Twenty-two male collegiate athletes, eleven NA and LA, participated in the study. The Arch Height Index Measurement System was utilized to obtain foot anthropometric measurement for arch height classification. Participants performed three complete trials of lateral hopping (one-leg ski jumping; LJ), unilateral forward hopping (FH), and unilateral stationary hopping (SH), at a self-selected speed. Normalized peak mediolateral ground reaction forces (mGRFs) were collected during the propulsion phase of each task. **RESULTS:** A 2 (arch type) x 3 (jumping/hopping tasks) mixed-factorial ANOVA were performed to determine the effects of arch height on the propulsion phase of each condition. A significant main effect across conditions was observed ($F(1.258, 25.154) = 11.526, p < 0.001, \eta^2 = 0.366$). Follow-up pairwise comparisons indicated that LJ yielded significantly greater lateral force, when compared to FH ($p = 0.011$) and SH ($p = 0.001$). Additionally, a significant difference was observed between arch height ($F(1, 20) = 4.502, p = 0.047, \eta^2 = 0.184$), indicating LA produced larger lateral forces when compared to the NA individuals. However, there was no significant interaction between arch height and the conditions ($F(1.258, 25.154) = 1.756, p = 0.198$). **CONCLUSION:** While the differences amongst conditions were expected, the results revealed that LA displayed larger mGRFs when compared to NA. These findings of this study may suggest that the altered foot positioning of the LA, specifically the everted posture, may act as a beneficial source for directionally specific tasks.

1012 Board #246 May 29 3:30 PM - 5:00 PM

Effect of Sex on Linear and Nonlinear Kinematic Variability during a Stop Jump

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Women are 4 to 6 times more likely to sustain a non-contact ACL injury compared to men. Sex differences in lower extremity landing mechanics are believed to be associated with this increased risk. However, no previous studies have examined sex-specific differences in the variability of lower extremity mechanics during a landing. Variability may provide unique information regarding movement control which pertains to injury risk. **Purpose:** To compare variability in hip and knee kinematics during a stop jump between men and women. **Methods:** 22 male and 20 female healthy uninjured individuals completed seven bilateral stop jumps while lower extremity kinematics and kinetics were collected. Hip and knee joint 3D kinematics were calculated from initial contact to toe off of the first landing and time normalized using Visual 3D. Linear variability was quantified as the standard deviation of peak knee flexion and peak knee ab/adduction across the seven trials, then as the average standard deviation during ground contact. Joint couples were created between knee flexion and knee abduction, hip flexion and knee abduction, hip rotation and knee abduction, knee flexion and knee flexion velocity, and knee abduction and knee abduction velocity, all isolated to the landing phase. Vector coding variability and divergence of nearest neighboring trajectories was quantified for each couple and divergence was quantified for knee flexion and knee abduction angle time series. All variability outcome measures were compared between sex for the dominant limb only using independent t-tests. **Results:** There were no sex-based differences when looking at any linear variability measures. Women had increased vector coding variability for the knee abduction/knee abduction velocity coupling ($F: 36^\circ \pm 12^\circ, M: 29^\circ \pm 7^\circ, p = 0.025$). Women had increased trajectory divergence of knee abduction angles ($F: 1.3^\circ/s \pm 4^\circ/s, M: 1.0^\circ/s \pm 3^\circ/s, p = 0.009$) and of the knee abduction/knee abduction velocity coupling ($F: 1.4^\circ/s \pm 4^\circ/s, M: 1.1^\circ/s \pm 3^\circ/s, p = 0.013$). No other sex-specific differences were observed. **Conclusion:** Women have increased knee kinematic variability during landing then men, particularly when looking at knee abduction. Linear methods of quantifying variability may be insensitive for identifying sex differences in landing variability.

1013 Board #247 May 29 3:30 PM - 5:00 PM

The Effect Of Video And Verbal Biofeedback In Landing Mechanics Parameters During Drop Vertical Jump.

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The video and verbal feedback, could offer a quick, simple and effective alternative to training programs for altering high-risk movement patterns during landing tasks such drop vertical jump. **PURPOSE:** To investigate the effect of verbal and video biofeedback on height, power, flight time and contact time during drop vertical jump. **METHODS:** Twenty-two recreationally trained women (22 ± 4 yrs; 72; 72 ± 3.9 kg; 172 ± 2.9) performed the drop vertical jump (DVJ) using a 40 cm box on three different protocols: control set (CS) – three DVJ were performed without any feedback; video feedback (VF) – the participant watched the video of the CS and were instructed to improve the stability or power in the next trials; verbal feedback (VBF) – the researcher provide instructions regarding landing, lower limb alignment and knee stabilization after CS. Three-minute rest were adopted between trials. A randomized order was adopted between protocols. The DVJ was assessed using a OPTOGAIT System. The jump height, relative power, flight time and contact time were measured during DVJ. **RESULTS:** Regarding the DVJ height (CS = 18.6 ± 7.5cm; VF = 20 ± 6.3cm; VBF = 20.1 ± 5.3cm), no main effects for protocols was noted ($F_{2,26} = 1.647; p = 0.212$). Similar results were observed for relative power (CS = 14.9 ± 4.1 w/kg; VF = 15.2 ± 3.2 w/kg; VBF = 15.1 ± 2.7 w/kg; $F_{2,26} = 0.195; p = 0.824$) and flight time (CS = 0.37 ± 0.08 sec; VF = 0.39 ± 0.06 sec; VBF = 0.39 ± 0.05 sec; $F_{2,26} = 2.776; p = 0.081$). However, a significant main effect for protocols was noted for contact time (CS = 0.64 ± 0.11 sec; VF = 0.69 ± 0.08 sec; VBF = 0.72 ± 0.09 sec; $F_{2,26} = 3.996; p = 0.031$). Longer contact time was observed under VF ($p = 0.033$) and VBF ($p = 0.031$) than CS. **CONCLUSION:** Therefore, the increase in contact time noted under VF and VBF protocols would lead to a decrease in the rate of loading experienced by the hip, knee and ankle joints during the initial landing of DVJ, therefore decreasing injury risk.

Table 1 – Drop vertical jump parameters between biofeedback protocols.
* Significant difference for control set ($p < 0.05$).

	Control Set	Video	Verbal
Height (cm)	18.6 (7.5)	20 (6.3)	20.1 (5.3)
Power (Watts/kg)	14.9 (4.1)	15.2 (3.2)	15.1 (2.7)
Flight time (sec)	0.37 (0.08)	0.39 (0.06)	0.39 (0.05)
Contact Time (sec)	0.64 (0.11)	0.69 (0.08)*	0.72 (0.09)*

1014 Board #248 May 29 3:30 PM - 5:00 PM
Association Of The Autonomous Nervous System And The Neuromuscular Performance In The Vertical Jump

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The interactions between neuromuscular and metabolic processes can produce muscular contraction; Thus, the sympathetic nervous system takes special relevance because of its contribution in the autonomic control, which participates in the energetic supply of the muscular fibers and in the neuromuscular performance. This performance can be evaluated by using the vertical jump test, and its relationship with autonomic regulation is determined by the analysis of heart rate variability (HRV).

PURPOSE: The aim of this study is to describe correlations between HRV and jump performance variables in young female professional soccer players.

METHODS: Thirteen professional female soccer players (Aged: 20.7 \pm 2.6 years; Weight: 60.9 \pm 4.4 Kg) were analyzed, we evaluated HRV to determine autonomic regulation, we also evaluated neuromuscular performance during countermovement (CMJ) and squat jump (SJ) using tri-axial force platform. A statistical analyses was calculated to determine associations between variables of autonomic regulation and jump performance.

RESULTS: Positive associations were found between CMJ contraction time and maximal heart rate (HR) during standing position ($p=0.01$, $r^2=0.4$), SJ peak concentric velocity and LF/HF index in immediate postural change ($P=0$, 0453, $r^2=0$, 2739). Additionally, negative correlations were observed in CMJ concentric force and Stress Index ($p=0.001$, $r^2=0.42$), sympathetic index ($p=0.001$, $r^2=0.41$), average HR ($P=0.002$ $r^2=0.58$) and minimum HR in supine position ($p=0.005$, $r^2=0.52$) and SJ peak concentric velocity and LF/HF index in orthostatic postural change ($P=0$, 0453, $r^2=0$, 2739).

CONCLUSIONS: There is an inverse correlation between concentric contraction force and sympathetic modulation. Likewise, a positive association was found between some parameters related to neuromuscular power and variables of sympathetic activity, evidencing the existence of an influence of sympathetic system in explosive sports. According to this correlation, we suggest the use of HRV parameters that reflect sympathetic activity in the monitoring of training loads.

1015 Board #249 May 29 3:30 PM - 5:00 PM
Screening for Injury Risk in Gymnasts: Examining the Sport Specificity of the Drop Vertical Jump

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Gymnastics has one of the highest rates of lower extremity (LE) ligamentous injury even among contact sports. Excessive frontal plane motion of the LE during landing from a DVJ is linked to injury at the hip, knee and ankle. In addition, sagittal plane motion plays a key role in absorption of forces upon landing. Frontal and sagittal plane motion of the LE during DVJ tasks are often used to screen injury risk in field sport athletes. However, no gymnastics-specific screening tool exists.

PURPOSE: To evaluate the differences in landing biomechanics during the DVJ and a sport specific landing during the roundoff back handspring (ROBHS) among gymnasts.
METHODS:

15 gymnasts (mean age: 17.0 \pm 3.1 y, height: 1.58 \pm 0.81 m, mass: 55.6 \pm 9.3 kg) underwent 3D motion capture during ROBHS and DVJ tasks using a 20-camera motion capture system (240 hz, Vicon™). A 15-segment model was created for joint calculations in Visual 3D™. Ankle, knee, and hip angles were analyzed at initial contact (IC) and peak knee flexion (PKF) of one trial of the ROBHS and DVJ. Paired samples T-test assessed differences in joint kinematics between the two skills ($\alpha=0.05$). **RESULTS:** At IC, sagittal plane ankle (DVJ -19.33 \pm 6.61°, ROBHS 5.04 \pm 7.9°, $p < .001$), hip (DVJ 23.43 \pm 12.17°, ROBHS 62.91 \pm 12.36°, $p < .001$), and frontal plane hip angles (DVJ 4.30 \pm 3.74°, ROBHS -2.48 \pm 3.23°, $p < .001$) are significantly different between skills. At PKF, sagittal plane knee motion is significantly different between skills (DVJ 75.70 \pm 14.43°, ROBHS 93.02 \pm 7.61°, $p < .001$). Hip motion between IC and PKF in two planes (sagittal: DVJ 35.08 \pm 17.96°, ROBHS -25 \pm 5.24°, $p < .001$ and transverse: DVJ -5.16 \pm 5.90°, ROBHS .40 \pm 4.60°, $p = .001$) are significantly different between skills. **CONCLUSIONS:** The difference in hip frontal plane results at IC and PKF between skills could be due to the difference in stance width. Additionally, the DVJ jump task encourages an upright posture at IC, rather than the flexed trunk position at IC of the ROBHS. Furthermore, the sagittal plane results at IC suggest that force absorption across joints differs during the two skills. Our results show that the DVJ may not be a sport specific screening tool for gymnastics. Therefore, further investigation is needed with comparison to other tumbling passes to clarify its usefulness in gymnastics.

1016 Board #250 May 29 3:30 PM - 5:00 PM
The Influence Of Concussion History On Landing Biomechanics In Adolescent Athletes: A Pilot Investigation.

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Sport-related concussion (SRC) is now classified as a major public health concern affecting millions of athletes each year. Recent evidence suggests that previously concussed athletes are at greater risk for lower extremity (LE) injury beyond the resolution of traditional SRC assessment batteries. The current literature has yet to elucidate the biomechanical movement patterns of sport-specific activities that may provide rationale for LE injury risk following SRC.

PURPOSE: To examine landing biomechanics in adolescent athletes who report a SRC history.

METHODS: Three athletes with a SRC history (age: 11.3 \pm 3.5 yrs; previous SRCs: 1.3 \pm 0.6) and two athletes without a SRC history (age: 13.0 \pm 4.2 yrs) completed drop-landings from 30 cm and 60 cm. Three dimensional kinematic data were measured via a 10-camera motion analysis system at 100 Hz, while kinetic data were collected at 1000 Hz with two adjacent force platforms. The preferred limb to initiate the drop-landing was used for data analysis in comparing landing mechanics between groups. Five landing trials were collected to ensure landing performance stability. The independent variables were group (concussion, control) and landing height (30, 60 cm), while the dependent variables included maximum vertical ground reaction force (vGRF), loading rate, and knee joint kinematic parameters during the landing tasks. **RESULTS:** Athletes with a previous SRC demonstrated a 7.9% increase (4.22 BWs vs 3.89 BWs) in maximum vGRF and 14.7% increase in loading rate (109.2 BWs / sec vs 93.2 BWs / sec) from the 60 cm height compared to control athletes. Additionally, previously concussed athletes demonstrated an 8.8 degrees (-4.9° vs 3.9°) and 11.2 degrees (-8.1° vs 3.1°) increase in knee abduction angle from the 30 cm and 60 cm heights compared to control athletes. Knee sagittal plane range of motion was decreased by 56.2% (52.0° vs 81.2°) from the 30 cm height and 30.3% (62.3° vs 81.1°) from the 60 cm height in athletes with a previous SRC. **CONCLUSIONS:** Preliminary analysis highlights that previously concussed adolescent athletes demonstrate landing mechanics that may increase LE injury risk. Specifically, athletes with a SRC history demonstrate sagittal and frontal plane knee motion during landings that are associated with greater risk of an anterior cruciate ligament injury.

1017 Board #251 May 29 3:30 PM - 5:00 PM
Post-Trial Feedback May Alter Single and Dual Task Landing Performance in Female Collegiate Athletes

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(No relevant relationships reported)

Anterior cruciate ligament (ACL) injuries are common during athletic landing activities especially in females. The use of performance-based feedback may be used to alter landing mechanics. **PURPOSE:** Provide vertical ground reaction force (vGRF), loading asymmetry (LA), and qualitative frontal-plane video (FPV) as post-trial feedback of each landing task using a low-cost custom portable system to evaluate

and train female collegiate athletes during single- and dual-task landing performances. **METHODS:** 65 female collegiate athletes participated. Trials were either single-task (ST) drop landings or dual-task (DT with/without jumping for a suspended ball). These were performed from a 50 cm drop height in blocks of 3 ST and 6 DT pre-tests, 6 ST and 6 DT with post-trial visual feedback (peak vGRF in bodyweight (BW), LA, and FPV), and 3 ST and 6 DT post-tests. Peak vGRF and frontal plane knee-to-ankle ratio between landing task (ST or DT) and over time (pre-test, feedback, post-test) were compared using a two-way repeated measures ANOVA. **RESULTS:** There was a decrease in the peak vGRF (4.29 ± 0.93 vs. 3.55 ± 0.57 vs. 3.44 ± 0.66 BW, $p < 0.001$) as well as an improvement in knee-to-ankle ratio (0.97 ± 0.15 vs. 1.01 ± 0.12 vs. 1.04 ± 0.13 , $p < 0.001$) over the time course of the blocked trials. A main effect showed ST to have lower peak vGRF than DT (3.71 ± 0.82 vs. 3.81 ± 0.83 BW, $p = 0.002$), with the greatest difference in the post-test (3.35 ± 0.57 vs. 3.53 ± 0.73 BW, $p = 0.001$). **CONCLUSION:** Peak vGRF was different between ST and DT landing but improved with immediate post-trial feedback. Knee-to-ankle ratio was not different between ST and DT landing but improved with post-trial feedback. Post-trial feedback appears to produce immediate short term changes in landing performance in female collegiate athletes within a single training session.

1018 Board #252 May 29 3:30 PM - 5:00 PM
Cognition Matters: Brain Function May Explain Deficiencies In Unanticipated Single-leg Landing Quality

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It has been speculated that cognitive performance may play a role in injury risk during sports-related movements such as jump landings. However, there is a paucity of research concerning this hypothesis. **PURPOSE:** The present study aimed to elucidate the potential association between brain function and biomechanical stability as well as decision-making success in an unanticipated jump-landing task. **METHODS:** Twenty healthy male participants (27 ± 4 years) performed 70 counter-movement jumps with single-leg landings ($n = 35$ anticipated/ unanticipated each) on a pressure plate. In the anticipated condition, the required landing leg was indicated already before take-off. For the unanticipated jumps, this information was presented only during the flight phase. Biomechanical landing quality was estimated from vertical peak ground reaction force (pGRF), time to stabilization (TTS), center of pressure path way (COP), and standing errors (i.e. falls, touching the ground with the free leg). Decision-making accuracy was assessed as the amount of landing errors (wrong/both feet). Differences between conditions as well as their associations with several measures of cognitive function were analyzed controlling for relevant covariates. **RESULTS:** Unanticipated landings resulted in higher COP values (588 vs. 516 mm, $p < .001$, $d = .65$) and more standing errors ($n = 2.1$ vs. 0.3 , $p < .001$; $d = 1.1$) than anticipated trials. While the biomechanical deficit was not related to cognitive function ($p > .05$), there was an unexpected correlation between the increase in standing errors and higher cognitive flexibility ($r = -.481$, $p = .037$) as well as better working memory capacity ($r = .502$, $p = .028$). An opposite pattern was found for the landing errors occurring in the unanticipated condition: poor decision-making was associated with deficits in cognitive flexibility ($r = .609$; $p < .001$) and working memory ($r = -.500$; $p < .05$). **CONCLUSIONS:** Cognitive function may be an important but understudied moderator of unanticipated jump landing safety. Further research should be dedicated to the development of specific training methods aiming to improve movement-related decision-making under time constraints.

1019 Board #253 May 29 3:30 PM - 5:00 PM
Risk Factors Associated With Medial Tibial Stress Syndrome In Military Cadets During Basic Training

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Medial Tibial Stress Syndrome (MTSS) is one of the most frequent pathologies in military personnel. As the muscles of the lower extremity contribute to the attenuation of impact forces in activities such as running and jumping, neuromuscular performance deficiencies and asymmetries may be associated with an increased risk for musculoskeletal injuries. **PURPOSE:** To determine the kinetic risk factors associated with MTSS through the bilateral countermovement jump (CMJ) in army cadets. **METHODS:** Ethical approval was granted by the General José María Córdova Military School of Cadets where the study was conducted. This observational study

was executed in a cohort of 123 cadets (followed for 24 weeks) who entered to the military school in 2017. Anthropometric, demographic data and MTSS history were recorded. Jump height (cm), peak landing force (N*kg), peak landing force asymmetry (%), concentric mean force (N*kg), concentric mean force asymmetry (%), eccentric deceleration rate of force development (EDRFD [N/s*kg]) and EDRFD asymmetry (%) were evaluated through the bilateral CMJ on a pair of uniaxial force platforms. After the follow-up, the cadets with MTSS were determined through the clinical history. **RESULTS:** The incidence of MTSS was 13% ($n = 16$). In the bivariate analysis, height, EDRFD asymmetry, sex (female; $RR = 2.84$; 95% CI = 1.16-6.94), provenance (rural; $RR = 2.65$; 95% CI = 1.04-6.72), and MTSS history (yes; $RR = 5.71$; 95% CI = 2.23-14.62), were significantly associated with MTSS ($p \leq 0.05$). In the logistic regression, EDRFD asymmetry ($OR = 1.03$; 95% CI = 1.00-1.07), sex ($OR = 4.91$; 95% CI = 1.38-13.37), and provenance ($OR = 4.82$; 95% CI = 1.04-6.72), were significantly associated with MTSS ($p \leq 0.05$). MTSS history was significant for $p \leq 0.1$ ($OR = 8.95$; 95% CI = 0.68-118.73). The predictive model was significantly associated with MTSS ($p \leq 0.01$), had a sensitivity of 31.3% and a specificity of 99.1% (overall prognosis of 90.2%). **CONCLUSIONS:** While we identified important non-modifiable risk factors for MTSS in cadets during basic training, we also found that higher CMJ EDRFD asymmetry was a significant risk factor. This suggests that the bilateral CMJ may be a useful tool for pre-entry screening in and that high EDRFD asymmetry could be a potential target of pre-basic training risk reduction conditioning.

B-65 Free Communication/Poster - Firefighter Physiology

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

1020 Board #254 May 29 2:00 PM - 3:30 PM
A Comparison Of On- And Off-Duty Physical Activity In Career Firefighters

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Physical inactivity coupled with increasing obesity levels in firefighters plays a critical role in accumulating cardiovascular events. **PURPOSE:** To examine differences in career firefighters' objectively measured physical activity (PA) levels while on- and off-duty. **METHODS:** Twenty-nine career firefighters (age: 34.45 ± 7.15 yr; BMI: 28.97 ± 2.52 kg · m⁻²) participated in a non-experimental, within-subjects study. Firefighters wore an accelerometer during waking hours of their nine-day tour, which included three, 24-hour on-duty days and six, off-duty days. Accelerometers assessed PA intensity using Freedson (1998) cut-points and step count. Height and weight were also measured to calculate BMI. Dependent t-tests, independent t-tests, and Pearson product-moment correlations were used to analyze the data in SPSS (v24). **RESULTS:** Firefighters (overweight=20; obese=9; normal weight=0) met the ACSM PA guidelines more often while on-duty ($n = 17$) compared to when they were off-duty ($n = 9$). While on-duty, firefighters attained an average of 35.51 ± 19.22 minutes of moderate-to-vigorous physical activity (MVPA) compared to 27.82 ± 18.91 minutes ($p = 0.055$, $d = 0.40$) when off-duty. Firefighters engaged in significantly more light PA during on-duty days (351.11 ± 59.90 minutes) compared to off-duty days (315.83 ± 86.90 minutes) ($p = 0.026$; $d = 0.47$). There were significant correlations between on- and off-duty days for sedentary behavior ($r = -0.53$, $p < 0.001$), moderate PA ($r = 0.37$, $p < 0.05$), and MVPA ($r = 0.41$, $p < 0.05$). **CONCLUSION:** As a group, firefighters in this study did not meet ACSM PA guidelines, especially when off-duty, which may place them at greater risk for a cardiac event. Firefighters must rely on their cardiovascular health to perform the physiologically demanding tasks that their job requires. In the future, researchers need to collaborate with fire departments across the country to assess and develop ways to enhance PA levels in firefighters with the goal of improving their overall health and well-being, which ultimately may decrease the risk of cardiac events.

1021 Board #255 May 29 2:00 PM - 3:30 PM
Comparing Physical Fitness in Career vs. Voluntary Firefighters

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PURPOSE: Some firefighting departments are composed of professional firefighters (career firefighters) while some smaller towns cannot fully fund a professional firefighting department and rely on their citizens to volunteer their time and put their lives at risk to perform fire suppression and other related firefighting tasks when those events arise. The purpose of this study was to assess the potential similarities and differences in health and physical fitness profile between career firefighters and volunteer firefighters.

METHODS: The research protocol consisted of a health and physical fitness assessment testing the 5 components of health-related fitness (body composition, cardiovascular fitness, muscular strength, muscular endurance, and flexibility) using previously published and accepted protocols. The participant population consisted of career firefighters (CFF) who were all members of the Bowling Green Fire Department in Bowling Green, KY and voluntary firefighters (VFF) were all members of the Warren County Fire Department (Warren County, KY). The total sample size consisted of 139 firefighters comprised of 120 CFF and 19 VF.

RESULTS: An independent *t*-test showed evidence of CFF having a significantly higher value/score for the following variables: height ($p = 0.034$), $\dot{V}O_2$ max ($p = 0.006$), push-ups completed ($p = 0.023$), and plank time ($p < 0.0005$). VFF had a significantly higher value for the following variables: fat mass ($p = 0.002$), body fat percentage ($p < 0.0005$), and absolute grip strength ($p = 0.029$). There were not shown to be any significant differences between groups for the following variables: age ($p = 0.299$), body mass ($p = 0.161$), fat-free mass ($p = 0.292$), body mass index ($p = 0.056$), flexibility ($p = 0.097$), or relative grip strength ($p = 0.934$).

CONCLUSIONS: In regards to the physical fitness testing of the current sample, the VFF had a significantly worse health and fitness profile across a number of variables compared to the CFF. Despite the financial and commitment status of volunteer firefighting departments, they perform an equally dangerous and important job as firefighters of professional/career firefighting departments and more attention should be directed at developing the fitness and performance of these firefighters as well.

1022 Board #256 May 29 2:00 PM - 3:30 PM
Handgrip Strength Levels in Male and Female Brazilian Military Firefighters

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Low handgrip muscular strength (HMS) is associated with increased morbi-mortality. HMS has been shown to predict some firefighters' job-related task performance.

However, little is known about firefighters HMS descriptive values and there is no specific fitness categories for grip strength for firefighters. **PURPOSE:** To describe HMS in Brazilian military firefighters in association with gender and job experience.

METHODS: We evaluated 290 firefighters (70% men) with mean age of 28.9±6.4 yrs. HMS was measured using a calibrated handgrip dynamometer (SaehanCorp, Korea). Volunteers performed to maximally maximal contractions with each hand, holding the dynamometer in line with the forearm in the upright position (ACSM 10th ed guideline). Final score was the sum of the highest values on each hand and categorized by ACSM guideline. Fair or poor HMS were classified as suboptimal, all other categories (excellent, very good and good) were classified as good strength. Data are presented as median (min-max) values due to nonparametric distribution (Kolmogorov-Smirnov test). Chi-square (of Fisher) test was used to compare

classification. Job experience was classified as rookie (those who have just finished training academy) and as veteran. Mann-Whitney test was used for comparisons. **RESULTS:** Absolute HMS was higher in men as compared to women: 100 (61-156) vs 64 (45-97) kg/f ($p=0.05$). However, the proportion of volunteers in each category was similar among genders ($p=0.26$). Proportions of HMS categories are shown on Table 1. **CONCLUSION:** This cross-sectional study showed that about 25% of volunteers showed suboptimal HMS and that male veterans had higher strength than rookies. Data support the recommendation for upper limbs strength training among firefighters, mainly among those joining the corporation.

Table 1: Handgrip strength classification among male and female firefighters by job experience				
Sex	Strength Classification	Rookie	Veteran	p value*
Male	Good	101 (63.1%)	35 (83.3%)	0.01
	Suboptimal	59 (36.9%)	7 (16.7%)	
Female	Good	58 (73.4%)	7 (77.8%)	1.00
	Suboptimal	21 (26.6%)	2 (22.2%)	

*: Chi-square or Fisher test

1023 Board #257 May 29 2:00 PM - 3:30 PM
Total Energy Intake and Self-selected Macronutrient Distribution During Wildland Fire Suppression

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Wildland firefighters (WLFF) are required to work long hours in extreme environments resulting in high daily rates of total energy expenditure (TEE) (Ruby, 2002; Cuddy, 2015). Increasing the number of eating episodes throughout the workshift and/or providing rations that better promote convenient nutrient delivery (Cuddy, 2007; Montain, 2008) has been shown to augment self-selected work output on the fireline. Regular consumption of supplemental carbohydrate (CHO) has also demonstrated enhanced work output, particularly during the shifts' latter hours (Cuddy, 2007). However, it remains unclear how current feeding strategies of WLFF compare to more frequent nutrient delivery. **PURPOSE:** The aim of the current study was to determine the self-selected field total energy intake (TEI), composition and patterns of WLFF feeding during wildland fire suppression shifts. **METHODS:** 86 WLFF (16 female, 70 male; 27.5±6.4 yrs) were deployed to 12 different wildland fire assignments across six regions of the US during the 2018 fire season. Pre- and post-shift food inventories were collected at WLFF basecamp and provided item-specific nutrient content (calories [kcal], CHO, fat, protein). Workshift nutrient consumption (TEI, feeding frequency [total number of and interval between feeding episodes], feeding episodic composition) was monitored in real-time by field researchers on the fireline via observational data capture in mobile tablets. **RESULTS:** Workshift length averaged 14.0±1.2 hr, with a TEI of 1523±639 kcal (51±10, 37±9, 14±5 % for CHO, fat, and protein, respectively). The total number of eating episodes was 4.3±1.7 with an average interval of 117±76 min. Eating episodes averaged 346±311 kcal and included 44±38 g CHO. Using similar intake metrics, TEI was 893±353 and 1356±560 kcal for breakfast and dinner, respectively. **CONCLUSION:** The present workshift TEI approximates 34% of the TEE compared to our prior doubly labeled water studies (Ruby, 2002; Cuddy 2015). These data also demonstrate that WLFF consumption patterns using current rations may not deliver adequate nutrients for the occupational demands of WLFF. Future work should elucidate the impact of workshift provisions on overall patterns of self-selected work output.

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1024 Board #258 May 29 2:00 PM - 3:30 PM
Longitudinal Changes in Single-Leg Dynamic Balance Asymmetries Among Firefighter Recruits: An Observational Cohort Study

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Previous research has demonstrated a link between asymmetries in single-leg dynamic balance ability and musculoskeletal injury (MSKI) risk. Specifically, previous research has indicated that a right vs. left asymmetry of ≥ 4 cm on the anterior reach direction of the star excursion balance test (SEBT_{ANT}) is associated with a greater risk of MSKI.

Previous research also suggests that the overall dynamic balance ability of firefighter recruits increases as they progress through their firefighter recruit training academy, but then decreases during the transition into active-duty service. However, longitudinal changes in single-leg dynamic balance asymmetries during and after firefighter recruit training academies have yet to be examined. **PURPOSE:** To describe longitudinal changes in single-leg dynamic balance asymmetries among firefighter recruits.

METHODS: 27 male firefighter recruits (mean \pm SD, age = 29.9 ± 4.1 yrs; height = 179.8 ± 4.6 cm; body mass = 87.2 ± 9.7 kg) enrolled in the same training academy volunteered to participate in the current study. The SEBT_{ANT} was conducted bilaterally at the beginning (W1) and end (W14) of their firefighter training academy, as well as at the end of the probationary period of their active-duty service (W38). All SEBT_{ANT} data were recorded in cm and right vs. left SEBT_{ANT} asymmetries were defined as: < 4 cm and ≥ 4 cm. A Cochran's Q Test was utilized to examine for changes in the frequency of SEBT_{ANT} right vs. left asymmetries across time. An alpha of 0.05 determined statistical significance. **RESULTS:** Although the number of firefighter recruits who demonstrated a right vs. left SEBT_{ANT} asymmetry of ≥ 4 cm increased from W1 to W14 (7/27 to 9/27), and from W14 to W38 (9/27 to 11/27), there was not a significant ($Q = 1.333$, $df = 2$, $P = 0.513$) change in asymmetry frequency over time (25.9% vs. 33.3% vs. 40.7%). **CONCLUSION:** Despite previous research suggesting that there are significant changes in dynamic balance ability among firefighter recruits as they progress through their firefighter recruit training academy and begin active-duty service, similar significant changes in single-leg dynamic balance asymmetries were not identified. Future research should prospectively examine which factors of dynamic balance ability are most predictive in MSKI risk among this cohort population.

1025 Board #259 May 29 2:00 PM - 3:30 PM
Contributors to Perceived Occupational Fatigue in Career Firefighters

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Firefighters are susceptible to work-related fatigue due to long and strenuous shiftwork. Work-related fatigue can be linked to the majority of the fatal and non-fatal injuries in the fire service. **PURPOSE:** The purpose of this study was to examine the influence of isometric strength, body mass index, and age on perceived work-related fatigue in career firefighters. **METHODS:** Thirty-two firefighters [29 males, 3 females; age: 33.7 ± 9.2 years (20-50); stature: 177.2 ± 7.6 cm (153.0-190.5); mass: 94.5 ± 20.8 kg (64.0-152.0)] volunteered for this investigation. Participants completed an occupational fatigue questionnaire that measured three dimensions of work-related fatigue: acute fatigue (AF), chronic fatigue (CF), and inter-shift recovery (IR). Participants performed 3-4 leg extension isometric maximal voluntary contractions (MVCs) on a custom-built calibrated load-cell dynamometer with a two minute recovery period in between each contraction. Maximal strength, or isometric peak force, was calculated as the highest 100ms value during the MVC plateau. Local firefighters work three 24-hr shifts on-off over one rotation followed by four days of rest. Maximal strength testing was completed pre-rotation and post-rotation (five days apart). Percent change in maximal strength [$\% \Delta PF = (Post-Pre)/Pre \times 100$] was calculated. Stepwise regression analyses were conducted for each dimension of fatigue. Predictor variables were $\% \Delta PF$, body mass index, and age. An alpha level was set *a priori* at 0.05 for all analyses. **RESULTS:** The stepwise analyses suggest that age alone significantly contributed to AF ($R^2 = 0.274$, $P = 0.001$) and CF ($R^2 = 0.280$, $P = 0.001$). Age and $\% \Delta PF$ combined significantly contributed to IR ($R^2 = 0.269$, $P = 0.004$). BMI failed to significantly contribute to any of the stepwise regression models. **CONCLUSION:** These findings suggest that older firefighters experience greater levels of perceived acute and chronic work-related fatigue. Furthermore, older firefighters with greater maximal strength losses experience poorer perceived IR. While age is non-modifiable, interventions aiming to mitigate strength loss across shiftwork may be helpful at enhancing IR. Supported by the National Institute of Occupational Safety and Health (T42OH008673)

1026 Board #260 May 29 2:00 PM - 3:30 PM
Sedentary Behavior and Daily Steps Count In Brazilian Wildland Military Firefighters - Brasília Firefighters Study

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Wildland firefighters' (WF) routine involves long displacements and intense physical demands, interspersed with sedentary behavior (SB). Little is known about SB and daily steps pattern of WF during routine work. **PURPOSE:** We analyzed the SB and total daily steps of Brazilian WF during a 24-hour shift-work. **METHODS:** We evaluated 22 WF, aged 35.9 ± 6.4 yrs, BMI of 25.3 ± 2.9 kg/m², during the dry season.

Volunteers wore an accelerometer (ActiGraph-GT3X+) during a 24h shift work and reported main duties performed on a log. SB was evaluated by the vector magnitude using < 200 counts/min as cut-off point. We compared SB and daily steps according to 3 periods of the day: morning (08:00-11:59 plus 06:00-07:59 of the following day); afternoon (12:00-17:59) and evening (18:00-23:59). Night period (00:00 to 05:59) was excluded due to insufficient data. We compared SB and daily steps during the day and between those who participated or not in at least one episode of wildland fire suppression (Mann-Whitney test). Friedman text with a Wilcoxon post-hoc test (p -value ≤ 0.02) were used to compare the 3 moments. Data are shown as median (min-max). **RESULTS:** WF spent 73 (15-142) min in the morning, 131 (17-192) min in the afternoon and 109 (13-193) min in the evening on SB. They accumulated 3,508 (1,322-12,237) steps in the morning, 4,105 (963-18,450) in the afternoon and 5,499 (571-13,883) in the evening. Those who participated or not in at least one episode of wildland fire suppression showed similar SB and daily steps ($p > 0.05$). SB pattern throughout the day are show on Figure 1. **CONCLUSION:** WF achieved similar daily steps in the 3 periods of the day. Time spent in SB was higher in the evening as compared to the morning. Our results suggest that WF remain little time in SB as compared to other professions and achieved a high daily steps count ($> 10,000$) during a 24-h routine work.

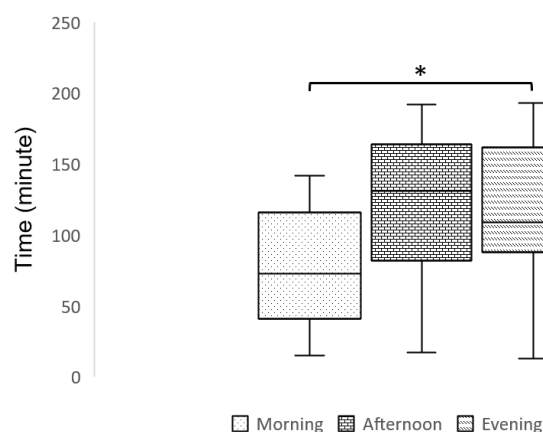


Figure 1. Sedentary behavior by different moment on day among on-duty firefighters Friedman text ($p = 0.03$); *Wilcoxon text ($p = 0.01$)

1027 Board #261 May 29 2:00 PM - 3:30 PM

Firefighters' Quality of Life is Positively Associated With Cardiorespiratory Fitness Both on Men and Women

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Firefighting is a hazardous profession. Occupational hazard may negatively impact quality of life (QoL). Firefighters' job-related activities result in vigorous physical effort that requires considerable cardiorespiratory fitness (CRF). The National Fire Protection Association (NFPA) recommends a CRF $\geq 42 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ (12 METs) for safety purposes. **PURPOSE:** We evaluated QoL of male and female firefighters in association with CRF. **METHODS:** We evaluated 104 female (35.0 \pm 6.2 yrs, BMI: 23.2 \pm 2.5 kg/m²) and 686 male (37.9 \pm 6.8 yrs, BMI: 26.3 \pm 3.0 kg/m²) Brazilian firefighters. CRF was estimated by the 12-min Cooper test and QoL was evaluated by the World Health Organization QoL questionnaire in four domains: physical (PHYD), psychological (PSYD), social relationship (SRD) and environment (ENV). QoL was compared within each gender among those who met or did not meet the minimum CRF recommendation for firefighters. Among men we used the NFPA CRF cut-off point (12 METs) and for women we used its corresponding value from the Cooper test gender-specific classification (9.5 METs). Comparison were made by Mann-Whitney test; GLM was applied for age-adjustment and Spearman test for correlations. **RESULTS:** Absolute CRF among men was higher than among women: 12.2 \pm 1.7 vs 10.1 \pm 1.7 METs ($p < 0.001$), but the proportion of volunteers who met the recommended CRF was similar between genders. QoL was similar between genders in all domains ($p \geq 0.21$). QoL comparisons by gender are shown on Table 1. QoL showed low significant correlation with CRF among women ($0.2 < r_s < 0.26$) and men ($0.16 < r_s < 0.28$) ($p < 0.04$). **CONCLUSION:** Among both men and women firefighters, better QoL was significantly associated with higher CRF. Firefighters with CRF above the minimum recommended gender-specific threshold showed higher values of QoL. Our results support the recommendation for regular physical training among firefighters both for safety and QoL reasons.

Table 1: Median (min - max) values of QoL among 104 female and 686 male firefighters compared by CRF

	Women	Women	Men	Men
	<9.5 METs	≥ 9.5 METs	<12 METs	≥ 12 METs
	n = 34 (32.7%)	n = 70 (67.3%)	n = 289 (42.1%)	n = 397 (57.9%)
PHYD	67.9 (28.6–96.4)	78.6 (50.0–100)*	71.4 (17.9–100)	78.6 (21.4–100)*
PSYD	70.8 (29.2–100)	75.0 (50.0–95.0)*	70.8 (20.8–100)	75.0 (16.7–100)*
RSD	64.0 (37.5–87.5)	75.0 (33.3–100)	75.0 (25.0–100)	75.0 (16.7–100)*
ENV	68.8 (53.1–90.6)	75.0 (16.7–100)*	62.5 (25.0–100)	68.8 (15.6–100)*

* $p < 0.05$ -Mann-Whitney test, age adjusted by GLM

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Comparing the Subjective and Objective Responses to Submaximal and Maximal Tasks in Firefighter Recruits

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Previous literature has established that numeric ratings of perceived exertion (RPE_{NUM}) are associated with heart rate (HR) during a task. Recently, the use of a 100mm visual analog scale (RPE_{VAS}) has been used as an alternative to RPE_{NUM} . Prior FF research has not concurrently examined RPE_{NUM} , RPE_{VAS} , and HR during tests of varying intensity. If RPE_{NUM} and RPE_{VAS} are not different from an objective measure such as HR during tasks of varying intensity, then RPE may represent a low cost method to determine the level of exertion following a FF task. **PURPOSE:** To determine the influence of test (submaximal and maximal) on RPE_{NUM} , RPE_{VAS} , and HR. **METHODS:** Seventeen FF recruit volunteers (20.63 \pm 0.5 yrs, 178.0 \pm 8.2 cm, 84.89 \pm 14.82 kg) from an urban fire department completed a submaximal Step-Test (SUB) and maximal Tower Climb Test (MAX). RPE_{NUM} and RPE_{VAS} were collected following each test and expressed as a percent of maximal possible response. HR was the average HR from each test and expressed as a percent of estimated maximum. A 2x3 repeated measures ANOVA was performed to determine the effect of test (SUB, MAX) on response (RPE_{NUM} , RPE_{VAS} , HR). An alpha of $p < 0.05$ determined statistical significance with an adjusted alpha of $p < 0.017$ for follow-up tests. **RESULTS:** The 2x3 ANOVA indicated a significant interaction between test type and response ($F(1,463,64) = 41.626$, $p < 0.001$). Follow-up paired t -tests revealed that for each response, SUB was significantly ($p < 0.001$) lower than MAX. There were non-significant differences between RPE type for the SUB (RPE_{NUM} [28.2 \pm 6.3%] vs. RPE_{VAS} [26.9 \pm 11.1%]; $p = 0.489$) and MAX (RPE_{NUM} [76.8 \pm 17.6%] vs. RPE_{VAS} [76.7 \pm 15.2%]; $p = 0.949$) tests. For the SUB test, HR (69.9 \pm 5.3%), was significantly ($p < 0.001$) higher than both RPE types, whereas for the MAX test HR (86.0 \pm 4.7%) was not different from RPE_{NUM} ($p = 0.059$) or RPE_{VAS} ($p = 0.036$). **CONCLUSIONS:** The absence of a difference between RPE and HR during MAX suggests that RPE may be a suitable alternative to heart rate monitors to monitor intensity in FF recruits during maximal tasks. The significant differences between RPE_{NUM} and RPE_{VAS} and HR during SUB suggests that FF recruits may underestimate the intensity of a SUB task. Practitioners should use caution when relying solely on subjective feedback from SUB tasks as RPE may underestimate actual intensity.

1029 Board #263 May 29 2:00 PM - 3:30 PM

Effect Of Uncompensable Heat From The Wlff Helmet

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Despite upwards of 40-50% of heat lost through the head during exercise, little regard has been given to the role of the wildland firefighter (WLFF) helmet in uncompensable heat stress. **PURPOSE:** To investigate factors of heat stress with and without a standard issue WLFF helmet. **METHODS:** Eleven male subjects (age = 25.2 \pm 4.9 yrs) were recruited with a $\dot{V}O_{2\max} > 40 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ and $\leq 65 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ($\dot{V}O_{2\max} = 54.2 \pm 5.5 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$). Subjects were required to finish a 90-minute exercise protocol in a heat chamber (35°C and 30% RH) with a standard WLFF para-aramid shirt and pants, cotton t-shirt, and either with or without a WLFF helmet. A randomized crossover design was implemented, with a minimum two week washout period. Skin blood flow to the head and neck (SBFH; SBFN), head heat (HH), T_{sk} , skin temperature on chest and neck (T_{skC} ; T_{skN}), HR, PSI, RPE, perceived head heat (PHH) and sweat rate were recorded during trials. A 2x3 ANOVA was used to analyze SBF, and 2x4 ANOVA was used to analyze HH, CT, ST, HR, PSI, RPE, and PHH. One-way ANOVA was used to analyze sweat rate. **RESULTS:** Nine of the 11 subjects were able to finish the 90 minute exercise trial. The HH, SBFh, and PHH (36.41 \pm 0.76°C w/helmet v. 35.22 \pm 0.98°C w/out helmet; 211.9 \pm 86.8 AU w/helmet v. 185.5 \pm 73.3 w/out helmet; 10.1 \pm 3.2 AU w/helmet v. 8.5 \pm 2.6 w/out helmet; respectively) were all significant ($p < 0.05$) with a main effect between trials. HR, PSI, T_{sk} , and T_{skN} demonstrated main effects of time ($p < 0.05$), but were not different between trials. Sweat rate was not significant among trials (2.09 \pm 0.44 L \cdot h⁻¹ w/helmet vs. 1.85 \pm 0.44 L \cdot h⁻¹ w/out helmet). **CONCLUSION:** These data (HH, SBFh, and PHH) suggest that the current WLFF helmet causes heat accumulation and resultant redirection of blood flow to the head. While some physiological factors (T_{sk} , HR, T_{skN} , PSI, and sweat rate) did not reach significance between trials; trends existed for PSI ($p = 0.09$) and RPE ($p = 0.09$). The design of the WLFF helmet lacks ventilation, which from these data, may result in metabolic alterations, and perceived discomfort.
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1030 Board #264 May 29 2:00 PM - 3:30 PM

Th Effects Exercise Within Personal Protective Equipment Microclimate On Mental Processing On Different Age PopulationsMorgan D'Ganigian, Cory Coehoorn, Lynne Stuart-Hill.
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(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine the effects of exercise within personal protective equipment microclimate leading to rapid head acquisition on mental processing and decision making in different age populations. **METHODS:** The study was factorial in design and included 15 male participants with an age range from 19-54 who were divided into 2 groups: 30 years old and above group (+30) (n=8), and 29 years old and below group (-29) (n=7). Each group performed a Go/No-Go test while wearing a Muse headband to obtain P300 ERPs, prior to and post exercise in firefighting turnout gear (PPE) and t-shirts and shorts while wearing a backpack matched in mass to the gear worn in PPE (CON). Subjects completed a graded exercise test until core temperature had rose 39.5 °C, or voluntary max had been achieved. The muse data was collected/analyzed by Peer-Analytics and later tested within Excel by a 2 tailed T-test between: 30+ and -29, and CON and PPE conditions. **RESULTS:** There was no significant differences between the 30+ and -29 P300 ERPs or within each groups CON/PPE conditions. However, both groups made significantly more errors ($p<0.05$) post-PPE than pre-PPE (+30: $\mu_{\text{post}} = 18.375$, $\mu_{\text{pre}} = 5.625$ -29: $\mu_{\text{post}} = 25.143$, $\mu_{\text{pre}} = 10.714$) while only the 30+ showed significant difference between post CON/PPE trials ($\mu_{\text{PPE}} = 18.375$, $\mu_{\text{CON}} = 12.5$). There was no difference between -23 and +30 when comparing post-PPE errors. **CONCLUSION:** Exercising within a personal protective equipment microclimate will negatively affect executive function of decision making regardless of age.

B-66 Free Communication/Poster - Military PhysiologyWednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA21031 Board #265 May 29 2:00 PM - 3:30 PM
Commercial Footwear with Lateral Torsional Stiffness that May Reduce Injury Risk in Army Basic TraineesJesse Hall¹, Erin M. Miller², Donald L. Goss². ¹University of New England, Biddeford, ME. ²Baylor University-Keller Army Community Hospital Division I Sports Physical Therapy Fellowship, West Point, NY.
(No relevant relationships reported)

Musculoskeletal injuries place a burden on the U.S. Military with estimates that 25% of men and 50% of women experience an injury in Army Basic Training. In 2016, 18% of Cadet basic trainees at the U.S. Military Academy (USMA) sustained a lower-extremity (LE) injury. In that sample, Cadets wearing shoes with mild to moderate lateral torsional stiffness (1.30 - 2.29 Newton [N] meters[m]) were 49% less likely to incur any type of LE injury and 52% less likely to incur an overuse LE injury than Cadets wearing shoes with minimal (<.0130 Nm) or extreme (>.0230 Nm) lateral torsional stiffness. **PURPOSE:** To identify athletic footwear, commercially available at West Point, NY, with mild to moderate lateral torsional stiffness characteristics. **METHODS:** Twenty (10 shoes men's size 10, 10 shoes women's size 8) new shoes of varying brands were included in this analysis. The Shoe Stiffness in Torsion Measurements device and methods of data collection described by Zifchock, were used to quantify lateral torsional stiffness. Each shoe was measured twice by a single rater and averaged for the overall analysis. Rater reliability analyses suggest the SySTM device is useful for repeatable measurements of lateral torsional stiffness. **RESULTS:** Six out of 20 shoes (2 men's, 4 women's) demonstrated mild to moderate lateral torsional stiffness to include; Men's New Balance Minimus MT10GG, and Nike Flex 2017 RN; Women's Sketchers Go Run 3, Asics Gel-Fit Sana 3, Nike Free TR 7 Selfie, and Nike Flex Trainer 7. Fourteen out of 20 shoes (8 men's, 6 women's) did not demonstrate mild to moderate lateral torsional stiffness. Of those 14 shoes, 13 demonstrated extreme lateral torsional stiffness; Men's Nike Lunar Fingertap TR, Nike Retaliation TR, Nike Air Zoom Pegasus 34, Asics FuseX Rush, Asics Gel-Contend 4, Brooks Adrenaline GTS 18, and New Balance Trufuse 860v7; Women's Under Armour Micro G Assert 7; Asics RoadHawk FF, Asics GT 1000-6, Brooks Ghost 10, Adidas Cosmic 2, and New Balance W940GP3. One demonstrated minimal lateral torsional stiffness; Women's Asics Metrolyte Gem. **CONCLUSION:** We identified 6 shoes commercially available at West Point, NY, with mild to moderate lateral torsional stiffness. These shoe recommendations can inform Cadet basic trainees on footwear that may be protective of LE injury during USMA Army Basic Combat Training.

1032 Board #266 May 29 2:00 PM - 3:30 PM

Changes in Body Composition during U.S. Army Basic Combat TrainingStephen A. Foulis, Julie M. Hughes, Leila A. Walker, Katelyn I. Guerriere, Kathryn M. Taylor, Susan P. Proctor, Karl E. Friedl.
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(No relevant relationships reported)

The last major investigations of body composition in Basic Combat Training (BCT) were in 1989 and 1993, before training was integrated for men and women. The data demonstrated that, with BCT, most individuals gained lean mass and the fattest individuals lost the greatest amount of fat mass. Current Army accession standards are derived from the changes observed during BCT for this earlier generation of recruits.

PURPOSE: To assess changes in body composition in current-day Army recruits. **METHODS:** Trainees (n=109 women, W, and 254 men, M), aged 17-38, body mass index 24.0 ± 2.7 kg·m⁻² (W, mean±SD) and 25.0 ± 3.5 kg·m⁻² (M), were assessed for body composition (DXA, Prodigy, GE Lunar) in the first week of BCT and during the final week (wk 8). Repeated measures ANOVA were used to assess changes in body mass (BM), body fat (%BF), and lean mass (LM). **RESULTS:** Average BM at entry was 62.9 ± 8.5 kg (W), 77.7 ± 12.2 kg (M), with changes by wk 8 of 0.3 ± 3.1 kg (W) ($p=0.29$) and 1.2 ± 4.5 kg (M) ($p<0.01$). Women started with 31.8 ± 5.3 %BF and lost 3.8 ± 2.2 %; men began with 22.4 ± 6.2 %BF and lost 3.3 ± 2.9 % ($p<0.01$ for both). Women began BCT with 41.5 ± 5.7 kg LM and gained 2.5 ± 1.7 kg; men began with 58.2 ± 7.0 kg LM and gained 1.7 ± 2.1 kg ($p<0.01$ for both). **CONCLUSIONS:** Compared to a national sample (NHANES), Army recruits are leaner than the US population, especially female recruits. During BCT, further gain in LM and loss of fat, especially in women, were masked in small or nonsignificant changes in BM. These pilot data provide up-to-date descriptions of the entry body composition of Army recruits and the magnitude of change that occurs with BCT; further analyses of the larger cohort including musculoskeletal injury, fitness testing, and long term service outcomes will help validate and redefine Army entry standards.

The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army.

1033 Board #267 May 29 2:00 PM - 3:30 PM

Relationship Of Sex And Physical Activity On Vertical Jump Power Changes In U.s. Army TraineesPeter N. Frykman, Kathryn M. Taylor, Barry A. Spiering, Marilyn A. Sharp, Brittany R. Hotaling, Julie M. Hughes, Stephen A. Foulis. USARIEM, Natick, MA.
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(No relevant relationships reported)

One goal of Basic Combat Training (BCT) is to improve the general fitness of recruits to successfully meet the demands of military activities. Previous studies have focused on the aerobic fitness responses to BCT. In contrast few investigations have examined the changes in whole body power production following BCT and if these changes may be modified by various pre-BCT factors. More specifically, do all recruits show similar training responses in terms of muscular power production as measured by vertical jump (VJ) testing? **PURPOSE:** To determine the relationship of sex and physical activity history on changes in VJ power output following BCT. **METHODS:** Four hundred fourteen recruits (298 men; 116 women; (mean ± SD) age: 21 ± 3 y; height: 172 ± 9 cm; body mass: 73.0 ± 13.4 kg) performed maximal VJ testing before and after 8 weeks of U.S. Army BCT. Body mass and VJ height were used to estimate VJ peak power using the Harman equation. Recruits filled out a survey on their prior physical activity during the 2 months prior to entering BCT. Logistic regression was used to calculate odds ratios showing whether sex or physical activity prior to BCT is predictive of changes in a recruit's VJ power output. **RESULTS:** Females were 2.1 times more likely to show an increase in VJ power than males ($p=0.01$). Recruits that performed running training 3-4 times per week were 1.8 times more likely to improve their VJ power than recruits that only ran 0-2 times per week ($p=0.01$). Recruits that had an average running mile time from 7:00-7:59 (min:sec) were 1.6 times more likely to generate more VJ power than those running at a sub 7:00 mile time ($p=0.03$). **CONCLUSION:** Recruits showed differential changes in VJ performance following BCT, depending on sex, prior running training experience, and average 1-mile running time. **DISCLAIMER:** The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government. Supported by the U.S. Army Medical Research and Materiel Command.

1034 Board #268 May 29 2:00 PM - 3:30 PM
Effects of U.S. Army Basic Combat Training on Vertical Jump Ability in Men and Women

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(No relevant relationships reported)

U.S. Army basic combat training (BCT) is designed to improve the general fitness of recruits. However, little scientific data exists to describe the effects of BCT on muscular power capabilities. Existing data indicates BCT has little or even a net negative effect on vertical jump (VJ) performance. This finding is concerning given the positive relationship between muscular power capabilities and military occupational task performance. **PURPOSE:** To describe the effects of BCT on VJ performance in men and women. **METHODS:** Four hundred fourteen recruits (298 men; 116 women; mean \pm SD age: 21 \pm 3 y; height: 172 \pm 9 cm; mass: 73.0 \pm 13.4 kg) performed maximal VJ testing before and after 10 weeks of BCT. Body mass and VJ height were used to estimate VJ peak power using the Harman equation. Comparisons were made using a sex by time repeated-measures ANOVA and Fisher LSD post hoc tests. **RESULTS:** A significant ($p < 0.05$) sex by time interaction existed for body mass, VJ height, and VJ peak power (Table 1). Men decreased body mass and VJ ability, while women maintained body mass and slightly improved VJ ability.

Table 1. Effects of basic combat training (BCT) on body mass, vertical jump (VJ) height, and VJ peak power in men and women

		Pre-BCT	Post-BCT
Body Mass (kg) [*]	Men	77.3 \pm 12.7	75.9 \pm 9.9*
	Women	62.2 \pm 8.0	62.7 \pm 7.2
VJ Height (cm) [*]	Men	51 \pm 9	50 \pm 9*
	Women	35 \pm 7	36 \pm 6*
VJ Peak Power (W) [*]	Men	7761 \pm 652	7643 \pm 618*
	Women	6221 \pm 491	6299 \pm 472*

Values = mean \pm SD; ^{*} = significant sex by time interaction; * = significantly different than corresponding pre-BCT value.

CONCLUSIONS: Men and women demonstrated differential responses to BCT; however, the changes were extremely small, indicating that BCT is not an effective stimulus to improve VJ performance.

Supported by the U.S. Army Medical Research and Materiel Command.

Disclaimer: The opinions or assertions contained herein are the private views of the author(s) and are not to be construed as official or as reflecting the views of the Army, the Department of Defense, or the U.S. Government.

1035 Board #269 May 29 2:00 PM - 3:30 PM
Comparison Of Body Composition Components in Civilian and Air Force Men and Women

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(No relevant relationships reported)

The military continues to evaluate body composition as a consideration for service. However, limited data are available comparing active duty (AD) and civilian (CIV) individuals. **PURPOSE:** To evaluate body composition of fat mass (FM), fat-free mass (FFM) and percent body fat (%fat) in AD and CIV men and women. **METHODS:** AD men ($n = 213$, 32.1 \pm 7.5 yrs, 177.6 \pm 6.9 cm, 87.6 \pm 12.7 kg) and women ($n = 115$, 32.2 \pm 9.3 yrs, 163.1 \pm 8.0 cm, 70.4 \pm 11.3 kg) and CIV men ($n = 64$, 46.1 \pm 7.5 yrs, 177.7 \pm 7.6 cm, 89.6 \pm 15.0 kg) and women ($n = 46$, 40.0 \pm 9.6 yrs, 163.4 \pm 6.4 cm, 75.9 \pm 15.9 kg) were stratified by exercise level as sedentary (SED), low active (LACT), active (ACT), and Very active (VACT) based on standard parameters. Each participant volunteered to be measured by whole body plethysmography. **RESULTS:** A sex \times duty \times activity ($2 \times 2 \times 4$) MANOVA produced nonsignificant interaction effects ($p > 0.32$) for %fat, FM, and FFM. Men were significantly lower in %fat (23.5 \pm 8.3%) and higher in FFM (66.6 \pm 8.3 kg) than women (33.6 \pm 8.5% and 47.3 \pm 6.0 kg, respectively), with no significant difference in FM (21.6 \pm 10.2 vs 25.1 \pm 10.2 kg). AD was significantly lower in %fat (26.5 \pm 9.3%) and FM (21.8 \pm 9.3 kg) and higher in FFM (59.7 \pm 11.9 kg) than CIV (31.2 \pm 10.4%, 26.0 \pm 11.5 kg, and 55.6 \pm 12.0 kg, respectively). More active individuals had significantly lower %fat (24.1 \pm 9.0%) and FM (19.8 \pm 8.9 kg) with no significant difference in FFM (61.2 \pm 12.1 kg) than sedentary individuals (33.0 \pm 8.2%, 27.7 \pm 9.9 kg, and 54.9 \pm 10.9 kg, respectively). Age was significantly correlated with %fat ($r = 0.20$) and FM ($r = 0.18$) but accounted

for no more than 4% of the common variable between them. Age was also negatively correlated with activity level in AD ($r = -0.23$, $p < 0.001$) but not in CIV ($r = -0.03$, $p = 0.78$). A greater portion of AD were ACT (51%) or VACT (16%) compared to CIV (30% and 11%, respectively). When sex was partitioned out, body mass index (BMI) had a slightly stronger correlation with %fat and FM in CIV ($r = 0.78$ and 0.91, respectively) than in AD ($r = 0.70$ and 0.82, respectively). **CONCLUSION:** Air Force AD personnel have better body composition profiles than CIV personnel but both appear to gain FM and %fat over time based on cross-section analysis. Further research should investigate the ability of other indices to longitudinally track body composition changes in military personnel.

1036 Board #270 May 29 2:00 PM - 3:30 PM
Backpack Hip Strap Use on Oxygen Consumption, Blood Pressure and Muscle Oxygen Saturation While Walking

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(No relevant relationships reported)

Previous work has shown that energy expenditure increases while carrying a loaded backpack. However, few investigations have focused on the impact of utilizing a hip strap. **PURPOSE:** To determine if using a backpack hip strap (HS) has any physiological effects while walking. **METHODS:** Thirteen subjects (23 \pm 4.8 yrs; 5 females, 8 males) walked for 30 mins on a treadmill with a backpack containing 30% of the subject's bodyweight at a 3% grade and speed eliciting 40-50% of their heart rate reserve. Two trials were performed: without a HS (UnST) and with HS (ST). Heart rate (HR), oxygen consumption ($\dot{V}O_2$), systolic blood pressure (SBP), and oxygen saturation of the quadriceps ($Q\ SmO_2$) and calf ($C\ SmO_2$) were measured throughout each trial. Five minute averages were calculated for HR, $\dot{V}O_2$, $Q\ SmO_2$ and $C\ SmO_2$ at baseline (BL), mins 0-5, 6-10, 11-15, 16-20, 21-25, and 26-30. SBP was analyzed as a change score from baseline. A repeated measures ANOVA was used to evaluate the differences between trials at each time point. **RESULTS:** HR at mins 0-5 (UnST: 121 \pm 4 bpm; ST: 120 \pm 3 bpm) was elevated ($p < 0.001$) compared to BL (UnST: 81 \pm 4 bpm; ST: 80 \pm 4 bpm) and remained elevated from BL for the remainder of the trial. All other HR measures were similar with no difference between trials ($p = 0.912$). $\dot{V}O_2$ at mins 0-5 (UnST: 1.6 \pm 0.1 L/min; ST: 1.5 \pm 0.1 L/min) was elevated ($p < 0.001$) compared to BL (UnST: 0.38 \pm 0.02 L/min; ST: 0.38 \pm 0.03 L/min), but was similar to all other time points with no difference between trials ($p = 0.317$). The change in SBP at mins 0-5 (UnST: 26 \pm 8 mmHg; ST: 31 \pm 6 mmHg) was similar to all other time points ($p = 0.115$) and did not differ between trials ($p = 0.224$). $Q\ SmO_2$ at mins 11-15 (UnST: 87 \pm 3 %; ST: 84 \pm 4 %) was higher compared to BL (UnST: 78 \pm 3 %; ST: 79 \pm 4 %; $p = 0.040$) and remained elevated for the remainder of the trial with no difference between trials ($p = 0.515$). $C\ SmO_2$ at mins 0-5 (UnST: 55 \pm 6 %; ST: 47 \pm 7 %; $p < 0.001$) was lower compared to BL (UnST: 72 \pm 4 %; ST: 74 \pm 4 %; $p < 0.001$) and remained lower until mins 11-15 (UnST: 69 \pm 6 %; ST: 66 \pm 6 %; $p = 0.776$). No further changes occurred throughout the rest of the trial ($p < 0.040$). $C\ SmO_2$ did not differ at any time between the trials ($p = 0.263$). **CONCLUSIONS:** This preliminary data suggests a backpack HS has little physiological effect during 30 minutes of walking with a load of 30% the wearers body weight.

1037 Board #271 May 29 2:00 PM - 3:30 PM
Sex Differences In Energy Balance During Arduous Military Training

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(No relevant relationships reported)

A negative energy balance has implications for the health and performance of military personnel, with women possibly more susceptible to metabolic perturbations associated with reduced energy availability than men. Women are increasingly employed in more physically arduous military roles, and therefore, there is a requirement to better understand the energy status of women operating in environments of high energy expenditures. **PURPOSE:** To investigate the sex differences in energy balance during 44 weeks (three terms of 14 weeks) of arduous military training. **METHODS:** Twenty Officer Cadets (men: $n = 8$; mean \pm SD, age 26 \pm 3 y, height 1.84 \pm 0.07 m, body mass 85.0 \pm 7.7 kg; women: $n = 12$; age 25 \pm 3 y, height 1.70 \pm 0.04 m, body mass 65.3 \pm 5.6 kg) participated. Dietary intake was measured during each term by researcher-lead weighed food during scheduled mealtimes, and food diaries and wrapper collection during non-scheduled mealtimes, over three 10 d periods (one per term). Total energy

expenditure (TEE) was measured over each 10 d sampling period using doubly labelled water. Body composition was measured by DXA at the start of training and at the end of each term. **RESULTS:** Average daily energy intake (3160 ± 568 vs 2609 ± 568 kcal·d⁻¹) and TEE (4552 ± 534 vs 3365 ± 416 kcal·d⁻¹) were higher for men than women, respectively (both $P \leq 0.005$). Both sexes demonstrated negative average daily energy balance, with a greater deficit in men compared to women (-1333 ± 965 vs -756 ± 826 kcal·d⁻¹, respectively, $P = 0.016$). There was no difference in average daily carbohydrate (4.3 ± 1.1 vs 4.7 ± 1.5 g·kg·d⁻¹), protein (1.7 ± 0.4 vs 1.6 ± 0.4 g·kg·d⁻¹) or fat intake (1.5 ± 0.4 vs 1.7 ± 0.5 g·kg·d⁻¹) between men and women, respectively ($P \geq 0.167$). Lean and fat mass did not differ in either sex over time (all $P \geq 0.336$). **CONCLUSION:** The observed greater energy deficit in men is predominantly due to the higher TEE, and should be considered when designing feeding strategies. Despite the acute demonstration of negative energy balance in both men and women, there were no differences in lean or fat mass in either sex at our measured timepoints. This finding may reflect an underestimation of energy intake, or the limited frequency of DXA measurements. Future work should explore how dietary intake may be optimised to achieve energy balance in arduous military training environments.

1038 Board #272 May 29 2:00 PM - 3:30 PM

Physical Fitness Decrements In The Postpartum US Army Servicewoman

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(No relevant relationships reported)

United States military service members are required to maintain a requisite level of physical fitness. Women in the US Army are exempt from fitness standards for the first 6 months postpartum. While many women successfully meet the minimum standards 6 months postpartum, the time course necessary to re-attain pre-pregnancy fitness levels is unknown. **Purpose:** To determine the time course necessary to re-attain pre-pregnancy physical fitness, as determined via the Army Physical Fitness Test (APFT), in a cohort of postpartum US Army women. **Methods:** 236 primagravid active duty Army women who delivered at Tripler Army Medical Center between 1 Jan 2011 and 31 March 2017 were eligible for inclusion. APFT data (push-up and sit-up repetitions, 2 mile run time) were obtained from the Digital Training Management System; the last test prior to and all available tests postpartum were used for analysis. Data were analyzed with repeated measures ANOVA and Fisher's exact test. **Results:** The number of postpartum APFTs available for analysis ranged from 1 to 6 per individual. Follow-up time ranged from 4.5 to 72 months postpartum. During the last pre-pregnancy APFT push-up, sit-up and 2 mile run scores were 39.2 ± 11.6 reps, 68.2 ± 11.5 reps and 17.1 ± 1.8 min, respectively. 6 months post-partum, push-up and sit-up scores were lower and run time was significantly longer (34.1 ± 11.1 , 61.5 ± 12.5 and 18.0 ± 1.8 , respectively; $p < 0.01$ for all). While scores gradually progressed towards pre-pregnancy levels, pre-pregnancy fitness was not re-attained during the study period. By 30 months postpartum push-up reps, sit-up reps and run times were 36.7 ± 12.4 , 66.6 ± 12.8 and 17.7 ± 1.7 , respectively, $p < 0.01$ vs pre-pregnancy for all. The failure rate for the APFT was 3.8% pre-pregnancy, 14.2% at the first postpartum APFT and ranged from 7.7-9.9% for all time points thereafter. **Conclusions:** These data indicate that the postpartum US Army servicewoman fails to return to pre-pregnancy fitness levels, when followed for up to 72 months. While a majority of the women meet minimum fitness standards, ~8-10% did not. The causal factors underlying these results are unknown. However, as ~25% of women had higher scores at the first postpartum APFT vs pre-pregnancy, it is possible to re-attain pre-pregnancy fitness levels.

1039 Board #273 May 29 2:00 PM - 3:30 PM

Equation to Estimate Total Energy Expenditure in Military Populations Using a Wrist-Worn Physical Activity Monitor

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PURPOSE: The gold-standard method for measuring free-living Total Energy Expenditure (TEE) is the Doubly Labelled Water (DLW) technique, but it is expensive and can only quantify TEE over 7-10 days. Wrist-worn physical activity monitors (PAM) are cheaper and can be used to estimate TEE over any time periods. Equations have been developed to estimate TEE from wrist-worn PAM in civilian but not in

military populations, where TEE and activity type differ markedly. The aim of this study was to develop an equation to estimate TEE from a wrist-worn PAM in a military population.

METHODS: Twenty-six (14 male, 12 female) Officer Cadets (OC, mean \pm SD: age 23 ± 2 years, height 1.73 ± 0.09 m, body mass 77.2 ± 9.4 kg) wore a PAM (GENEActiv, Cambridge, UK) continuously on the dominant wrist over three 10-day blocks of military training on base and field exercises. Immediately prior to each 10-day block, OCs consumed a bolus of DLW and provided daily urine samples, which were analysed by mass spectrometry to determine TEE_{DLW}. The PAM recorded continuously at 50 Hz throughout each 10-day block and the manufacturer's software was used to estimate TEE for each OC using an equation developed in a civilian population (TEE_{CIV}). Each OC in each 10-day block was treated as a separate 'observation' ($n=53$). A random sample of 30 observations were entered into a linear regression to produce a model to estimate TEE for military populations (TEE_{MIL}). The TEE_{MIL} equation was applied to the remaining 23 observations to quantify the mean bias \pm 95% Limits of Agreement (LoA) between TEE_{DLW} and TEE_{CIV} or TEE_{MIL}. **RESULTS:** The TEE_{MIL} equation [$TEE_{MIL} = 563.116 + (0.886 \times TEE_{CIV})$] exhibited a strong correlation ($r=0.826$) and a Standard Error of the Estimate of 475 kcal·day⁻¹. Applying the equation reduced mean bias \pm 95% LoA against TEE_{DLW} from -194 ± 1055 kcal·day⁻¹ for TEE_{CIV} to 0.79 ± 996 kcal·day⁻¹ for TEE_{MIL}.

CONCLUSIONS: The TEEMIL equation developed in this study improves the estimation of TEEDLW from a PAM in military populations compared to an existing TEECIV equation. Future research should explore data processing techniques to identify different physical activity types from wrist-worn PAM in military settings to further improve TEE estimation and validate these equations in different military cohorts.

1040 Board #274 May 29 2:00 PM - 3:30 PM

Differences Between Responders and Non-responders for Endurance Performance During Combined Training in Military Operation

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Military operations lasting several months may cause negative changes in aerobic fitness of deployed soldiers. Despite the well-known benefits of physical training on soldier readiness, intervention studies focusing on endurance performance during military operations are lacking.

PURPOSE: To investigate inter-individual variation in training adaptations of endurance performance during deployment.

METHODS: 91 male soldiers (30 ± 8 yr) volunteered for the baseline tests including assessments of body composition, physical performance (3000-m run, max. isometric leg and arm extension, 1-min push-ups and sit-ups, and standing long jump), as well as a military simulation test (MST). Training was monitored using diaries. After the 19-week follow-up, the available data was divided into two groups based on the change in endurance performance: Responders ($n=25$) decreased their 3000-m run time while non-responders ($n=24$) maintained or increased their 3000-m run time.

RESULTS: The responders initially had higher fat mass (12.8 ± 3.6 vs. 9.6 ± 5.7 kg, $p < 0.001$), lower muscle mass (38.0 ± 3.9 vs. 40.3 ± 4.1 kg, $p = 0.046$), poorer standing long jump (227 ± 16 vs. 242 ± 27 cm, $p = 0.016$) and MST performance (156 ± 23 vs. 143 ± 24 s, $p = 0.028$) compared to non-responders. Both groups performed a similar volume of endurance training during the follow-up (1.7 ± 0.8 vs. 1.9 ± 2.8 times/week, $p = 0.22$). During the operation, the responders maintained their training frequency at the level of pre-deployment ($\Delta 0.1 \pm 1.1$ vs. -1.2 ± 1.9 times/week, $p = 0.012$). In addition, they performed lower body strength training with lower average volume load (14354 ± 6076 vs. 19489 ± 6202 kg/week, $p = 0.010$). However, their fat mass decreased (-7.6 ± 11.7 vs. 14.2 ± 20.4 %, $p < 0.001$) and MST time improved (-13.6 ± 6.8 vs. -7.5 ± 6.5 %, $p = 0.006$) more when compared to the non-responders.

CONCLUSIONS: Soldiers who initially demonstrated lower physical fitness and higher fat mass improved their physical performance more than their non-responder counterparts. Positive training responses in non-responders might have been achieved using higher volume and / or intensity of endurance training. In addition, it is obvious that more individualized strength and endurance training should be emphasized during prolonged military operations.

- 1041** Board #275 May 29 2:00 PM - 3:30 PM
The Effect of Body Mass on Physical Performance in Naval Special Warfare Operators
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 (No relevant relationships reported)

The Effect of Body Mass on Physical Performance in Naval Special Warfare Operators

Dallas E. Wood, David P. Swain, FACSM.

Naval Special Warfare, Virginia Beach, VA, Old Dominion University, Norfolk, VA US Naval Special Operations Forces have performed some of the US Military's most rigorous missions. The Human Performance Program (HPP) developed a physical performance testing battery to assess and monitor physical performance. Testing bias relative to body mass has been noted in past literature, including military physical fitness tests. **PURPOSE:** This retrospective study looked to determine if there is body mass bias in the HPP performance assessment and if an optimum body mass for each performance test could be determined. **METHODS:** Data from 333 subjects (age: 28.4 ± 5.0 yr; height: 178.4 ± 6.2 cm; mass: 86.0 ± 9.2 kg) were analyzed to compare body mass to performance on the eight performance tests: standing long jump, Pro-Agility test, weighted pull-up, body weight bench press, 1-RM deadlift, 274-m shuttle run, 4.83-km run, and 800-m swim. Linear regression analysis was used to analyze the relationship of body mass to performance; a 2nd degree polynomial was utilized to determine best-fit curves for each of the physical performance tests; ANOVA was utilized to examine differences in performance between body mass quartiles. **RESULTS:** Significantly better performance for lighter subjects was found in the Pro-Agility test, weighted pull-up, body weight bench press, 274-m shuttle run, and 4.83-km run. Heavier subjects performed better in the 1-RM deadlift. Second-degree polynomial regression revealed optimum body mass for the Pro-Agility test, 274-m shuttle run, and 4.83-km run to be somewhat heavier than the lowest body mass. **CONCLUSION:** These findings could help professionals better assess and train operators of varying body size.

The views and opinions expressed are the authors' and do not reflect those of Naval Special Warfare Command, the US Navy or the Department of Defense.

- 1042** Board #276 May 29 2:00 PM - 3:30 PM
Minimalist Style Military Boot Improves Running Economy Under Load In Trained Males
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PURPOSE: Minimalist style boots (MIN) may improve running economy for soldiers under load versus the traditional boot type (TRD). However, running economy (RE) under load with MIN has not been examined. **METHODS:** In this study, male participants ($n = 14$) completed a VO₂ peak test (46.6 ± 7.3 ml/kg/min) under load (16 kg) while wearing their normal athletic shoes. Treadmill speed for RE tests was determined by the slowest pace in which participants completed a full stage with a running gait pattern during the VO₂ peak test. Load was applied using a ~7.5 kg weighted compression garment to simulate body armor and a ruck sack of ~8.5 kg. During the second trial participants completed two, 5-min running treadmill exercise bouts with the same load arrangement while wearing MIN (~500 g) and TRD (~800 g). RE was evaluated using indirect calorimetry (TrueOne2400, Parvo Medics Inc. Provo, Utah) and calculated by averaging the 60-s average values of minutes 3-4 and 4-5 with confirmation of steady state (difference in VO₂ < 0.1 L/min between minutes). There was a 10-min rest period between running bouts (counter-balanced crossover design). **RESULTS:** Paired sample t-tests indicated a significant difference ($p = 0.003$) in RE between MIN (2.95 ± 0.28 L/min) and TRD (3.04 ± 0.30). Thirteen participants had lower RE during MIN producing a small-moderate effect size (Cohen's $d = 0.32$). RER also increased ($p < .001$) during TRD (0.99 ± 0.07) versus MIN (0.94 ± 0.06). Overall, leg, and breathing RPE ($p < 0.05$) were all improved during MIN. **CONCLUSIONS:** When moving at minimal running speed under load, MIN provides notable improvement in RE.

- 1043** Board #277 May 29 2:00 PM - 3:30 PM
Effects Of Core Stability Exercise On Subjective Rating Of Low Back Pain In ROTC Cadets
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 (No relevant relationships reported)

PURPOSE: While previous research has investigated lower extremity injuries and low back pain in Soldiers during basic training, little research has investigated load carriage and low back pain in Reserve Officer Training Corps (ROTC) program participants. Thus the purpose of this study was to investigate the effects of a core stability program on subjective rating of low back pain and overall physical function during load carriage exercise.

METHODS: Subjects (age: 19.75 ± 1.55 years) included cadets enrolled in the ROTC program at the University of Massachusetts (Amherst) ($n=10$) who were randomly assigned into a core stability or a non-core stability group. All subjects completed a 1.5 hour ruck march with 35lb load at volitional pace once per week over a 3-week period. At baseline and upon completion of the 3-week intervention period, subjects completed a 3-mile timed ruck march. Immediately prior to each 1.5 hour ruck march session, the core stability group performed a series of core stability exercises. Subjective low back pain score (Visual Analog Scale) was obtained immediately after completion of each ruck march session.

RESULTS: The core stability group showed a significantly lower average low back pain score (mean score = 1.90) over the course of the intervention period compared to the control group (mean score = 3.00). No significant difference ($p = 0.49$) was found between pre- and post-intervention 3-mile ruck march completion times between groups.

CONCLUSIONS: The core stability program resulted in significant decreases in subjective rating of low back pain associated with load carriage in ROTC participants. Study results suggest that implementing a core stability program in military personnel during basic training or tactical operations involving load carriage may thus provide benefit in preventing low back pain.

- 1044** Board #278 May 29 2:00 PM - 3:30 PM
Factors Impacting Soldier-Athletic Performance of U.S. Service Academy Cadets
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Early identification of factors impacting soldier-athletic performance can assist in designing training programs & selection of key personnel. **PURPOSE:** Investigate factors via selected physical assessment tests {(PAT's); Soldier Performance Index (SPI); Cadet Combine (CC)} which identify overall soldier-athletic performance of U.S. Service Academy cadets (USSAC's). **METHODS:** 66 fit subjects (42 men; 24 women) participated in a 19-hour lecture/lab course over a 2-month period which included 2 embedded PAT's examining combat readiness components of strength, endurance, mobility, power/speed. Specific data analysis & criterion determination was used on the 0-368+ point SPI & 0-137.5 point CC. **RESULTS:** Multiple regression analysis indicated push-ups (PU) & 400 meter run; adjusted $R^2 = 0.83$ for CC, while PU, 500 meter row & reps to failure of 220-lb trap bar dead lift (TBDL); adjusted $R^2 = 0.84$ for SPI. Correlation between the two PAT's; $r = 0.91$, adjusted $R^2 = 0.83$. Criterion cut points (70% of USSAC's best scores; or top 10 performers) for both SPI & CC revealed a stable metric in identifying higher end physical performance cadets. Descriptive data:

Group (n) (±SD)	HT in	BM Lbs	45lb GSq Rep	65lb BP Reps	5- Sec Pull-ups Reps	2MR Secs	300 MF/RSB Secs	155lb BP Reps	APFT Pts	SPI Pts	CC Pts	TBDL/BM Ratio
ALL (66)	68 (3.8)	163 (26.5)	63.7 (27)	51.6 (34.3)	7.4 (4.4)	862.2 (103)	66.9 (7.7)	5.6 (7.1)	276.8 (31.6)	180.2 (57.8)	92.9 (24.2)	1.75 (31)
70% Best >240 SPI (10)	71.3 (3.1)	186.9 (19.8)	82.8 (23)	104.8 (37.9)	11.3 (1.6)	811 (64.6)	62.3 (3.6)	17.6 (6.4)	294.8 (39.8)	261.5 (15.2)	116.9 (5.5)	1.99 (30)
Group (n)	HT/ BM in/ lb	5-10-5 Secs	SLJ cm	MB Put cm	5- Sec Pull-ups Reps	Beep levls	500 M Row Secs	220lb TBDL Reps	APFT Pts	SPI Pts	CC Pts	TBDL/BM Ratio
ALL (66)	Same	5.1 (41)	217 (36)	621.4 (118)	7.4 (4.4)	8.4 (1.6)	110 (13.4)	9.1 (10.2)	276.8 (31.6)	180.2 (57.8)	92.9 (24.2)	1.75 (31)
70% Best >87 CC (41)	70.6/ 175 2.6/ 21	4.89 (27)	232 (24)	691 (90.5)	10.1 (2.3)	9.3 (1.3)	102.4 (7.2)	14.2 (9.9)	279.9 (31.2)	216.5 (33.4)	109.7 (8.9)	1.84 (32)
>240 SPI (10)	Same	4.83 (20)	251 (21)	771 (92)	11.3 (1.6)	9.3 (1.5)	97.2 (3.7)	20.8 (9.7)	294.8 (39.8)	261.5 (15.2)	116.9 (5.5)	1.99 (30)
>116 CC (10)	70.8/ 174.4	4.81 (16)	246 (22)	747 (55.5)	11.6 (1.4)	9.9 (8.5)	97.0 (3.9)	19.4 (8.7)	302.9 (31.5)	253.4 (22.9)	119.2 (2.96)	2.08 (36)

DISCUSSION: Our data indicate that both SPI & CC provide a stable metric in PAT's & the top tier (n=10) are able to provide robust physical ability in the strength, endurance, mobility, power/speed realm. Lower body strength as indicated via reps of 220-lb TBDL & 1-RM TBDL/BM ratio suggests a simple test which is predictive of higher SPI & CC scores respectively. While soldier-athletic performance is key, our robust PAT's were not influenced via BM when separated via gender.

CONCLUSIONS: For soldier-athletes desiring success on the five combat readiness components, reps of 220-lb TBDL, 400 meter run, 500 meter row, PU and either the SPI or CC are simple, reliable field tests which can assist classify and select personnel for more arduous military applications. An enhanced physical profile should be the goal of any soldier-athlete.

1045 Board #279 May 29 2:00 PM - 3:30 PM Sleep Patterns During Arduous Military Training in Men and Women

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(No relevant relationships reported)

Sleep is a critically important component of health, but is often restricted in a military environment as a stressor in training and in preparation for operations. Following the recent opening of combat roles to women serving in the UK military, quantifying sleep parameters during arduous training, and understanding how men and women respond to disturbed sleep, is necessary for management of health and performance. Sex differences in sleep quantity and efficiency may manifest in responses to training-related stressors, and it is therefore important to quantify these sleep parameters in a basic military setting. **Purpose:** To quantify sleep duration and efficiency in male and female Officer Cadets over 7 days of arduous basic military training. **Methods:** Twenty-six Officer Cadets (mean ± SD; 9 men; age: 25.3 ± 3.2 y, height: 1.83 ± 0.07 m, weight: 84.7 ± 7.2 kg; and 17 women; age: 24.8 ± 2.5 y, height: 1.71 ± 0.04 m, weight: 66.5 ± 5.9 kg) wore wrist-based tri-axial accelerometers (GeneActiv, UK) continuously for 7 days, during the first term of British Army Officer Training at the Royal Military Academy, Sandhurst, UK. Data were processed using commercially-available software (GeneActiv, UK) to derive: time in bed (min); time asleep (min) and sleep efficiency (%). **Results:** Officer Cadets spent an average of 412 ± 140 min (6h 52 min) in bed, and 329 ± 80 min (5h 29 min) asleep, giving a mean sleep efficiency of 83% ± 14%, over 7 days. Compared with men, women spent longer in bed (433 ± 149 (7h 13 min) vs 370 ± 108 min (6h 10 min), respectively, $P \leq 0.01$) and longer asleep (341 ± 83 (5h 41 min) vs 304 ± 67 min (5h 4 min), respectively, $P \leq 0.01$). There was no difference in sleep efficiency between the sexes (84 ± 13% vs 82 ± 14%, respectively, $P = 0.30$). **Conclusion:** Officer Cadets slept less than the 7-9 hours per night recommended by The National Sleep Foundation. This may have implications for musculoskeletal and immune health during arduous training. Women slept more than men, however it is unclear whether this is due to physiological or behavioural differences between the sexes. The implications of inadequate sleep, and the mechanisms for the reported sex difference, warrant further examination to optimise performance and reduce injury risk in arduous military basic training.

1046 Board #280 May 29 2:00 PM - 3:30 PM Sympathetic Nervous System Response During Close Quarters Combat in Elite Military Men

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(No relevant relationships reported)

Combat is physiologically stressful and associated with alterations and declines in several performance domains vital to the success of ground combat element (GCE) operations. Acutely, the body responds to stress via the "fight-or-flight" system, which alters activity of the autonomic nervous system (ANS) and can be monitored via heart rate variability (HRV). Currently, it is not well understood if ANS plays a role in the shooting performance of GCE operators. **PURPOSE:** To determine if HRV is correlated to shooting performance. **METHODS:** Active duty, elite GCE operators ($n = 40$) were recruited to participate in a 21-day close quarters combat (CQC) training program. Measures of HRV, marksmanship, and tactical/safety violations (errors) were recorded prior to (anticipation), during (execution), and immediately after (recovery) a similar shooting task on Day 1 and Day 21 of training. **RESULTS:** Heart rate was significantly less at every time point on Day 21 when compared to Day 1 (anticipation: -8.9%, execution: -11.5%, recovery: -8.6%; $p < .05$). The mean normalized low frequency power (LFnu)—a measure of sympathetic drive—was not different between days ($p > .05$), but it was significantly lower during the execution phase in comparison to the anticipation (-11.2%) and recovery phases (-12.0%, $p < .05$). The mean normalized high frequency power (HFnu)—a measure of parasympathetic modulation—was 14.9% higher in Day 21 compared to Day 1 ($p < .05$). In addition, the HFnu was 17.7% lower in the recovery compared to the execution phase ($p < .05$). The mean ratio of LF to HF (LF/HF) power was not different between days ($p > .05$), but it was significantly higher during recovery (35.4%) when compared to the execution phase ($p < .05$). Pearson product-moment correlation analysis revealed there was also a positive correlation between the LF/HF power ratio during the anticipation phase and the number of errors committed during execution on Day 1 ($r = .635$, $p < .05$). **CONCLUSION:** There is a positive correlation between sympathetic drive, during the anticipation phase of CQC training, and error rate at the onset of CQC training. These data suggest that those with a lower sympathetic tone perform better than those with a higher sympathetic tone.

1047 Board #281 May 29 2:00 PM - 3:30 PM Leveraging Machine Learning Techniques to Reveal Relationships between Neuromuscular Traits in Previously Concussed Warfighters

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Concussions are common in military personnel and may result in an increased risk of musculoskeletal injury. The underlying mechanisms for this increase risk are unknown and warrant additional research. One plausible explanation may be that neuromotor deficiencies may enhance injury risk following concussion through altered muscular activation or contraction timing. **Purpose:** To compare military personnel with at least one concussion during the past 1 month to 2 years (CONCUSSED) to military branch-, age- and Special Forces group- matched controls (CONTROL) on physiological, musculoskeletal and biomechanical performance. **Methods:** A total of 48 (24 CONCUSSED, 24 CONTROL) male Air Force Special Operators and Naval Special Warfare Operators aged 19 to 34 years participated in the study. Participants provided self-reported demographics and injury history and the following assessments: 1) physiological- body composition, anaerobic power and capacity, aerobic capacity and lactate threshold; 2) musculoskeletal- isokinetic strength testing of the lower extremity, including time to peak torque for each muscle group, and balance using the Neurocom system; and 3) biomechanical- single-leg jump and landing task, including landing kinematics of the hip, knee and ankle. A C5.0 decision tree algorithm and one-way ANOVA were used to compare the two groups on the physiological, musculoskeletal, and biomechanical outcomes. **Results:** No differences were demonstrated using one-way ANOVA. The C5.0 algorithm revealed CONCUSSED demonstrated quicker time to peak knee flexion angle during the single-leg landing task (< 0.170 sec; CONCUSSED: $n = 22$ vs. CONTROL: $n = 14$), longer time to peak torque in knee extension isokinetic strength testing (> 500 msec; CONCUSSED: $n = 18$ vs. CONTROL: $n = 4$) and larger knee flexion angle at initial contact ($> 7.7^\circ$; CONCUSSED: $n = 18$ vs. CONTROL: $n = 2$). **Conclusion:** The findings supported the hypothesis that CONCUSSED military personnel would demonstrate altered neuromuscular control in landing strategies and muscular activation. Future research should assess prospectively potential neuromuscular changes following concussion and determine if these changes increase the risk of subsequent musculoskeletal injuries and concussion.

B-67 Free Communication/Poster - Translational/ Occupational Physiology

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1048 Board #282 May 29 2:00 PM - 3:30 PM Effects Of Exercise And Sanqi Ginseng Interventions On Mtss Of Swat Trainees

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PURPOSE: To investigate the therapy effects of exercise and Sanqi Ginseng, a Chinese herbs, and their combination on medial tibial stress syndrome (MTSS) of the special weapons and tactics (SWAT) trainees.

METHODS: 162 SWAT trainees with MTSS were divided randomly into 3 groups: exercise (E), Sanqi ginseng tablets group (S), and their combination (ES). Participants in E-group maintained the original training, including jumping and all of other training movements, for four months while S-group used oral Sanqi ginseng tablets, (1.2 g for each time, 3 times per day to control the pain at a mid-level for 4 months) without training, and finally, ES-group took both exercise and Sanqi tablets at the same time. The MTSS healing rates measured (numerical ratings scale (NRS) = 0 was seemed as healing) were compared 4 months later. The tibia bone mineral density and average lumbar T score, left and right leg muscle mass, subjective pain NRS were tested also before and after the intervention.

RESULTS: The healing rates of E, S and ES groups were 63.0, 88.9, 96.3%, respectively; the average NRS in ES (mean =1.04 & SD =0.3) group after the intervention was lower than E (mean =3.5 & SD =0.46, $p < 0.05$, $\eta^2=0.899$) and S (mean =1.4 & SD =0.51, $p < 0.05$, $\eta^2=0.023$), and the lower limb muscle mass was significantly higher than that in the other two groups ($p < 0.05$, for SE vs E, $\eta^2=0.595$; for SE vs S, $\eta^2=0.266$).

CONCLUSIONS: A combination of exercise and Sanqi ginseng could effectively reduce the NRS during training process, resulting in a better healing effect of MTSS.

1049 Board #283 May 29 2:00 PM - 3:30 PM Cardiovascular Risk Factors of Working Primary School Teachers

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In Hungary about 77000 people work as teachers in primary school. Generally, stressful work negatively affects health and can increase risk of noncommunicable diseases. Previous research revealed that teachers have better physical health status compared to the general population (Seibt 2011). Health status is often assessed using questionnaires, and as a result, there is a lack of research using objective measures of health in primary school teachers. **PURPOSE:** To collect data about health status, body composition, blood pressure and arterial stiffness in primary school teachers and compare some results to the EHIS study results reported in 2014. The participants involved were over 35 years of age and had more than ten years' experience as school teachers.

METHODS: 24 subjects (mean age: 46.8±7.4y.) were recruited from different primary schools using the snowball research method (Kaltan2001). Data collected included body mass index (BMI) and body composition (BF%), information from a health behaviour questionnaire (eating habits, physical activity, smoking) (WHO 2010) and resting arterial stiffness measured via TensioMed arteriography (Illyés 2005). Descriptive statistical analysis and Chi square tests were used with SPSS Statistics program version 22.

RESULTS: The mean BMI was 26.9±5.5 and BF% was 26.9±6.5 in teachers, 50% were overweight or obese. According to the questionnaire 62% of the teachers ate breakfast regularly and only 20% were physically active ≥ 2.5h/week, 20% smoked, 22% had elevated blood pressure and 20% had elevated pulse wave velocity or augmentation index (Willum-Hansen et al. 2006). Compared to data from the European Health Interview Survey (EHIS) (www.ksh.hu/docs/hun/xftp/stattukor/elef14.pdf) teachers in this study were the same active (4.1%vs.4.5%) and were the same overweight and obese (50%vs.54%) as Hungarians in the general population. The prevalence of smoking among teachers was significantly ($p < 0.05$) less (20%) than the general population (29%).

CONCLUSIONS: Half of the investigated middle-aged teachers already had some health problems. The health-related concepts and mental health programs for teachers are essential to prevent chronic diseases and psychosomatic disorders.

1050 Board #284 May 29 2:00 PM - 3:30 PM Effects of Environmental Condition and Body Fat Percentage on Substrate Utilization during and following Exercise

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(No relevant relationships reported)

PURPOSE: To examine the effects of environmental condition and body fat percentage on substrate utilization during and following exercise.

METHODS: Recreationally active men consisting of 4 low-fat (LF; 10.9% ± 2.5; 23.8 ± 3.1yrs; 182.6 ± 7.1cm; 80.7 ± 4.5kg; 4.03 ± 0.34L·min⁻¹) and 4 high-fat (HF; 15.9% ± 2.2; 23.3 ± 1.9yrs; 180.9 ± 4.3cm; 79.6 ± 5.9kg; 3.63 ± 0.13L·min⁻¹) completed six experimental trials: a VO₂max test and 5 cycling trials in 5°C/20%RH (LT), 22°C/45% RH (MTMH), 22°C/70% RH (MTHH), 35°C/45% RH (HTMH), and 35°C/20% RH (HTLH) in a counterbalanced fashion. During cycling trials, participants completed 60-min of cycling at 60% VO₂max, a 15-min rest period, cycling at 90% VO₂max until exhaustion (TTE), and a 60-min recovery (REC). AUCi for absolute carbohydrate (CHO) utilization was calculated during cycling at 60% VO₂max, TTE, and REC for each condition. Data were analyzed using a mixed-design ANOVA.

RESULTS: A condition x BF interaction was observed during cycling at 60% VO₂max ($F=2.907$; $p=0.048$). Specifically, CHO utilization was greater during LT (496.9 ± 83.43kcal; $p=0.015$) compared to MTHH (416.12 ± 73.91kcal) in LF individuals, with no significant differences between conditions in HF individuals ($p > 0.05$). During the TTE, no condition x BF interaction was observed ($F=0.410$; $p=0.799$) however; a main effect of condition was observed ($F=3.412$; $p=0.028$). Specifically, CHO utilization was greater during MTMH (73.53 ± 11.96kcal; $p=0.020$) and MTHH (75.66 ± 16.69kcal; $p=0.019$) compared to HTMH (29.87 ± 5.55kcal). During REC a condition x BF interaction was observed ($F=5.982$; $p=0.004$). Post-hoc analysis indicated a main effect of condition in LF individuals ($F=12.371$; $p=0.016$). Specifically, absolute CHO utilization was significantly higher in LT (96.259 ± 4.929kcal) compared to HTLH (5.783 ± 1.583kcal). No main effect of condition was observed in the HF individuals ($F=1.402$; $p=0.292$).

CONCLUSIONS: Data suggests that individuals with a lower BF% may utilize greater absolute CHO during exposure to cold environments compared to those with higher BF%, during both moderate intensity exercise and resting conditions. Additionally, exposure to moderate compared to hot temperatures may result in prolonged TTE, likely due to a longer TTE.

Study partially funded by the Kent State University Research Council.

1051 Board #285 May 29 2:00 PM - 3:30 PM An Examination of Physiological Responses in EMT Students During Occupational and Heat Stress

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PURPOSE: The purpose of the present study is to observe the impact of a hyperthermic environment on physiological responses in EMT students performing a simulated occupational task. **METHODS:** Ten EMT students completed a simulated occupational task in two conditions; thermoneutral environment, or hyperthermic condition (100°F, 60-70% RH). The following primary dependent variables were analyzed; heart rate (HR), mean arterial pressure (MAP), rating of perceived exertion (RPE), oxygen consumption (VO₂), thermal sensation (TS), mood (TMD), core temperature (T_c), and mean skin temperature (MST). Following 30 minutes of acclimation participants completed an aerobic bout of exercise followed immediately by an anaerobic bout of exercise. The aerobic exercise consisted of a 10-minute treadmill walk at 70%-80% of their previously determined maximal heart rate. The anaerobic exercise consisted of lifting a 50 lb. sandbag to a metronome over the course of 5 minutes. This process was repeated once, resulting in a total exercise time of 30 minutes. **RESULTS:** A main effect of condition was found for T_c ($p=0.033$), further explained by elevated T_c post-exercise in the hyperthermic condition (38.08±0.38°C) compared to the thermoneutral condition (37.71±0.33°C) ($p=0.002$). A significant time by condition interaction was seen for TS ($p=0.043$), further explained by elevated TS scores at every time point with the exception of post-exercise. During exercise, average TS score was 8.35±0.87 in the hyperthermic condition, compared to 6.85±0.78 in the thermoneutral condition ($p < 0.05$). MST also elicited a significant time by condition interaction ($p=0.033$). MST was elevated at all time points in the hyperthermic condition when compared to the thermoneutral condition. Average MST during exercise was 36.75±0.70°C in the hyperthermic condition, compared to 33.44±0.73°C

in the thermoneutral condition ($p < 0.001$). No difference was observed for TMD between conditions ($p = 0.354$), although a worsening mood following acclimation (19.96 ± 42.00) compared to baseline (-77.08 ± 74.41) was observed. **CONCLUSION:** Future research should emphasize a focus on maintaining a lower core and skin temperature while focusing on enhanced mood under occupational and heat stress in order to improve physiological and motor performance.

1052 Board #286 May 29 2:00 PM - 3:30 PM
Effects Of Nsaid Use On Biomarkers Of Kidney Stress Following A Marathon

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(No relevant relationships reported)

The use of nonsteroidal anti-inflammatory drugs (NSAID) is common practice by participants in marathons and other endurance events. Previous research suggests that renal stress is apparent immediately following marathon completion. However, the potential exacerbating effect of NSAID use during a marathon is not well-understood. **PURPOSE:** Investigate the effect of NSAID use on biomarkers of renal stress following a marathon. **METHODS:** Twenty-two volunteer participants (14 males, 8 females; 38 ± 10.2 y, 70.7 ± 10.1 kg, 171.0 ± 7.7 cm) at the Kansas City Marathon were recruited and assigned to either a control ($n = 15$) or NSAID ($n = 7$) group based on planned or habitual use. Pre-race NSAID ingestion was self-reported as 9.15 ± 4.62 mg/kg of ibuprofen ($n = 4$) or 3.75 ± 1.73 mg/kg naproxen sodium ($n = 3$). Urine samples were collected pre-marathon, post-marathon, and 24-h post-marathon. Samples were stored at -80°C and later analyzed for urinary neutrophil gelatinase lipocalin (uNGAL) and urinary cystatin C (uCyC). A robust two-way mixed ANOVA with trimmed means was utilized to account for potential outliers. When significant interaction or main effects were observed, pairwise comparisons were calculated using robust bootstrapped effect sizes with 95% confidence intervals. **RESULTS:** Immediately post-marathon, there was a significant increase in uNGAL (Cohen's $d_r = 0.47$ 95% C.I. [0.23, 0.85]) but there was no longer a significant elevation by 24-h post-marathon (Cohen's $d_r = 0.16$ 95% C.I. [-0.61, 3.36]). There were no significant effects detected for Cystatin C. Further, NSAID ingestion did not affect uCyC or uNGAL values. **CONCLUSION:** Renal stress biomarkers suggest potential kidney tubular injury immediately post-marathon, but potential renal stress was negated by 24-h of recovery. Moderate NSAID ingestion before the marathon did not affect kidney stress biomarkers.

1053 Board #287 May 29 2:00 PM - 3:30 PM
A Novel Assessment of Law Enforcement Officer Response to a Dynamic Shooting Protocol

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(No relevant relationships reported)

Police officers' responses to violent situations are frequently scrutinized. **PURPOSE:** This study was created to establish a Target Assessment, Action, and Accuracy Protocol (TAAAP), assessing law enforcement personnel's decision making and firearm proficiency in a dynamic environment. We hypothesized the TAAAP would result in a greater performance differentiation than a traditional shooting test. **METHODS:** Healthy, non-colorblind, law enforcement officers ($n = 7$) participated in four trials; traditional fatigued, TAAAP fatigued, traditional fresh, and TAAAP fresh. The traditional protocol required officers to fire eight shots in 15 s at a target 3 m away, then fire four rounds in 6 s at a target 6.1 m away. Following a magazine change, the protocol was repeated. The TAAAP consisted of multiple targets, both hostile and friendly, at varying distances across five separate shooting bays. Fatigued protocols required participants to run until volitional fatigue and shoot, whereas subjects had no physical exertion prior to beginning the fresh trials. Shooting accuracy and response time were collected and analyzed. **RESULTS:** The traditional shooting test demonstrated an accuracy rate of $88 \pm 9\%$ while the TAAAP demonstrated an accuracy rate of $49 \pm 17\%$. The findings of the current study demonstrated TAAAP is a more challenging assessment tool as compared to traditional shooting tasks. **CONCLUSIONS:** While the traditional task demonstrated a potential ceiling effect, the TAAAP may provide a better example of shooting accuracy in naturalistic settings when compared to the results from officer involved shootings at less than 6.1 m.

1054 Board #288 May 29 2:00 PM - 3:30 PM
Correlation Between $\dot{V}O_{2\max}$ and Anaerobic Power in Law Enforcement SWAT Team Members

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(No relevant relationships reported)

PURPOSE: The purpose of this investigation was to examine the relationship between maximal oxygen uptake ($\dot{V}O_{2\max}$) and anaerobic power in Special Weapons and Tactics (SWAT) team members of law enforcement. **METHODS:** Fourteen healthy men and one healthy woman (age: 33 ± 6 y, height: 179.6 ± 6.7 cm, body mass: 89.6 ± 10.4 kg) performed a graded exercise test to measure $\dot{V}O_{2\max}$ and a Wingate Anaerobic Test to measure anaerobic power on two separate occasions. $\dot{V}O_{2\max}$ was determined with a graded exercise test on a motorized treadmill using the Costill-Fox protocol. Anaerobic power was determined using the Wingate Anaerobic Test where participants cycled against a resistance of 9% of body mass (8 ± 1 kg) on a Wingate cycle ergometer. Pearson's r correlations were conducted to analyze the relationship between absolute $\dot{V}O_{2\max}$ and absolute power as well as relative $\dot{V}O_{2\max}$ and relative power. **RESULTS:** Absolute $\dot{V}O_{2\max}$ was significantly positively correlated to absolute peak power ($r = 0.60$; $p = 0.02$) and absolute average power ($r = 0.75$; $p < 0.01$). Moreover, relative $\dot{V}O_{2\max}$ was significantly positively correlated to relative peak power ($r = 0.56$; $p = 0.03$) and relative average power ($r = 0.64$; $p = 0.01$). **CONCLUSIONS:** There are moderate-to-strong positive correlations between $\dot{V}O_{2\max}$ and anaerobic power. It is possible that adaptations that occur with high intensity anaerobic exertions might be related to changes in aerobic metabolism. Future research might consider examining the effectiveness of anaerobic power training on aerobic fitness among the tactical athlete populations.

1055 Board #289 May 29 2:00 PM - 3:30 PM
Influence Of Working Hours On Pregnancy Outcomes: A Systematic Review And Meta-analysis

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(No relevant relationships reported)

Approximately 90% of women remain employed during pregnancy. Long working hours have been hypothesized to be associated with an increased risk of adverse pregnancy outcomes including miscarriage and preterm delivery. **PURPOSE:** The purpose of this review was to evaluate the effect of long working hours (>40 hour work week) on maternal and fetal health outcomes. **METHODS:** Five electronic databases and two grey literature sources were searched up to March 12, 2018 and the results underwent duplicate independent screening. Studies of all designs were included (except case studies), and contained information on the Population [women who engaged in paid work during pregnancy], Exposure [>40 h work week], Comparator [working ≤ 40 h/week], and Outcomes [preterm birth, low birthweight (birthweight $< 2,500$ g), small for gestational age, miscarriage, gestational hypertension, pre-eclampsia and intrauterine growth restriction]. Pooled odds ratio (OR) and 95% confidence interval (CI) were calculated using a random-effect, inverse variance method. Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework was used to assess the quality of evidence. **RESULTS:** A total of 41 observational studies ($N = 126,632$) were included. "Low" to "Very low" quality evidence from observational studies revealed that compared with normal working hours (working ≤ 40 h/week), long working hours were associated with an increased odds of having a preterm delivery (OR: 1.16, 95% CI: 1.04, 1.3, $I^2 = 53\%$), a small-for-gestational age baby (OR: 1.13, 95% CI: 1.00, 1.27, $I^2 = 47\%$) and miscarriage (OR: 1.36, 95% CI: 1.17, 1.59, $I^2 = 47\%$). When meta-analysis was restricted only to adjusted ORs, long working hours were associated with an increase in risk of preterm delivery (OR: 1.18, 95% CI: 1.01, 1.37, $I^2 = 60\%$) and miscarriage (OR: 1.39, 95% CI: 1.09, 1.78, $I^2 = 54\%$). We found no significant association between long work hours and low birth weight, pre-eclampsia, gestational hypertension or intrauterine growth restriction. **CONCLUSIONS:** Engaging in a work week over 40 hours is associated with an increased risk of adverse pregnancy outcomes. Supported by an Occupational Health and Safety Futures Research Grant, Alberta SPOR SUPPORT Unit KT Platform and Heart & Stroke Foundation of Canada National New Investigator Award (MD).

1056 Board #290 May 29 2:00 PM - 3:30 PM

Influence Of Shift Work On Pregnancy Outcomes: A Systematic Review And Meta-analysisChenxi Cai, Robin Featherstone, Meghan Sebastianski, Margie H. Davenport. *University of Alberta, Edmonton, AB, Canada.*
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(No relevant relationships reported)

Shift work including rotating shift and night shift has been suggested to be associated with risk of adverse pregnancy outcomes due to disrupted circadian rhythms and neuroendocrine adaptations which may affect fetal growth and timing of parturition. **PURPOSE:** To evaluate the association between shift work and pregnancy outcomes. **METHODS:** Five electronic databases and two grey literature sources were searched up to March 12, 2018 and the results underwent duplicate independent screening. Studies of all designs were included (except case studies), and contained information on the Population [women who engaged in paid work during pregnancy], Exposure [rotating shift work (working a pattern of days and nights) or fixed night shift (typical working day between 22:00 to 08:00)], Comparator [fixed day shift (typical working day between 8:00-18:00)], and Outcomes [preterm birth, low birthweight, small for gestational age, miscarriage, gestational hypertension and pre-eclampsia]. Pooled odds ratio (OR) and 95% confidence interval (CI) were calculated using a random-effect, inverse variance method. Grading of Recommendations Assessment, Development and Evaluation (GRADE) framework was used to assess the quality of evidence. **RESULTS:** A total of 41 observational studies (N=145,671) were included. "Low" to "Very low" quality evidence from observational studies revealed that compared with fixed day shift, rotating shift was associated with an increased odds of preterm delivery (OR: 1.16, 95% CI: 1.03, 1.3, $P=34\%$) and having a small-for-gestational age baby (OR: 1.23, 95% CI: 1.08, 1.39, $P=11\%$). Fixed night shift was associated with an increase odds of preterm delivery (OR: 1.25, 95% CI: 1.05, 1.48, $P=36\%$), miscarriage (OR: 1.31, 95% CI: 1.09, 1.57, $P=34\%$) and gestational hypertension (OR: 1.22, 95% CI: 1.01, 1.48, $P=0\%$). When meta-analysis was restricted only to adjusted ORs, fixed night shift was associated with an increase in risk of miscarriage (OR: 1.34, 95% CI: 1.10, 1.63, $P=38\%$). Rotating shift or fixed night shift were not significantly associated with low birth weight or pre-eclampsia. **CONCLUSIONS:** Pregnant women who work with rotating shift or fixed night shift have an increased risk of adverse pregnancy outcomes.

Supported by Alberta OHS Futures Research Grant and the Alberta SPOR SUPPORT Unit.

1057 Board #291 May 29 2:00 PM - 3:30 PM

Effects of Powered Air-Purifying Respirators on Tear Osmolarity after ExerciseEdward J. Sinkule, FACSM¹, Jeffrey B. Powell¹, Amanda L. Strauch¹, Tyler D. Quinn². ¹Centers for Disease Control and Prevention/NIOSH, Pittsburgh, PA. ²University of Pittsburgh, Pittsburgh, PA.

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(No relevant relationships reported)

Powered air-purifying respirators (PAPRs) are used frequently in healthcare because they provide superior respiratory protection and improved comfort when compared to N95 filtering facepiece respirators. However, dry eyes from airflow on the face with PAPRs have been reported by users. Tear osmolarity is among several factors for diagnosing dry eye syndrome. **PURPOSE:** This study compared tear osmolarity measurements among participants performing the same energy expenditures while wearing two different NIOSH-approved PAPRs. **METHODS:** After protocol approval by the NIOSH IRB, men (n=12) and women (n=12) provided written informed consent. Participants wore randomly-assigned PAPRs at the same absolute energy expenditures. The treadmill exercise trials included four minutes each of standing rest, $VO_2=1.0$ L/min, $VO_2=2.0$ L/min, and $VO_2=3.0$ L/min or maximum (all STPD); separated by 20 minutes of sitting rest and rehydration. All PAPRs were equipped with HEPA filters. Tear osmolarity (mOsm/L) was measured with an instrument which uses a 50 nanoliter tear sample. The largest measurement from both eyes was used for the results. The BASELINE tear osmolarity measurements were the average of osmolarity measurements obtained when participants arrived and the pre-exercise period before donning the PAPR. The tear osmolarity measurements from both PAPRs (PAPR1 and PAPR2) were measured immediately after each exercise trial. **RESULTS:** Tear osmolarity between the men and women across all trial periods were not statistically different (BASELINE $p=0.17$; PAPR1 $p=0.53$, PAPR2 $p=0.11$). Mean (\pm SD) tear osmolarity for BASELINE, PAPR1, and PAPR2 from men were 315 ± 19 , 304 ± 12 , and 314 ± 23 , respectively. Mean (\pm SD) tear osmolarity for BASELINE, PAPR1, and PAPR2 from women were 307 ± 9 , 307 ± 11 , and 300 ± 14 , respectively. Tear osmolarity of each PAPR was not statistically different from BASELINE for men (PAPR1 $p=0.07$; PAPR2 $p=0.81$) and women (PAPR1 $p=0.90$; PAPR2 $p=0.18$). **CONCLUSION:** After wearing PAPRs for more than 20 minutes, tear osmolarity for each PAPR was not different than baseline. Areas of future research include the evaluation of tear osmolarity with longer

periods of PAPR use and the comparison of tear osmolarity with blood osmolarity for research when instantaneous, non-invasive osmolarity measurements would be beneficial.

1058 Board #292 May 29 2:00 PM - 3:30 PM

Validity and Reproducibility of Commercial Cycling Power Meters in Hot and Cold Environmental TemperaturesCamille Larson. *University of Nebraska at Omaha, Omaha, NE.*
(Sponsor: Dustin Slivka, FACSM)

(No relevant relationships reported)

PURPOSE: Power meters provide objective monitoring of exercise intensity, unaffected by day-to-day physiological variations. The validity and reliability of most power meters have been assessed in laboratory settings with controlled, stable environmental conditions. Since a factor of importance for athletes exercising in a wide range of different environmental temperatures is the accurate recording of the training values regardless of environmental fluctuations. The purpose of this study was to examine potential differences in power output of the CompuTrainer, PowerTap, Stages, and Vector power meters in hot and cold compared to a room temperature environment. **METHODS:** Recreationally trained participants (7 males, 3 females, n = 10, age: 24 ± 1 years, height: 176 ± 6.1 cm, weight: 75.4 ± 10 kg, VO_{2peak} : 56.6 ± 8.3 ml · kg⁻¹ · min⁻¹) completed three incremental VO_{2peak} cycling trials in hot (33°C), cold (7°C), and room temperature (RT, 20°C) conditions. The power meters were placed on a standard road bicycle and power output was logged and recorded. **RESULTS:** The CompuTrainer's power output was higher in the RT trial compared to the cold ($p = 0.006$) and hot ($p = 0.047$), but not between the hot and cold trial ($p = 0.734$). The PowerTap's power output was not different in RT and cold ($p = 0.875$), but was lower in the hot compared to RT ($p < 0.001$) and compared to cold ($p < 0.001$). The Stages' power output was not different between RT and cold ($p = 0.234$), but was lower in the hot compared to RT ($p < 0.001$) and cold ($p < 0.001$). The Vector's power output was not different between RT and cold ($p = 0.067$) but was lower in the hot compared to RT ($p < 0.001$) and cold ($p < 0.001$). **CONCLUSION:** Environmental temperature may affect the reproducibility of power meters, thus revealing the significance of recognizing potential differences between temperatures when choosing a power meter.

1059 Board #293 May 29 2:00 PM - 3:30 PM

Effect of Recreational Soccer Play in the Air of Fine Particulate Matter on Pulmonary Function and Blood Pressure in Collegiate MenMin Gi Jung, Jaemyung Kim, Yunbin Lee, Somi Yun, Eunjin Hwang, Dahye Lim, Dae Taek Lee. *Kookmin University, Seoul, Korea, Republic of.*

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(No relevant relationships reported)

PURPOSE: Although exercise in polluted air was not recommended, no concrete information regarding health effects of air pollution has been established in real situations. This study aimed to examine the effects of polluted air on pulmonary responses and blood pressure following vigorous outdoor exercises. **METHODS:** A total of 9 healthy young men (21.5 ± 1.5 yrs, 172.2 ± 5.2 cm, 68.4 ± 9.9 kg), who formed an intramural collegiate team and regularly played recreational soccer, participated in two of four-week experiments. Each was conducted in the fall (October, FS) and the Spring (April, SS). Before (Wk0) and after (Wk4) the experiments, their maximal oxygen uptake (VO_{2max}), forced vital capacity (FVC), forced expiratory volume in first second (FEV_1), FEV_1/FVC , and systolic and diastolic blood pressure (SBP, DBP) were measured. During each of the experimental period, they played on the average of six sessions while recording their heart rate. In each session, they were trained for 54 ± 1 min (at an intensity of 60.4 ± 2.5 and $57.8 \pm 4.8\%$ of VO_{2max} in FS and SS, respectively) followed by 55 ± 4 min of friendly game (at 84.8 ± 3.0 and $82.6 \pm 1.1\%$ of VO_{2max} in FS and SS, respectively). After each play session, FVC, FEV_1 , FEV_1/FVC , SBP, and DBP were measured. Air quality was measured by light-scattering method. PM_{10} and $PM_{2.5}$ in FS was 44.0 ± 34.1 and 24.1 ± 23.7 $\mu\text{g}/\text{m}^3$, while those in SS was 92.0 ± 23.7 and 49.3 ± 25.7 $\mu\text{g}/\text{m}^3$, respectively. **RESULTS:** When the change of measured variables between Wk0 and Wk4 was compared, no differences were found. Repeated measures of FVC, FEV_1 , FEV_1/FVC , SBP, and DBP during sessions of FS did not revealed any significances, but FVC, FEV_1 , FEV_1/FVC and SBP in SS were significantly increased ($p < 0.05$). When the lowest and the highest particulate concentrations were compared in each season (20 vs. 107 of PM_{10} and 8 vs. 69 $\mu\text{g}/\text{m}^3$ of $PM_{2.5}$ in FS; 28 vs. 159 of PM_{10} and 17 vs. 90 $\mu\text{g}/\text{m}^3$ of $PM_{2.5}$ in SS), no differences were noticed during FS. But FVC and FEV_1 were increased higher after play sessions in highly polluted air than clean air. **CONCLUSIONS:** In general, the concentration of fine particulate matter in the air did not affect pulmonary and blood pressure responses for the healthy recreational exercisers. But the higher concentration of particulate matter in the air may influence on pulmonary responses after vigorous outdoor activities.

- 1060** Board #294 May 29 2:00 PM - 3:30 PM
Blood Pressure Responses to Air Pollution in Chinese Children: Effect Modification by Obesity
 Zhaohuan Gui¹, Mao Wang¹, Li Cai¹, Jun Ma², Yinghua Ma², Jin Jing¹, Yajun Chen¹. ¹*School of Public Health, Sun Yat-sen University, Guangzhou, China.* ²*School of Public Health, Peking University, Guangzhou, China.*
 (No relevant relationships reported)

PURPOSE: To assess effect modification by obesity on the association between pollutants and blood pressure (BP) in Chinese children.

METHODS: We investigated 26,039 Chinese children, aged 6-18 years old, from 50 elementary schools and 44 middle schools from seven provinces in China in 2014. The weight, height, waist circumferences, and BP were measured. Total seven and half months concentrations of particulates with an aerodynamic diameter < 2.5 and ≤10 μm (PM_{2.5} and PM₁₀), ozone (O₃), sulfur dioxide (SO₂), nitrogen dioxides (NO₂), and carbon monoxide (CO) were assessed based on the measurement from national monitoring stations and the personal short-term inhalation rate. Two-level regression analysis was used to examine the effects, controlling for sex, age, early life factors, physical activity, screen time, socioeconomic status, passive smoking exposure, and family history of hypertension.

RESULTS: The results showed that associations existed between elevated BP and pollutants. The increase in systolic BP ranged from 0.21 mmHg per 62.2 mg/m³ increase for CO (95%CI: 0.03-0.40 mmHg) to 1.49 mmHg per 1320.4 μg/m³ increase for PM₁₀ (95%CI: 1.21-1.86 mmHg). The increases in mean diastolic BP ranged from 0.42 mmHg per 368.6 μg/m³ increase for NO₂ (95%CI: 0.22-0.62 mmHg) to 0.82 mmHg per 1320.4 μg/m³ increase for PM₁₀ (95%CI: 0.54-1.10 mmHg). Compared to children with normal weight or non-abdominal obesity, underweight, overweight, obese, or abnormally obese children exhibited consistently stronger effects.

CONCLUSIONS: Study findings indicate that high levels of PM_{2.5}, PM₁₀, SO₂, NO₂, O₃, and CO are associated with increased BP among Chinese children. Underweight, overweight, obesity, and abdominal obesity may increase the risk.

- 1061** Board #295 May 29 2:00 PM - 3:30 PM
Effect of Two Equipment Load Bearing Strategies on Low Back Discomfort in On-duty Police Officers
 Jeffrey M. Janot, Chantal Bougie, Anna Kohler, Sierra Freid, Jessica Nagel, Maddy Downing, Lindsey Opelt, Marquell Johnson, Nick Beltz, Andrew Floren, Saori Braun. *University of Wisconsin-Eau Claire, EAU CLAIRE, WI.*
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Jeffrey Janot, Chantal Bougie, Anna Kohler, Sierra Freid, Jessica Nagel, Maddy Downing, Lindsey Opelt, Marquell Johnson, Nick Beltz, Andrew Floren, Saori Braun
ABSTRACT

Effect of two equipment load bearing strategies on low back discomfort in on-duty police officers

KEY WORDS: back pain, load bearing vest, occupational health

PURPOSE: Low back pain is a common condition affecting active-duty police officers. Carrying equipment at the waist using a standard duty belt has been linked to discomfort while on duty. The purpose of this study was to determine if a load bearing vest worn on the trunk is more effective at decreasing low back discomfort compared to the standard duty belt. **METHODS:** 15 police officers (13 m, 2 f), aged 25-45 y/o, were recruited for this study. Screening criteria were active duty for 1 year and a rating of "minimal disability" on the Oswestry LBP Disability scale. Officers were randomized into either a duty belt or load bearing vest group pre-study. A crossover design was used for the 6-mo study requiring each officer to wear the duty belt or vest each for a 3-mo period. Each work shift the officers rated their level of low back discomfort using a visual-analog scale (VAS) numbered 0-10 (0 = no pain; 10 = worst pain imaginable). Other physical measures included in the analysis were body composition, spine mobility, and core and aerobic endurance. **RESULTS:** There were significant ($p < .05$) differences between vest and belt conditions for each month (1: 2.97±0.73 belt vs 0.95±1.24 vest; 2: 4.08±1.03 belt vs 0.55±1.12 vest; 3: 4.17±1.21 belt vs 0.24±0.41 vest; 4: 4.97±2.43 belt vs 2.03±1.63 vest; 5: 3.33±1.18 belt vs 1.29±1.05 vest; 6: 4.90±2.57 belt vs 1.03±1.10 vest). Pearson's r values indicated weak ($r = -.26$ to $-.39$) and nonsignificant ($p > .05$) correlations between belt VAS scores and physical measures and some moderate ($r = -.51$ to $-.46$) but nonsignificant ($p > .05$) correlations between vest VAS scores and physical measures. **CONCLUSIONS:** Results demonstrated that a load bearing vest produced lower VAS scores compared to the duty belt. There were no significant relationships between physical measures and VAS scores indicating that the load bearing devices were most responsible for eliciting the VAS results reported. Thus, to decrease discomfort, we recommended that officers use a load bearing vest system while on duty.

- B-68** Free Communication/Poster - Medical Issues
 Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

- 1062** Board #296 May 29 3:30 PM - 5:00 PM
No Association between Serum Vitamin D and Physical Fitness in Trained Youth Soccer Athletes
 Shane D. Scholten¹, Derek D. Ferley², Matthew D. Vukovich, FACSM³, Brooke S. Bleeker¹, Hunter A. Haman¹, McKayla J. Horstman¹, Alaina K. Klapperich¹, Tara L. Sandgren¹, Clark P. Vargo¹. ¹*Augustana University, Sioux Falls, SD.* ²*Avera Sports Institute, Sioux Falls, SD.* ³*South Dakota State University, Brookings, SD.* (Sponsor: Dr. Matthew Vukovich, FACSM)
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Vitamin D is known to affect bone health and muscle function. Insufficient vitamin D (25(OH)D) status may negatively affect adolescent physical performance levels.

Purpose: To examine the cross-sectional association between 25(OH)D status and several markers of physical performance in youth club soccer athletes.

Methods: 42 adolescent, male and female club soccer players age 14-18 were recruited during the winter season. 25(OH)D status, measured in January, was assessed from a capillary blood sample analyzed using liquid chromatography-tandem mass spectrometry. Physical performance was evaluated using a variety of agility, muscular strength, and cardiorespiratory fitness tests. Participants were classified as 25(OH)D Deficient (< 50 nmol/L), Insufficient (50-75 nmol/L), or Sufficient (> 75 nmol/L) and a relationship between physical performance and 25(OH)D classification was determined using a one-way ANOVA.

Results: Mean 25(OH)D status was 67.0 ± 16.7 nmol/L. 19% (8/42) of the participants were vitamin D deficient, 55% (23/42) were vitamin D insufficient, and 26% (11/42) were vitamin D sufficient. There were no associations found between 25(OH)D status and the variety of agility, muscular strength, and cardiorespiratory fitness tests ($p > 0.05$).

Conclusions: This investigation demonstrates there are no associations between 25(OH)D status and physical performance in adolescent soccer players. Our participants were competitive adolescent athletes with none being severely deficient which may mask associations in this population group.

- 1063** Board #297 May 29 3:30 PM - 5:00 PM
Acute and Chronic Changes of Hematological Variables in College Football Athletes with Sickle Cell Trait
 Haoyan Wang¹, Nathan P. Lemoine, Jr.¹, Matt Martone¹, Brian A. Irving, FACSM¹, Guillaume Spielmann¹, Jack Marucci¹, Shelly Mullenix¹, Derek D. Calvert¹, Timothy S. Church², Jennifer Rood², Brian Harrell³, Neil M. Johannsen¹. ¹*Louisiana State University, Baton Rouge, LA.* ²*Pennington Biomedical, Baton Rouge, LA.* ³*Baton Rouge General Sports Medicine, Baton Rouge, LA.*
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 (No relevant relationships reported)

PURPOSE: To determine the acute and chronic changes of hematological in NCAA Division I football players with sickle cell trait (SCT) and healthy control (CON) before and after a single practice (acute) and pre-and post-training camp in pre-season (chronic). **METHODS:** Eight athletes (n=4 SCT; n=4 CON) had blood drawn pre-and post-training camp in pre-season. Six of them (n=3 SCT; n=3 CON) had blood drawn before and after a single pre-season scrimmage. Hemoglobin electrophoresis (Hb-A, Hb-A2, Hb-S and Hb-F), complete blood count, and chemistry panel 26 were analyzed using 2-way RM ANOVA. **RESULTS:** Baseline total hemoglobin content was similar between SCT and CON (mean±SD; 14.1±0.6 g/dL vs. 14.5±0.6 g/dL; $P=0.41$). However, Hb-A was lower (58.4±3.8% vs. 86.6±17.5%; $P=0.02$) and Hb-S was higher in SCT than CON (36.8±3.6% vs. 0.2±0.4; $P<0.0001$), and results were consistent at all time points. After a single practice, uric acid was significantly higher in SCT compared to CON (7.5±0.8mg/dL vs. 6.4±0.4mg/dL; $P_{all}=0.04$). However, blood urea nitrogen (BUN) was lower in SCT (16.1±3.5mg/dL) than CON (23.4±1.6mg/dL; $P_{all}=0.006$). The chronic changes between pre-and-post camp showed that SCT had lower in BUN (16.1±3.9mg/dL vs. 20.5±3.3 mg/dL; $P_{all}=0.015$) and total bilirubin (0.73±0.14mg/dL vs. 1.13±0.27mg/dL; $P_{all}=0.027$) compared to CON. In complete blood count profile, white blood count, neutrophils, lymphocytes, and monocytes significantly decreased in both groups ($P_{all}<0.05$). **CONCLUSION:** Both acute and chronic changes showed SCT had lower BUN than CON suggesting exercise might have different effects on kidney function between two groups. Subclinical changes in resting immune cell counts between pre- and post-training camp suggest that athletes' immune function may be dampened by repeated bouts of exhaustive exercise.

1064 Board #298 May 29 3:30 PM - 5:00 PM

Blood Flow Response and Changes in Fluid Distributions after Percussive Massage Therapy

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(No relevant relationships reported)

PURPOSE: Percussive massage therapy is a widely used modality for sports rehabilitation and recovery after intense exercise. Recent advancements in handheld vibration technology have further increased its popularity. While athletes, trainers, and therapists collectively tout its practical benefits for sports performance, the underlying mechanisms are largely unknown. To provide such insight, we assessed blood flow response and changes in fluid distributions after applying percussive massage therapy to the quadriceps muscles of each leg.

METHODS: Forty-one participants (23 female, 25.1 ± 3.0 years of age) with a range of body fat percentage ($23.8 \pm 7.9\%$) were tested. Percussive massage therapy was applied for 2 minutes by a study investigator. Two devices were used simultaneously, TheraGun G2PRO and HyperIce Hypervolt, with similar speed setting (40 percussions per second) and randomly assigned to one of each participants' legs. A thermal camera (FLIR C2) was used as a proxy for blood flow. All images were taken with participants seated and an ice-water slurry between their abducted legs as a control for temperature. Fluid distributions, including extracellular water (ECW) and the ratio of ECW to total water (ECW/TW), were assessed through bioelectrical impedance analysis (Biospace Inbody 770).

RESULTS: Immediately after the treatment, there was no difference in surface temperature compared to baseline in either thigh. However, the temperature in both thighs was greater than baseline in the 3rd to 8th minutes ($\sim 3^\circ\text{F}$, $P < 0.006$), indicating a delayed blood flow response. Temperatures returned to baseline by the 12th minute post-massage. Differences between devices were observed. The percent change from baseline was significantly greater in the G2PRO thigh than the Hypervolt thigh at minutes 5 (3.7% vs 3.2%), 6 (3.7% vs 3.2%), 7 (3.6% vs 3.1%), and 12 (1.9% vs 1.4%, respectively) post-massage (all $P < 0.006$). For ECW and ECW/TW, a significant decrease was observed only in the G2PRO leg between 2 and 9 minutes post-massage ($P < 0.0167$). However, there was no difference between legs.

CONCLUSIONS: Overall, the G2PRO and Hypervolt induce a delayed blood flow response; however, the G2PRO has a larger, longer-lasting effect. In addition, the G2PRO appears to influence fluid distributions, while the Hypervolt does not.

1065 Board #299 May 29 3:30 PM - 5:00 PM

Low Energy Availability May Cause REE Suppression and Bone Loss in Japanese Male Athletes

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(No relevant relationships reported)

PURPOSE: Recently, it has been reported that low energy availability (EA) affects physical conditions (i.e. impairments of metabolic rate, bone health, immune functions, protein synthesis etc.) in male athletes as well as female. However, few EA data of male athletes have been reported. The aim of this study was to estimate EA of Japanese male athletes, and to examine the relationship between their EA and resting energy expenditure (REE), and the status of bone health.

METHODS: Five male collegiate long-distance runners (age: 19.6 ± 0.8 yrs., average running time: 133 ± 20 min/day) during a training season participated in this study. Total energy intake (TEI) was assessed using 7-day dietary records with food pictures that were taken by the athletes. Further, they were interviewed on their food picture by a sports dietitian. Exercise energy expenditure (EEE) was determined by HR-VO₂ method. EA was calculated by subtraction of EEE from TEI and normalized by fat free mass (FFM). REE was measured in the morning fasting by indirect calorimetry using Douglas bag technique, and blood sampling were conducted to assess Triiodothyronine, sex hormones and bone resorption marker (serum NTx). Body composition was measured by DXA (Hologic Horizon A). REE was predicted using organ-tissue mass derived from DXA, and REE suppression was estimated by the ratio of measured REE to predicted REE.

RESULTS: Mean EA of the subjects was 16.4 ± 3.3 kcal/kg FFM/day, which was below the cut off value (30kcal/kg FFM/day). Measured REE was also below the average of Japanese athletes presented in our previous study. Based on the mean ratio of measured REE to predicted REE (0.91), energy metabolism of these athletes seemed to be suppressed. In addition, the value of NTx showed a high value exceeding the reference range, subjects were considered to be in a state where bone resorption was promoted.

CONCLUSIONS: These data suggested that low EA could impair energy metabolism and bone health in Japanese male collegiate long-distance runners.

1066 Board #300 May 29 3:30 PM - 5:00 PM

Nocturnal Hypoglycemia Incidents Following Moderate and Vigorous Physical Activity in Athletes With Type 1 Diabetes

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(No relevant relationships reported)

PURPOSE: For adolescent athletes with type 1 diabetes mellitus (T1DM), proper glucose management during and after prolonged activity could prove difficult because of the body's response throughout the process of gluconeogenesis. Understanding their body's glucose response to physical activity could aid in effectively addressing nocturnal hypoglycemia. Therefore, the purpose of this investigation was to examine the acute temporal associations between blood glucose and measures of moderate and vigorous intensity physical activity via an accelerometer in a sample of athletes with T1DM. **METHODS:** 10 adolescent athletes with diagnosed T1DM between the ages of 13 - 17 and who were involved in competitive sports in the previous 12 months were recruited for this study. All participants wore an accelerometer and continuous glucose monitor (CGM) consecutively for a minimum of 2-weeks with a total of 168 patient-days of collected data. Nocturnal hypoglycemia was defined as a blood glucose reading < 70 mg/dl during sleeping hours that lasted ≥ 10 minutes as indicated by the CGM.

RESULTS: Incidents of nocturnal hypoglycemia occurred 29% of the nights measured with an average duration of 52.33 ± 41.04 minutes. A multiple linear regression showed vigorous intensity to be a significant predictor of nocturnal hypoglycemia after controlling for all variables ($\beta = 0.169$, $p = 0.02$) with an average time of 26 minutes of vigorous intensity. **CONCLUSIONS:** Engaging in vigorous intensity physical activity increased the risk of prolonged nocturnal hypoglycemia in adolescent athletes with T1DM. Incorporating accelerometers into patient care could prove beneficial when making further recommendations for athletes by improving glucose management. Funded by Children's Hospital Foundation, Christensen Family, Norton Children's Hospital, and University of Louisville.

1067 Board #301 May 29 3:30 PM - 5:00 PM

The Implications of New Blood Pressure Guidelines on Hypertension Prevalence in Former NFL Players

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(No relevant relationships reported)

Purpose: Examine potential implications of the new 2017 ACC/AHA hypertension (HTN) guidelines on the prevalence of HTN in a population of former professional football players.

Methods: Blood pressure (BP), height, weight, and waist circumference were collected from former professional football players ($n = 1240$) between April 2015 and August 2018 during cardiovascular screening events held throughout the U.S. Demographic information was collected, including age, race, career playing position, and previous HTN diagnosis. HTN status was assessed via 2010 JNC (2010) and 2017 ACC/AHA (2017) guidelines. Means were analyzed using one-way ANOVA, Pearson's correlation, and Chi square, where appropriate.

Results: The overall prevalence of hypertensive BP observed in this cohort was 38.5% (2010) and 70.5% (2017; $p < 0.0001$). While all subjects previously identified as having stage 1 HTN by 2010 guidelines were re-categorized as stage 2 under new 2017 guidelines, 72.8% of subjects previously identified as prehypertensive were re-categorized as having stage 1 HTN. There was an overall increase ($p < 0.0001$) in HTN prevalence by 2017 versus 2010 criteria in all groups when data were stratified by age, race, and playing position. There was an 83.4% increase in the prevalence of previously undiagnosed HTN under the new 2017 guidelines (48.6%) versus 2010 guidelines (26.5%; $p < 0.0001$). Correlation of body mass index and waist circumference with HTN revealed a significant association ($p < 0.0001$) of body mass index and HTN under both 2010 guidelines ($r = 0.2036$) and 2017 guidelines ($r = 0.1547$). Conversely, the association between waist circumference and HTN under 2010 guidelines ($r = 0.1825$; $p < 0.0001$) was better than that of 2017 guidelines ($r = 0.0422$; $p = 0.1379$), but only the correlation with HTN under 2010 guidelines was found to be significant.

Conclusions: Changes to the guidelines for the categorization of BP are expected to substantially increase HTN diagnosis in this population of former professional football players, as previously undiagnosed HTN under the new 2017 guidelines almost doubled in the current study. Given the significant increase in former players found to have stage 2 HTN, it is also likely that the number of men in this population prescribed antihypertensive medications will increase substantially.

1068 Board #302 May 29 3:30 PM - 5:00 PM

Comparison between Dual X-ray Absorptiometry and Magnetic Resonance Imaging for Visceral Fat Assessment in Athletes

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PURPOSE: Visceral fat is related to cardiometabolic risk in athletes as well as non-athletes. Magnetic resonance imaging (MRI) estimates visceral adipose tissue (VAT) from a direct differentiation of VAT from subcutaneous adipose tissue. Recently, some validation studies of VAT assessment using dual X-ray absorptiometry (DXA) have been reported. This study aimed to compare DXA measurements of VAT with the gold standard MRI in athletes with wide ranges of body size.

METHODS: This study included 77 male collegiate athletes (age, 20 ± 2 yr; height, 175.1 ± 7.4 cm; body weight, 79.6 ± 17.4 kg; body mass index, 25.9 ± 5.3 kg/m²) from different sports (e.g. sumo, judo, lifters, wrestlers, basketball, volleyball, swimming, etc.) Paired measurement of VAT was performed using MRI (Signa 1.5T; General Electric Co., Ltd., WI, USA) and DXA (Horizon A configured with software APEX 5.6, Hologic Inc.). MRI-VAT volume was calculated by integrating six 65-mm single MRI slices corresponding to the level of DXA-VAT volume measurement. Data were compared using Wilcoxon signed rank test and a Bland-Altman plot was used to assess systematic error. Data were shown mean \pm SD for parametric data and median (Inter quartile range) for nonparametric data.

RESULTS: The VAT volumes of DXA ($248 (212 - 298)$ cm³) and MRI ($211 (180 - 269)$ cm³) differed significantly ($p < 0.01$). Regression analysis showed a linear relationship between DXA and MRI VAT volumes ($r = 0.89$). The fit line for the relationship between MRI and DXA VAT volume was calculated as follows: DXA-VAT volume = $0.87 \times$ MRI-VAT volume + 68 (cm³). Bland-Altman analysis showed DXA-VAT volume overestimated by 37 ± 50 cm³ compared with MRI-VAT volume, with no systematic error ($p = 0.75$).

CONCLUSIONS: DXA-VAT volume was overestimated compared to MRI-VAT volume among male collegiate athletes with wide ranges of body size. The overestimation of DXA-VAT volume needs further investigation.

1069 Board #303 May 29 3:30 PM - 5:00 PM

Rapid Diagnostic Testing as a Tool for Guiding Treatment of Infectious Disease in Elite Athletes

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(No relevant relationships reported)

PURPOSE:

To describe the most common etiologies of upper respiratory tract infections (URI) in elite athletes presenting to an ambulatory sports medicine clinic as diagnosed with polymerase chain reaction rapid diagnostic testing (PCR).

METHODS:

Retrospective analysis of medical records from 42 patient-athletes who presented to a sports medicine clinic for evaluation of URI. Clinic care pathways identify a criterion for the implementing PCR testing of patient's presenting with symptoms and objective signs of an URI. Descriptive statistics were used to describe the etiology of URI in this cohort.

RESULTS:

42 URI cases met clinical criteria for PCR testing. 22 of these cases yielded positive identification of at least one pathogen. 21 of the 22 positive cases represented viral agents (95%). Influenza was the responsible agent in 50% of positive cases. *Chlamydia pneumoniae* was the sole bacterial pathogen identified. There were 3 cases of co-infection composed of multiple viral pathogens.

CONCLUSION:

Viral pathogens are the most common cause of URI in the elite athlete population. The identification of viral URI with PCR testing in athlete populations provides for the opportunity to implement evidence-based management. The significant number of negative PCR findings in patients with upper respiratory symptoms suggests there are additional unidentified etiologies for respiratory symptoms in athletes. The impact of PCR on the treatment strategies and outcomes of URI requires further investigation.

1070 Board #304 May 29 3:30 PM - 5:00 PM

Effects of Two Cooling Strategies on Performance and Perceptual Measures Among Athletes with an SCI

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(No relevant relationships reported)

Individuals with spinal cord injury (SCI) have thermoregulatory inhibition, increasing the risk for heat related complication during exercise. Studies have examined cooling methods within this population, however many strategies are impractical.

PURPOSE: To compare the effects of ad libitum use of two practical cooling methods: ice slurry (IS) and artificial sweat (SB), on performance and perceptual measures in recreationally trained athletes with SCI.

METHODS: Recreational wheelchair basketball (WB) and rugby (WR) athletes with SCI ($n = 5$; age 32.8 ± 12.0 y; playing 3.2 ± 1.9 y; BMI 25.0 ± 8.1 kg/m²; peak oxygen consumption [VO_{2peak}] 19.6 ± 3.5 ml/kg/min) completed three lab visits; a familiarization, and two cooling trials in a climate controlled chamber ($30.1 \pm 0.2^\circ\text{C}$, $51.7 \pm 2.0\%$ relative humidity). Following familiarization, participants were assigned to IS or SB with an isocaloric, isovolumetric control beverage (CON). Participants completed an arm ergometry game simulation consisting of four quarters (four minutes of active recovery (A_1, A_2, A_3, A_4) and a 15-s sprint (S_1, S_2, S_3, S_4)). The assigned ad lib cooling method was available during programed rest after each sprint. IS and CON were split into two 3.4g/kg boluses provided 10-min prior to exercise and during passive rest. Peak power output (W), perceived exertion (RPE), and thermal sensation (TS) were collected every four and five min.

RESULTS: W (mean \pm SD) was greater during sprints with SB than IS, respectively (S_1 : 93.6 ± 57.8 W, 85.9 ± 53.5 W; S_2 : 97.1 ± 53.2 W, 86.5 ± 40.8 W; S_3 : 99.1 ± 57.0 W, 90.9 ± 48.9 W; S_4 : 96.5 ± 51.2 W, 90.6 ± 47.7 W). TS (mean \pm SD) was similar across all exercise for both SB and IS, respectively: S_1 : 5.2 ± 1.1 , 5.4 ± 0.5 ; S_2 : 6.0 ± 1.0 , 6.2 ± 0.8 ; S_3 : 6.4 ± 0.9 , 6.4 ± 0.6 ; S_4 : 6.8 ± 1.1 , 6.8 ± 0.5 ; A_1 : 5.0 ± 0.7 , 5.4 ± 0.5 ; A_2 : 5.4 ± 1.1 , 6.0 ± 1.0 ; A_3 : 6.2 ± 0.8 , 6.6 ± 0.9 ; A_4 : 6.6 ± 0.9 , 6.6 ± 0.6 . RPE (mean \pm SD) was similar for SB and IS, respectively, with SB trending higher at the end of exercise: S_1 : 12.4 ± 1.6 , 12.4 ± 2.0 ; S_2 : 14.2 ± 1.6 , 13.8 ± 1.6 ; S_3 : 15.6 ± 0.9 , 13.8 ± 1.3 ; S_4 : 15.4 ± 1.5 , 14.6 ± 1.1 ; A_1 : 10.2 ± 1.8 , 11.0 ± 2.5 ; A_2 : 11.8 ± 0.8 , 12.4 ± 1.8 ; A_3 : 13.4 ± 2.5 , 12.8 ± 1.3 ; A_4 : 14.0 ± 1.4 , 13.2 ± 1.5 . **CONCLUSIONS:** Implementation of SB yielded a greater power output and RPE than IS, but similar TS outcomes. Athletes may use either cooling method based on comfort and availability.

1071 Board #305 May 29 3:30 PM - 5:00 PM

Hydration Status and Drinking Behavior of Adolescent Athletes

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(No relevant relationships reported)

Professional young athletes should adopt an appropriate nutritional behavior including fluid consumption and hydration program. Previous studies showed high prevalence of inappropriate pre-training hydration status and poor drinking habits among athletes.

Purpose: To estimate pre and post-training hydration status and to assess water consumption patterns of young elite athletes during a training session at the Academy for Sport Excellence at Wingate Institute.

Methods: Seventy seven academy athletes (38 females, ages 13-21) training in basketball, waterpolo, volleyball, handball, rugby, triathlon and swimming were included. Body weight, urine specific gravity (USG) and volume of fluid intake before and after afternoon training session were measured.

Results: The average USG prior training was 1.021 ± 0.007 (no difference between different sports), indicating dehydration status equal to the loss of 3%-5% body weight (according to Casa DJ et al, 2000). A further decrease of an average of $1.5 \pm 0.7\%$ Body weight was measured during practice, which sums up to a deficit of approximately 4.5-6.5% in body weight by the end of practice. Athletes lost an average of $0.4 (\pm 0.57)$ kilograms and consumed $0.7 (\pm 0.44)$ liters of water during training, both with a significant difference between teams at different sport professions ($P < 0.001$, $P = 0.001$ respectively). Volleyball players lost less weight than other athlete during training (difference was significant when compared to swimmers and basketball players (difference between groups = 0.7 and 0.8 kilograms; $P = 0.018$, $P = 0.002$ respectively). Swimmers, waterpolo players and triathletes drank less compared to other athletes and most significantly less than handball players (difference between groups = 0.9 , 0.9 and 1.1 liters; $P = 0.007$, $P < 0.001$ and $P = 0.003$ respectively).

Conclusions: Young athletes in our center do not consume sufficient amount of fluids. Both pre-training hydration status and water consumption during training were not

adequate, and varied between different sport disciplines. Water-sports athletes drank less than other athletes. Education and intervention should be conducted to improve athletes drinking behavior and hydration status.

1072 Board #306 May 29 2:00 PM - 3:30 PM
Medical Encounters, Cardiac Arrests and Deaths During a 109km Mass-Participation Cycling Event Involving 102251 Starters

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 (No relevant relationships reported)

PURPOSE: Limited data are available on medical encounters, including serious life-threatening encounters and deaths during cycling events. The purpose was to determine the incidence and nature of medical encounters during a community-based mass participation cycling event.

METHODS: This retrospective, descriptive study was conducted during the Cape Town Cycle Tour (109km) in South Africa over 3 years, and involved 102251 race starters. Medical encounters were recorded on race day each year and are reported as an incidence rate (IR per 1000 starters; 95% CI). Overall illness-related (by organ system) or injury-related (by anatomical region) encounters, and severity (moderate, serious life-threatening, sudden cardiac arrest / death) were recorded.

RESULTS: In 3 years, 539 medical encounters were recorded (IR 5.27 (4.84-5.74), with a significantly higher injury- (3.23; 2.90-3.60) compared to illness-related (2.10; 1.84-2.40) ($p < 0.0001$) incidence. Incidence of serious life-threatening medical encounters was 0.49 (95%CI; 0.37-0.65) and 2 cardiac arrests and 1 death occurred (1/51126 and 1/102251 respectively). Injury incidence was highest in upper limb (1.85; 1.60-2.13), lower limb (0.96; 0.79-1.0) and head/ neck (0.77; 0.62-0.96) while illnesses incidence was highest for fluid/electrolyte abnormalities (0.59; 0.46-0.76) and the cardiovascular system (0.48; 0.36-0.63).

CONCLUSIONS: In a 109km community-based mass participation cycling event, 1 in 190 cyclists starting the race required medical assistance or evaluation by the medical team on race day. Injury-related (1 in 310 cyclists) encounters were higher than illness-related medical encounters (1 in 476) among race starters. Serious life-threatening medical encounters occurred in 1 in 2045 race starters. Risk factors associated with medical encounters need to be determined to enable implementation of safer cycling strategies.

1073 Board #307 May 29 3:30 PM - 5:00 PM
Impact of Silver Ion Laundry Treatment on Athletic Gear and Environmental Pathogens and Athlete Health

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Community-acquired infections caused by *Staphylococcus* and MRSA can spread easily through sharing towels, gear and contaminated surfaces. The resulting skin infections can lead to athlete disqualifications, cancellations of competitions and potential impact on team performance. In this study, we evaluate a residual antimicrobial textile treatment as an environmental hygiene and infection control strategy through improved textile cleanliness and reduced athlete risk for infection. **PURPOSE:** To determine the impact of silver-based residual antimicrobial textile treatment on *Staphylococcus* and MRSA levels on athletic gear, environmental surfaces, athlete infection rates and number of missed play days. **METHODS:** The study, conducted at a professional sports facility over a six-month period, included pre-season and regular season use. Residual antimicrobial silver ion laundry additive was injected onto textiles during the final rinse stage of the facility's standard laundry process. Bioburden data for *Staphylococcus* and MRSA was collected approximately every 4 weeks using contact plates. Athletes' shirts, shorts, jerseys, girdles and towels, and locker room surfaces including carpets, upholstery and other hard surfaces were sampled. Infection rates and number of days missed pre- and post-laundry treatment are also being recorded. Samples collected before initiating the silver ion textile treatment served as the control data set. **RESULTS:** Prior to silver-ion treatment implementation, significant levels of *Staphylococcus* were measured on athlete textiles (average 75 CFU/100 sq. cm.) and on environmental surfaces (average 16 CFU/100 sq. cm.). Silver ion treatment of the textiles resulted in dramatic decreases in *Staphylococcus* by 77% on textiles and by 37.5 % on environmental surfaces. Similar trends were also observed with MRSA. The overall bioburden levels continue to trend downward during the period of treatment. **CONCLUSIONS:** The current results demonstrate that a normal laundry process augmented with an active antimicrobial

treatment provide athletic gear and a locker room environment that are and stay cleaner. Final data related to cleanliness, infection rates and player days will be tallied at the close of 2018.

1074 Board #308 May 29 3:30 PM - 5:00 PM
Effects of Mistletoe Extract Supplementation on Inflammation Markers after Strenuous Exercise in Rowers

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Excessive long-term training and extensive exertion during exercise can inflammatory cytokine expression. Various measures have been explored to minimize this, and dietary supplements having anti-inflammatory and antioxidant functions can help athletes recover from repetitive intensive exercises, thereby preventing reduced vitality.

Purpose: This study aimed to identify the effect of mistletoe extract consumption on inflammatory markers of university male rowing athletes for 8 weeks during the winter training period. **Methods:** This study included 20 male rowing athletes divided into the Korean Mistletoe extract supplement group (KME, $n = 10$) and the control group (CON, $n = 10$). The KME group took 110 mL of mistletoe extract every morning and evening after meals (total of 220 mL) for eight weeks. Before and after taking mistletoe for eight weeks, 2,000 m rowing performance capabilities were measured, and KME group took 110 mL of mistletoe extract after recovery from the rowing exercise. Blood samples were collected during the rest, immediately after exercise, and after 30 min of recovery. Among inflammatory markers, IL-6 and TNF- α were analyzed. **Results:** Both groups showed a significantly reduced 2,000-m rowing time (KME; $p < 0.001$, CON; $p < 0.01$), and the total number of strokes were significantly fewer in the KME group than in the CON group ($p < 0.05$). After supplementation the levels of IL-6 and TNF- α were lower in the KME group than in the CON group in all periods of the rest ($p < 0.001$), immediately after exercise (IL-6; $p < 0.01$, TNF- α ; $p < 0.001$), and after 30 min of recovery ($p < 0.01$). **Conclusion:** Therefore, mistletoe extract intake can reduce the serum inflammatory cytokine levels (which are otherwise increased due to high-strength exercise) among active individuals, indicating improved anti-inflammatory activity.

1075 Board #309 May 29 3:30 PM - 5:00 PM
A Retrospective Analysis Of VPBs In Trained Bicuspid Aortic Valve Athletes.

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Purpose: Bicuspid aortic valve (BAV) represents a common congenital cardiac disease (1-2%) normally compatible with sports activity. In case of competitive sports, the eligibility can be otherwise limited by the presence of symptoms, aortic valve dysfunction or arrhythmias. The investigation aims to verify, in a large cohort of BAV athletes, the prevalence of ventricular arrhythmic events (VPBs) found at the maximal exercise test (ET) at the first sports medicine clinical evaluation. **Methods:** A sample of 356 BAV athletes, regularly followed at Sports Medicine Center of the University of Florence, since 10 years, was retrospectively evaluated for arrhythmic events found at the first check-up. The athletes (321 M and 35 F) were in the range of 8-50 years old (medium 24.00 ± 14.14) and practiced sports at high cardiovascular impact (predominantly soccer, basketball and track and field). Inclusion criteria were to undergo a 2D echocardiography and ET conducted at 85% of their maximal effort. VPBs were reported if they were ≥ 3 at rest and/or during the test. Exclusion criteria were age > 50 years and the presence of any other cardiac or systemic structural disease. They were matched with a control group of 400 athletes (age 19.70 ± 9.7) without BAV and similarly trained. **Results:** Only 25 (7.02%) showed VPBs at the ET. The total amount was 403 single VPBs and 4 monomorphic couples; a polymorphic pattern was present in only 3 athletes and only 5 had induced-exercise VPBs at peak. None of them showed acute events or had major arrhythmias. The difference of the VPBs prevalence in BAV athletes versus control (VPBs in 6.25%) was not significant ($p > 0.05$). **Conclusions:** Prevalence of VPBs is low in BAV athletes and it seems to be not different from athletes without BAV. In case of sports eligibility, BAV should not be considered as a cause of risk of major arrhythmic events. More data in this field could optimize the cost/effective ratio for the eventual ECG holter indications.

1076 Board #310 May 29 3:30 PM - 5:00 PM
Knowledge, Attitude, and Behavior Related to Exertional Heat Illnesses in Japanese College Athletes

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(No relevant relationships reported)

Previous studies reported sport was number one cause of heat illness for young people visiting the emergency department in Japan. However, information of athletes' perception for exertional heat illnesses (EHI) is limited.

Purpose: To examine the current level of knowledge, attitude, and behavior of EHI in Japanese college athletes.

Methods: We distributed a questionnaire to 1386 students among 5 universities in Japan, and 556 athletes responded, resulting in a response rate of 57%. Knowledge was measured with 18 true/false questions, attitude was measured with 1 scenario toward playing through symptoms of EHI on 4-point Likert scale, behavior was measured with 3 questions on 4-categories modified based on the Transtheoretical Stages of Change (unaware, undecided to implement, decided to implement, implemented) about EHI. Descriptive statistics and Chi-Squared tests of association were conducted.

Results: Only 4 subjects correctly answered all of the knowledge questions. More than half of the subjects answered incorrectly to questions about the relationship between survival rate and duration of hyperthermia (60%, n=326), the best cooling method for EHI (91%, n=493), and heat acclimatization (56%, n=302). Thirty percent of subjects (n=160) reported they would play through symptoms of EHI. Thirty nine percent (n=205) of subjects were unaware that physical activities should be canceled if temperature exceeds 35°C, while 39% (n=206) undecided to implement, 11% (n=59) decided to implement, and 11% (n=58) had already implemented the recommendation. Twenty percent (n=104) of subjects were unaware ice should be prepared for workouts in the heat, while 13% (n=67) undecided to implement, 15% (n=80) decided to implement, and 52% (n=278) had already implemented the recommendation. Subjects who were undecided to implement the recommendation to cancel workouts when temperature exceeds 35°C were associated with continuing exercise despite having EHI symptoms ($\chi^2=27.64$ (df=3), $p<.01$).

Conclusion: Most of the respondents had not implemented the recommendation to cancel physical activities in extreme heat condition and the behavior was associated with an attitude toward the need to stop exercise when having EHI symptoms. The overall findings of this study show the need for improved education for Japanese athletes.

1077 Board #311 May 29 3:30 PM - 5:00 PM
Comparison of Various Body Condition Measurements to Air Displacement Plethysmography in Female Collegiate Athletes

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(No relevant relationships reported)

Body composition is an important consideration for athletes and coaches. Air displacement plethysmography (ADP) is often preferred in this population due to relative ease of administration and accuracy of measurement. However, other methods may provide a quicker or more cost-effective way of determining body fat percentage (BF%) in athletes. **Purpose:** To compare BF% from various body fat estimators to the criterion of ADP in female Division-I collegiate athletes. **Methods:** Forty-eight female athletes (age: 18.0 ± 0.7 years, height: 146.3 ± 56.9 cm, weight: 55.9 ± 23.8 kg) underwent a body composition test battery consisting of: 1) hand-to-foot bioelectrical impedance spectroscopy (HF-BIS); 2) hand-to-foot bioelectrical impedance analysis (HF-BIA); 3) foot-to-foot BIA (FF-BIA); and 4) 3-site Jackson-Pollack skinfold (SF). All SF testing was performed by the same test administrator, and BF% was estimated using the Brozek body density formula. Mean comparisons were assessed using a one-way ANOVA against the criterion of ADP and all correlations were run using Pearson's product moment correlations. **Results:** Significant, positive relationships were found between all variables when compared to ADP (HF-BIS: $r = 0.68$, $p < 0.01$; HF-BIA: $r = 0.79$, $p < 0.01$; FF-BIA: $r = 0.76$, $p < 0.01$; and SF $r = 0.84$, $p < 0.01$). When compared to the criterion of ADP ($22.2 \pm 7.1\%$), only the HF-BIA ($26.1 \pm 5.4\%$) was found to significantly overestimate BF% ($p = 0.03$). No significance was noted with HF-BIS ($25.5 \pm 5.6\%$, $p = 0.38$), FF-BIA ($22.1 \pm 5.7\%$, $p = 0.16$), or SF ($24.6 \pm 6.1\%$, $p = 0.21$). **Conclusion:** The results of this study suggest that a moderate-to-strong relationship exists between BF% estimated via ADP and other laboratory and field-based methods. Given the strength of its relationship to ADP, it appears 3-site SF analysis may provide a cheap, time-saving estimate of BF% in Division-I female athletes.

1078 Board #312 May 29 3:30 PM - 5:00 PM
The Association Between Sleep Quality On Quality Of Life Among Healthy High School Athletes

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Purpose: The objective of our study was to investigate the association between self-reported sleep quality (SQ) and quality of life (QOL) measures in healthy high school athletes.

Methods: We assessed the SQ and QOL of high school athletes (age range = 13-18 years) during their pre-participation physical examination (PPE). Participants completed the Pittsburgh Sleep Quality Index (PSQI), and the PROMIS Pediatric Profile 37 QOL questionnaire. Standard PPE forms which included demographics, sports participation, and injury history were also completed by the participants. Based upon the self-reported sleep habits assessed during the PSQI, we grouped participants into poor (PSQI score ≥ 5) or good (PSQI score < 5) SQ. We compared QOL between groups using independent sample t-tests and Fisher's exact tests. A series of multivariable linear regression models were then constructed to evaluate the independent association between PSQI and QOL ratings after adjusting for age and sex.

Results: A total of 99 participants completed both the PSQI and PROMIS 37 questionnaires; 33 were classified as having poor SQ [mean PSQI: 6.8 ± 2.0 ; mean age: 15.1 ± 1.0 ; 56% female] and 66 were classified as having good SQ [mean PSQI: 2.2 ± 1.3 ; mean age: 15.2 ± 1 ; 59% female]. There were no significant demographic differences (age, sex, level of play, hours per week in sports, injury history) between the groups. While the two groups reported similar bed times, the poor SQ group reported taking significantly longer to fall asleep than the good SQ group (mean = 25.7 ± 18.6 vs. 11.2 ± 5.5 minutes; $p < 0.001$), and woke up one hour earlier than the good SQ group (mean = $6:10$ AM vs. $6:28$ AM; $p < 0.001$). Multivariable regression analysis indicated that worse SQ was significantly associated with higher pain interference ($\beta = 0.42$; 95% CI = $0.14-0.70$; $p = 0.004$), anxiety ($\beta = 0.48$; 95% CI = $0.16-0.80$; $p = 0.004$), depressive symptoms ($\beta = 0.49$; 95% CI = $0.19-0.80$; $p = 0.002$), and fatigue ($\beta = 0.60$; 95% CI = $0.14-0.70$; $p = 0.004$) ratings.

Conclusion: Poor self-reported SQ among healthy adolescent athletes is associated with more anxiety and depressive symptoms, fatigue, and pain interference ratings. When treating youth athletes, clinicians should consider assessing sleep hygiene and patterns in order to provide guidance on issues pertaining to reduced QOL.

1079 Board #313 May 29 3:30 PM - 5:00 PM
Examination of Athletic Identity and Quality of Life Related to Sport Participation

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(No relevant relationships reported)

Athletes often develop athletic identities over time, which helps an athlete's performance and self-esteem during sport participation but can have negative repercussions once an athlete retires. Preparation for this loss is important in preventing negative mental health consequences and decreases in the quality of life.

Purpose: To examine overall quality of life and athletic identity (e.g., immediately after retirement and "now" in retirement) and determine differences across gender, sport type (team vs. individual), and number of years of participating in sport and number of years retired (e.g., 0-5, 6-10, 10-15 year, etc.). **Methods:** Retired athletes (n=125; ages: 29.1 ± 11.1 years; males: n=51; females: n=74) were recruited via convenience sample to participate in an online survey. Each participant completed at minimum of 4 years of high school sports, or ≥ 2 years of collegiate athletics, or ≥ 2 years of professional sports. The survey included demographic questions, the Athletic Identity Measurement Scale (AIMS) to measure athletic identity (immediately following sport and "now") and the Quality of Life Index (QLI). Basic descriptive, independent samples t-tests and ANOVAs were used. **Results:** A significant difference between gender and AIMS "now" in retirement was found (males: 31.2 ± 10.1 ; females: 26.4 ± 7.5 ; $P = .003$); but no differences were found between gender and QLI total, QLI subscales and AIMS "now" in retirement. No significant differences were found between team vs. individual sport and total QLI and both AIMS. A significant difference was revealed between number of years participating in sport and AIMS immediately following retirement ($P = 0.02$) and QLI-family subscale ($P = 0.014$). There was a significant difference between number of years retired and the QLI-family subscale ($P = .014$); with Tukey post hoc revealing significant differences between years 0-5 and 21-25 (6.08 ± 4.5 vs. 12.8 ± 2.2 ; $P = .018$). **Conclusion:** Those who played sports longer, had the strongest athletic identities upon retirement. Men are more

likely to maintain a strong athletic identity, even after retirement. Men and women are equally likely to exhibit a decrease in quality of life, in regards to family 25 years post retirement.

- 1080** Board #314 May 29 3:30 PM - 5:00 PM
Effect of Low Ph Magnesium-sulfate Foam on Night Leg Cramps: A Double-blind Randomized Trial
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 (No relevant relationships reported)

A large portion of the adult population suffers from night leg cramps (NLC); but there are few safe and effective treatment options. Magnesium oxide supplementation has been found ineffective; however, low pH topical foam with magnesium sulfate has not been examined. **Purpose:** Examine the effectiveness of a topical low pH foam with and without magnesium sulfate on NLC spasm frequency, severity/pain and the effects on activities of daily life. **Methods:** A double-blind randomized trial of 36 (females = 27, males = 9) adult participants (age: 52.0 ± 11.9 yrs.; weight: 94.8 ± 24.3 kg; height: 167.9 ± 9.0 cm; body fat%: 39.8%±12.3%) who experienced a minimum of 3-NLCs per week were recruited from local medical facilities in southeast region. Participants were randomized into 2 groups (Control [C] or Intervention [INT]) and completed a 14 consecutive day home-based treatment (Theraworx Relief®). Participants were given 5 bottles of foam (C or INT) to rub on their lower limbs twice a day and in the event of a cramp for the 14 days and completed surveys to assess frequency of NLC, pain levels, restless leg syndrome quality of life questionnaire (RLSQL) and the multi-dimensional fatigue inventory to assess social and daily function, sleep quality, and emotional well-being which were turned in at the end of each week. **Results:** The INT group had significant improvements in post-intervention: total social function ($P=0.02$), total daily function ($P=0.003$), total emotional well-being ($P=0.03$), and total RLSQL ($P=0.01$). Regression models also demonstrated significant improvement within the INT group in emotional well-being (-13.3; $P=.03$), total number of NLCs (-1.9; $P=.02$), and severity x frequency (-12.8; $P=.02$). The C group had significant improvements in daily (-11.5; $P=.03$) and social function (-10.9; $P=.04$). **Conclusion:** Theraworx Relief® with magnesium significantly improved quality of life as measured by domains on the total RLSQL. Although there was no difference in frequency and severity of NLCs between groups, we did see a significant reduction in NLCs within the intervention group. Few evidence-based treatments options are available for NLCs. Given the high prevalence of this condition and potential impact on health and well-being this treatment has the potential to improve health outcomes in patients who suffer with NLCs.

- 1081** Board #315 May 29 3:30 PM - 5:00 PM
Difference Between USI Humeral Head Medial Joint Space Measurements Using Gravity-induced Vs. 3kg External Load Valgus Forces
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PURPOSE: Injuries of the ulnar collateral ligament (UCL) are a common pathology in overhead athletes. Ultrasound imaging is becoming a more common diagnostic tool to diagnose UCL pathology. Ultrasound imaging protocols have been described using external mechanical valgus forces to evaluate medial joint space (MJS) opening as an indicator of joint instability and UCL insufficiency. However, this external mechanical force is often poorly tolerated by athletes with acute injuries. A gravity induced valgus force is often better tolerated, however this method may potentially result in lesser joint space opening. The purpose of this pilot study was to examine differences in joint space opening measurements between these two methods of applying valgus force while performing ultrasound imaging. **METHODS:** Nine asymptomatic NCAA Division I collegiate baseball pitchers (age 20.1 ± 1.3 yrs) participated in this study. Ultrasound images were obtained of the MJS on the participant's throwing arm using a GE LOGIQ e ultrasound unit. Participants were placed supine with elbow position at 30 degrees, with a wedge placed underneath the humerus creating a gravity induced valgus force on the MJS. Ultrasound imaging measurements to evaluate MJS opening were performed from the apex of the trochlea to the apex of the ulna. A 3-kg valgus force, as measured by a hand-held dynamometer, was applied 20 cm distal to the medial epicondyle, and the imaging measurement was repeated. A paired t-test was performed to evaluate differences in joint space measurements between the two test protocols. **RESULTS:** There was no significant difference between the MJS

measurements (mean difference .005cm, $t = -.743$, $p = .479$) using the gravity-induced valgus method (mean opening .441cm, SD .074cm) and the 3kg external force method (mean opening .446cm, SD .071cm).

CONCLUSIONS: The results of this pilot study indicate that a gravity induced valgus force during ultrasound imaging of the UCL and MJS may yield similar joint opening compared to a mechanically induced 3kg external force. As external valgus force is often poorly tolerated in the presence of acute injury, gravity induced force may provide for an alternate method of evaluating medial joint space opening. Further research is recommended using larger sample size and symptomatic populations.

- B-69** Free Communication/Poster - Diabetes
 Wednesday, May 29, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

- 1082** Board #316 May 29 3:30 PM - 5:00 PM
Comparison of Two Diabetic Education Programs Designed to Tread Adult-Onset Diabetes Mellitus
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 (No relevant relationships reported)

INTRODUCTION: Diabetes mellitus or adult onset diabetes or type 2 diabetes, is the most common form of diabetes. Millions of Americans are diagnosed with type 2 diabetes every year, and many more are unaware they are at high risk.

PURPOSE: The purpose of this study was to compare the diabetic education programs of two certified diabetic dietitians, one with a focus on diet and the other with a focus on exercise, over 6 months, to determine which program was more successful in the treatment of type 2 diabetes.

METHODS: Forty participants were randomly selected and separated into two groups. The subject pool was limited to those using oral diabetic medications. All participants had an initial evaluation of body mass index (BMI), hemoglobin A1c, fasting blood sugar, waist circumference, and weight. These measurements were repeated again after three and six months of treatment for analysis. The exercise group and the diet group each included 10 males and 10 females. The exercise (E) group met with their trainer five times per week and the diet (D) group received information about choosing foods to limit impact on blood glucose. A 2 x 3 repeated measures ANOVA was used to determine the effects of an exercise vs diet program.

RESULTS: All participants completed their respective programs. The exercise group (10 males, 10 females) were 62.4 ± 8.6 yrs and the diet group (10 males, 10 females) was 65.1 ± 9.8 yrs. The exercise group (31.9 ± 4.5) had a significant decrease ($p < 0.05$) in BMI at 6 months when compared to the diet group (29.5 ± 4.32). Measurements of A1c (E=6.94±0.7%; D=7.77±1.1%), fasting blood glucose (E=132.2±13.4 mg/dl; D=132.2±16.0 mg/dl), waist circumference (E=40.4±4.5 in; D=45.2±6.5 in), and weight (E=207.9±43.1 lbs; D=222±43.8 lbs) decreased in both groups over the six month study, however, the changes were accelerated in the exercise group resulting in significantly lower values.

CONCLUSION: After six months of either an intensive exercise regimen or diet regimen, there were significant decreases seen for all variables. However, the results for the exercise group were associated with accelerated decreases as compared to the diet group by a significant margin. Individualized exercise programs appear to be the most effective at controlling type 2 diabetes with the potential for decreasing the risk of other comorbidities.

- 1083** Board #317 May 29 3:30 PM - 5:00 PM
Post-Meal Walking Improves Postprandial Glycaemia in Women with Gestational Diabetes Mellitus
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 (No relevant relationships reported)

PURPOSE: To investigate the effects of post-meal walking (PMW) on glycaemic control in women with Gestational Diabetes Mellitus (GDM).

METHODS: Eighty women with physician-diagnosed GDM will be randomised to i) Control standard-care alone (CON), or ii) PMW in addition to standard-care, from weeks 28 to 36 of gestation. Participants in the PMW group were advised to perform 10 min of PMW after main meals, whilst the CON group were advised to perform 30 min of daily physical activity. Blood glucose was assessed using continuous Glucose Monitoring (iPro CGM) and physical activity, sedentary time and adherence was assessed using ActivPal accelerometers for 7-days at weeks 28 and 35 of gestation. Fasting glucose was measured from capillary glucometer measures each morning.

RESULTS: Preliminary data from nine women with GDM are presented (PMW n=5 and CON n=4). Postprandial, fasting glucose and physical activity did not

differ between the CON and PMW groups during the first 7-day monitoring period. Compared to baseline, the PMW improved the 3-h average glucose after breakfast (-0.35 mmol.L $^{-1}$, $p = 0.03$) and lunch (-0.34 mmol.L $^{-1}$, $p = 0.01$), enough to remain in target ranges for blood glucose ($5.0 - 7.4$ mmol.L $^{-1}$). No difference was seen after dinner in the PMW group (-0.11 mmol.L $^{-1}$, $p = 0.22$), due to reduced adherence (40%) to PMW after dinner. **CONCLUSIONS:** Preliminary data supports the notion that PMW can improve blood glucose levels after breakfast and lunch in women with GDM when adhered to, however the impact of dinner requires further research. PMW may be an effective adjunct to standard-care for the management of GDM in pregnancy.

1084 Board #318 May 29 3:30 PM - 5:00 PM

Accuracy Of A Handheld Blood Glucose Monitor During Exercise And An Oral Glucose Tolerance Test

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PURPOSE: The purpose of the present study was to examine the validity and reliability of a handheld blood glucose monitor during an oral glucose tolerance test (OGTT) and 60-minute bout of exercise.

METHODS: A total of 30 subjects (mean age \pm SD = 22.3 ± 1.9 yrs; body mass = 77.6 ± 14.2 kg; height = 171.3 ± 9.6 cm; physical activity = 6.2 ± 4.3 hr-wk $^{-1}$) volunteered to participate in a single visit to the laboratory for an OGTT ($n=15$) or 60-minute treadmill exercise test ($n=15$). For the OGTT, the subjects were required to visit the laboratory in the morning following an 8-hour overnight fast and ingest a 75-gram load of glucose. For the treadmill test, the subjects were required to walk at 5.6 km-hr $^{-1}$ for 60 minutes. Blood glucose concentrations were measured from the fingertip at six different time points during the OGTT (0, 10, 20, 30, 60, and 90 min) and treadmill test (0, 5, 10, 15, 30, and 60 min). Each blood sample was analyzed four times at each time point, two by the reference method and two by the handheld monitor.

RESULTS: Our findings indicated that the blood glucose values provided by the handheld monitor were significantly ($P < 0.05$) greater than the reference method at all time points of the OGTT and treadmill test. In addition, the handheld device exhibited an overall mean absolute relative deviation (\pm SD) of 9.0 (± 7.0) and did not meet the 95% accuracy requirements of ISO 15197:2013 (only 87.2% of all values met the criteria). The Bland-Altman plot for constant error (reference method - handheld monitor) versus the reference method indicated an average negative bias ($CE = -8.2$ mg-dL $^{-1}$) that increased ($r = -0.23$) at higher blood glucose values. Intra-device reliability analyses for the handheld monitor on two consecutive measurements taken at the same time points demonstrated the intra-class correlation (ICC) was $R = 0.99$ and coefficient of variation (CV) = 3.0% , with no mean differences between measurements.

CONCLUSIONS: The present findings indicated that the handheld monitor provided highly reliable, yet inaccurately high blood glucose values compared to the reference method during the dynamic conditions associated with an OGTT and exercise.

1085 Board #319 May 29 3:30 PM - 5:00 PM

Effects of IT-based Interactive Exercise Education Program on Exercise Duration in Gestational Diabetes Mellitus Patients

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Purpose : Adoption of Information Technology (IT) to promote and manage health behaviors in clinical settings is an emerging modality. This study investigates the effects of IT-based interactive exercise education program on exercise duration in Gestational Diabetes Mellitus (GDM) patients.

Methods : For 3 months long study, 49 pregnant women (33.6 ± 3.3 yrs, 161 ± 5 cm, 60.6 ± 13.8 kg, and 23.4 ± 5.1 kg/m 2 , before pregnancy), who were diagnosed GDM at 24-28 weeks of gestation (100 g oral glucose tolerance test; 89 ± 10 , 186 ± 26 , 179 ± 20 , and 148 ± 23 mg/dL, at 0, 60, 120, and 180 min, respectively), agreed to participate. Only those who met study criteria were included in the study. Prior to the study, they were educated how to use and record their on-line life log including exercise duration, intensity and types. They were recommended to participate in exercise program; aerobic activities for 20-30 min/d, a minimum of 150 min/week, at perceived exertion (RPE) of 11-13, and/or 40-60% of heart rate reserve, and strength training 2-3 d/week, 10-15 rep/set, and 2-3 sets. Based on the on-line communication frequencies, they were grouped as less frequent (LF, $n=27$, as <1 times/week) and highly frequent (HF, $n=22$, as ≥ 1 times/week). Statistical software SAS version 9.4 were used and statistical significance was set at $p < 0.05$.

Results : A total of 5,947 life log from 49 participants were acquired. Approximately 88.5% of participants preferred walking as an aerobic exercise mode, and they walked at RPE of 11-13. The communication frequency was 4.5 ± 4.3 times for LF and 24.3 ± 19.4 times for HF ($p < 0.001$). The daily exercise duration was 25.1 ± 28.6 and 51.9 ± 41.9 min/day ($p < 0.05$), and weekly exercise duration was 164 ± 177 and 356 ± 271 min/week in LF and HF, respectively ($p < 0.05$).

Conclusion : They met exercise recommendations in terms of exercise duration, intensity, and type. The frequent interactive communications between GDM patients and exercise professionals thru on-line using IT-based exercise behavior data may be effective for the GDM patients to exercise longer.

B-70 Free Communication/Poster - Exercise Testing I

Wednesday, May 29, 2019, 1:00 PM - 6:00 PM

Room: CC-Hall WA2

1086 Board #320 May 29 3:30 PM - 5:00 PM
Exercise Stress Echocardiography and Myocardial Perfusion Testing in Pediatric Patients with Coronary Artery Anomalies

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(No relevant relationships reported)

Introduction: Exercise stress echocardiography (echo) detects ischemic wall motion abnormalities. Exercise stress nuclear imaging (Mibi) detects perfusion abnormalities. We present results of Cardiopulmonary Exercise testing (CPET) with simultaneous echo and Mibi in pediatric patients with coronary artery anomalies, including those with other congenital heart disease. **Purpose:** To determine the yield of CPET electrocardiography with two simultaneous imaging techniques (echo and Mibi) in the detection of exercise-induced myocardial ischemia. **Methods:** Retrospective review of CPET with echo and Mibi results in patients with coronary abnormalities (CAA). CAA group was age, gender, and size matched to normals (Control) undergoing CPET only. CPET performed with a ramped cycle protocol with echo and Mibi images obtained at rest and peak exercise. Oxygen consumption (VO $_2$), carbon dioxide production (VCO $_2$) and respiratory minute volume (VE) were measured throughout exercise. Respiratory exchange ratio (RER), oxygen uptake efficiency slope (OUES), VE/VO $_2$ and VE/VCO $_2$ equivalents and VE/VCO $_2$ slope were calculated at anaerobic threshold (AT) and peak exercise. **Results:** No significant difference in Peak RER. Significant difference was seen in VE/VCO $_2$ slope and OUES at AT and VE/VO $_2$, VE/VCO $_2$ equivalents and VE/CO $_2$ slope at peak exercise. At peak, CAA group had 1 patient with significant ST segment depression, another had significant wall motion abnormalities and a third had a perfusion defect. No significant ST depression in the control group.

CPET Results						
	AT	Peak				
VE/VCO $_2$ Slope	OUES	VE/VO $_2$	VE/VCO $_2$	VE/VCO $_2$ Slope	OUES	RER
Normal (n=9)	20 \pm 6	2672 \pm 1164	32 \pm 5	28 \pm 5	25 \pm 5	2501 \pm 1110 1.21 \pm 0.1
CAA (n=9)	*27 \pm 7	*1617 \pm 580	**41 \pm 8	**34 \pm 5	**32 \pm 5	1891 \pm 681 1.16 \pm 0.1
Inter-group comparisons were made using an unpaired student t-test. *P<0.05, **P<0.01						

Conclusion: Both groups had similar exercise intensity. There were significant differences in VE/VO $_2$, VE/VCO $_2$ equivalents and VE/VCO $_2$ slope at peak exercise suggesting aerobic and ventilatory inefficiency in CAA patients. There was a significant frequency of ischemic response to exercise uncovered equally by each testing modalities. Combined use of Mibi and echo improves diagnostic yield in CAA patients with ischemia.

1087 Board #321 May 29 3:30 PM - 5:00 PM

Cardiopulmonary Exercise Testing in Pediatric Idiopathic Bronchiectasis

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(No relevant relationships reported)

Abstract:

Introduction: Pediatric bronchiectasis etiologies consist mainly of cystic fibrosis (CF), primary ciliary dyskinesia (PCD) and idiopathic. Cardiopulmonary exercise testing (CPET) is gaining importance in clinical medicine and provides clinical insight into overall fitness, exercise limitations, disease prognosis, and therapeutic interventions. While there is growing data on exercise capacity using CPET in pediatric CF and PCD patients, studies on idiopathic bronchiectasis (IB) are scarce. **Purpose:** To compare exercise capacity using CPET in IB vs CF and PCD in pediatric population. **Methods:** Cross-sectional retrospective/prospective controlled study assessing CPET using cycle ergometer. Exercise parameters were compared. **Results:** Forty-two patients with bronchiectasis and 50 controls were evaluated; 12 IB (age 13.4 ± 3.4 y/o, $FEV_1\%$ predicted 84.3 ± 15.3), 9 PCD (11.7 ± 3.6 y/o, $FEV_1\%$ predicted 72.8 ± 23.5) and 21 CF (12.2 ± 3.2 y/o, $FEV_1\%$ predicted 80.7 ± 11.5). Peak oxygen uptake (peak $\dot{V}O_2$) was preserved in IB and CF groups vs. control (2104.0 ± 712.4 ; 1695.6 ± 537.3 ; $1937.8.0 \pm 718.2$ mL/min respectively) while PCD patients had decreased values (1315.0 ± 330.7) vs. IB and control ($p < 0.005$). Breathing limitation was found in all study groups vs. control; low breathing reserve (25% in IB; 52% CF; 33% PCD; 4% control, $p < 0.02$) and increased $\dot{V}E/\dot{V}CO_2$ (IB 29.1 ± 2.6 ; CF 32.1 ± 4.0 ; PCD 32.0 ± 4.4 ; control 27.2 ± 2.1 , $p < 0.015$). Moreover, IB patients had lower $\dot{V}E/\dot{V}CO_2$ compared to CF patients ($p < 0.03$). **Conclusions:** CPET parameters may differ between IB and other bronchiectasis etiologies. IB pediatric patients demonstrated preserved exercise capacity and lower $\dot{V}E/\dot{V}CO_2$ compared to PCD and CF respectively. Larger longitudinal studies are needed to better study exercise capacity in different etiologies pediatric bronchiectasis.

1088 Board #322 May 29 3:30 PM - 5:00 PM

Estimation of Ventilatory Thresholds in Physically Active Subjects During an Incremental Treadmill Test

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(No relevant relationships reported)

Purpose: The aim of the present study is to develop equations to estimate ventilatory thresholds (VT) 1 and 2 in physically active subjects. Such equations can be very useful for training prescription, since most physical education professionals and athletes do not have access to ergospirometric tests.

Methods: Fifteen physically active men, age 32.53 ± 11.83 years, with VO_2^{peak} of 54.17 ± 11.74 mL / kg / min participated in the study. All volunteers underwent a progressive ergospirometric treadmill test, which was maintained at a one percent slope (to simulate the friction of a run on the street) and speed was increased by 1 km/h each stage (2 minutes). This incremental procedure was adopted until the subject reached fatigue. A gas analyzer and a heart rate monitor were used to measure VO_2^{peak} . The gas analyzer has been calibrated as per manufacturer's specifications. Based on the results, a linear regression was used to estimate the speed in km/h of VT 1 and 2 as a function of the maximum speed (MS) reached, in km/h of the final heart rate (FHR), in beats per minute.

Summary of Results: The ventilatory threshold 1 was given by equation 1:

$$VT1 \text{ (km/h)} = 0.160 + 0.745 \text{ (MS)} - 0.004 \text{ (FHR)}$$

In the regression a R^2 of 0.86 (and an R of 0.94) was found, which can be considered a model with a good fit, as a function of the explained variance.

The ventilatory threshold 2 was given by equation 2:

$$VT2 \text{ (km/h)} = -1.043 + 1.054 \text{ (MS)} - 0.007 \text{ (FHR)}$$

In the regression, a R^2 of 0.94 (and an R of 0.97) was found, which can be considered a model with an excellent fit, as a function of the explained variance.

Conclusion: According to the results obtained, the proposed equations can be a very useful alternative for estimating ventilatory thresholds 1 and 2, constituting an important instrument, mainly for professionals who do not have access to laboratory measures, according to their applicability and assistance in planning and application of physical activity.

1089 Board #323 May 29 3:30 PM - 5:00 PM

Methodological Considerations for Calculating Ventilatory Efficiency from a Maximal Exercise Test in Apparently Healthy Adults

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(No relevant relationships reported)

The slope of the relationship between ventilation rate (\dot{V}_E) and rate of carbon dioxide production ($\dot{V}CO_2$) known as ventilatory efficiency ($\dot{V}_E/\dot{V}CO_2$ slope), is associated with mortality in clinical populations and may have prognostic utility in apparently healthy adults. Despite its prognostic potential, there is currently no standardized method for calculating the $\dot{V}_E/\dot{V}CO_2$ slope in apparently healthy adults. **PURPOSE:** To compare how different methods of data averaging influence the calculation of the $\dot{V}_E/\dot{V}CO_2$ slope from a maximal cardiopulmonary exercise test (CPX). **METHODS:** Two hundred seventy-two apparently healthy adults (49% female, age 44 ± 20 y, body mass index 27.1 ± 5.6 kg/m², $VO_{2\text{max}}$ 33.3 ± 12.5 mL/kg/min) performed a maximal CPX to determine cardiorespiratory fitness. For each test, the $\dot{V}_E/\dot{V}CO_2$ slope was determined by commercially available metabolic software (ParvoMedics TrueOne 2400) calculating CPX data using time averages of 60, 30, 20, 15, and 10s, and also by averaging every 4 breaths. Pearson correlations and one-way analysis of variance with Dunnett's multiple comparison tests were used to examine differences between averaging methods. The criterion method was the 20s average. **RESULTS:** The different data averaging methods were all significantly correlated to the criterion (all $P < 0.001$; $r = 0.99$). However, in comparison to the criterion mean (29.6 ± 4.6), all other methods were significantly different (60s: 29.2 ± 4.6 ; 15s: 29.7 ± 4.7 ; 10s: 29.7 ± 4.7 ; 4-breath: 30.4 ± 4.9 ; all $P < 0.001$), with the exception of 30s averaging (29.5 ± 4.6 ; $P = 0.22$). The greatest difference from the criterion occurred with the 4-breath averaging method (mean difference -0.9; CI: -1.0, -0.8). **CONCLUSIONS:** The calculation of ventilatory efficiency is impacted by varying methods of data averaging. However, the differences between data averaging methods is small and future research is needed to determine if these differences influence the prognostic utility of ventilatory efficiency in this population.

1090 Board #324 May 29 3:30 PM - 5:00 PM

Comparison of Peak Cardiopulmonary Exercise Parameters in Recumbent Bicycle Versus Treadmill Exercise Testing

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(No relevant relationships reported)

The recumbent bicycle (RB) is a novel exercise testing modality that has a patient exercise in a semi-supine position, allowing for increased echocardiographic imaging during exercise compared to a treadmill (TM) test. Previous studies have shown higher peak heart rate (HR) and higher VO_2^{peak} measured on the TM versus an upright bicycle ergometer (UBE). More recent studies between RB and UBE demonstrate lower peak HR on a RB but no significant difference in VO_2^{peak} on RB versus UBE. There are no studies that directly compare exercise parameters on the TM to those on a RB. **PURPOSE:** To determine if RB testing yields comparable maximal cardiopulmonary exercise results to the TM. **METHODS:** Patients with a history of non-progressive Kawasaki disease who performed a maximal Bruce TM test and RB test within two years per standard of care were evaluated. All tests were performed on the same metabolic system (MedGraphics). Group differences were evaluated with t-testing. **RESULTS:** Nine children completed maximal tests on both the TM and RB. There were no significant differences in age (TM 13.2 years ± 3.9 , RB 14.7 ± 3.7 , $p = 0.4324$), height (TM 154.2 cm ± 18.56 , RB 161.6 ± 12.88 , $p = 0.3454$) weight (50.3 kg ± 18.38 , RB 55.2 ± 13.70 , $p = 0.5332$) or BMI (TM 20.31 ± 4.22 , RB 20.89 ± 3.47 , $p = 0.7550$) between groups. There was no significant difference in peak HR (TM 194 ± 5.5 , RB 186 ± 13.5 , $p = 0.1343$) or VO_2^{peak} (mL/kg/min; TM 47.68 ± 13.15 , RB 45.21 ± 13.53 , $p = 0.7001$) between modalities. There was no significant difference in anaerobic threshold (AT; TM 32.24 ± 13.11 , RB 27.88 ± 10.26 , $p = 0.4602$) or percentage of VO_2^{peak} at which AT occurred (TM $67\% \pm 15$, RB $62\% \pm 10$, $p = 0.4618$). Peak respiratory exchange ratio (RER) was significantly higher on the RB (TM 1.02 ± 0.07 , RB 1.11 ± 0.0175 , $p = 0.0175$) and $VE/\dot{V}CO_2$ was significantly higher on the TM (TM 27.63 ± 1.73 , RB 22.18 ± 3.62 , $p = 0.0009$). **CONCLUSION:** Exercise testing by RB yields comparable peak exercise parameters (HR, VO_2^{peak} , AT, and AT percent of VO_2^{peak}) compared to the TM despite a different body position. The significant difference seen in peak RER and $VE/\dot{V}CO_2$ between modalities may be due to different positional body mechanics or small sample size.

1091 Board #325 May 29 3:30 PM - 5:00 PM
Twelve-lead Ecg And Echocardiography Evaluation In Division II College Athletes

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(No relevant relationships reported)

Twelve-lead ECG and Echocardiography Evaluation in Division II College Athletes

Ludmila Cosio-Lima, Emily Grammer, Cameron Addie, Marisa Straughn, Lauren Adlof, Jeffrey Simpson, Youngil Lee, Amy Crawley
 University of West Florida, Pensacola, FL 32514

The presence of cardiac abnormalities due to ventricular mass and volume has been documented in elite and Division I College athletes. Due to limited resources, cardiovascular screening among Division II College athletes is scarce or non-existent. **PURPOSE:** To examine ventricular remodeling through electrocardiographic (ECG) characteristics and focused echocardiography (FECH) in Division II college athletes. **METHODS:** Thirty six athletes (males = 18; females = 18) of different ethnicities (Caucasian = 60%, African American = 40%) from basketball (48%), soccer (27%), volleyball (9%) and football (16%) completed cardiovascular screening with a resting 12-lead ECG and focused echocardiography analysis. ECG abnormalities were compared with race, gender, and sports using a mixed model ANOVA. **RESULTS:** Although sports teams were not predictors for an abnormal ECG, 20% of the athletes presented with abnormal ECGs. The highest independent predictor of abnormal ECGs was found in African American males, when compared to Caucasians (65% vs. 32%; $p = 0.035$). African American male athletes had, on average, higher left ventricular mass indexes (72 ± 8 vs 66 ± 8 g/m²; $p = 0.008$), higher mass/volume ratio (1.01 ± 0.11 vs 0.98 ± 0.07 g/ml; $p = 0.002$), and higher QRS vector magnitudes (2.9 ± 0.5 vs 2.4 ± 0.4 mV; $p = 0.002$) than Caucasian male athletes. In addition African American athletes demonstrated a significantly greater prevalence of left ventricular hypertrophy compared to Caucasians male athletes (68% vs. 32%; $p = 0.04$) and all female athletes (72% vs. 21 %; $p = 0.001$). **CONCLUSIONS:** African American male athletes at the Division II level present with increased concentric ventricular remodeling and ventricular voltage in comparison to Caucasian athletes of both genders. This highlights the need for a greater emphasis to be placed on cardiovascular screenings, specifically for African American males in Division II athletics, as a diagnostic tool to detect early warning signs of cardiovascular irregularities.

1092 Board #326 May 29 3:30 PM - 5:00 PM
Hemodynamic Responses to an Exercise Stress Test in Parkinson's Disease Patients without Orthostatic Hypotension

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(No relevant relationships reported)

The presence of postganglionic sympathetic denervation is well established in Parkinson's disease (PD). Denervation at cardiac and peripheral blood vessel sites may lead to abnormal cardiovascular and hemodynamic responses to exercise. **PURPOSE:** The aim of the present investigation was to examine how heart rate (HR) and hemodynamics are affected by an exercise test in PD patients without orthostatic hypotension. **METHODS:** Fourteen individuals with PD and sixteen age-matched healthy controls performed an exercise test on a cycle ergometer. HR, blood pressure, and other hemodynamic variables were measured in a fasted state during supine rest, active standing, exercise, and supine recovery. **RESULTS:** Peak HR and percent of age-predicted maximum HR (HRmax) achieved were significantly blunted in PD (MD=9, $p < .05$; MD=5, $p < .01$). HRmax remained significantly elevated in PD at minutes five (MD=7, $p = .03$) and ten (MD=6, SE=2, $p < .05$) of recovery, compared to controls. Systolic, diastolic, and mean arterial pressures were significantly lower at multiple time-points during active standing in PD compared to controls, but not a peak exercise. Systemic vascular resistance (SVRI) decreased significantly at the onset of exercise in PD compared to control (Stage 1: MD=-335.9, $p = .03$), and remained significantly lower during exercise (Stage 2: MD=-338.6, $p = .01$) and the first minute of supine recovery (MD=-328.6, $p = .02$). End diastolic volume (EDVi) was significantly lower in PD during supine rest (MD=-10.2, $p = .04$) and at minutes one (MD=-9.7, $p = .01$) and five (MD=-7.1, $p = .04$) of recovery. **CONCLUSIONS:** Our results indicate for the first time that normal hemodynamics are disrupted during orthostatic stress and exercise in PD. Despite significant differences in EDVi at rest and during recovery, and SVRI during exercise, cardiac index was not affected. Our finding of significantly blunted HRmax and HR recovery in PD patients has substantial implications for exercise prescription and recovery guidelines.

1093 Board #327 May 29 3:30 PM - 5:00 PM
Influences Of Race And Body Composition On Vo2 Peak: Findings From The Activity Counseling Trial

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 (No relevant relationships reported)

Previous studies suggested blacks have lower estimated cardiorespiratory fitness (CRF) levels compared to whites, reflecting a higher burden of obesity among blacks. Lesser known are the joint effects of race and measures of obesity on directly measured CRF.

PURPOSE: To characterize the impact of obesity [body mass index (BMI) and body fat percent (% fat)] on directly measured CRF in blacks and whites.

METHODS: We included 874 Activity Counseling Trial participants (24.8% self-reported blacks) who completed maximal oxygen uptake (VO₂ peak) treadmill exercise test, BMI, and percent body fat, determined by skinfold measurement, at baseline. Linear regression models were constructed with VO₂ peak as the outcome and adjusted for age, sex, race, socioeconomic status, BMI, % body fat, and cardiovascular risk factors.

RESULTS: VO₂ peak indexed to body mass was substantially lower in blacks (20.40 vs 26.70 ml/kg/min, $p < .0001$), reflecting higher indices of obesity in blacks (BMI: 32.73 vs 28.32, $p < .0001$; % body fat 36.58 vs. 31.44, $p < .0001$). Similar findings were observed comparing absolute VO₂ peak (1919.18 vs. 2229.72 ml/min, $p < .0001$). In multivariable adjusted models, black race was strongly associated with both lower absolute and indexed VO₂ peak [Std. Beta (blacks vs. whites = -0.12 & -0.14 respectively $p < 0.0001$ for both)]. There was a significant interaction between race and both BMI ($p < .0001$) and % body fat ($p < .0001$) on indexed VO₂ peak. In race-stratified analyses, we observed a modestly weaker association between BMI and VO₂ peak in blacks (see Table). Similar findings were observed for % body fat.

CONCLUSIONS: Directly measured VO₂ peak is lower in blacks reflecting a higher burden of obesity. Nevertheless, the impact of obesity on VO₂ peak is modestly greater among whites, suggesting excessive adipose tissue has a slightly more negative impact on VO₂ peak among whites.

Table: Association between measures of BMI, % body fat and indexed VO ₂ peak in blacks and whites.			
	Blacks	Whites	Intercept p-value
	Std. Beta	Std. Beta	
BMI	-0.32	-0.40	<.0001
% Body fat	-0.37	-0.50	<.0001

1094 Board #328 May 29 3:30 PM - 5:00 PM
Influence of an Exercise Program on Cardiopulmonary Exercise Testing Derived Variables

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(No relevant relationships reported)

Cardiopulmonary exercise testing (CPX) has emerged as a useful tool in assessing disease severity and prognosis in clinical populations. Yet, little is known about the trainability of specific variables, aside from cardiorespiratory fitness (CRF), particularly in apparently healthy individuals. **PURPOSE:** The purpose of this study was to evaluate the changes in oxygen consumption at ventilatory threshold (VO₂ at VT), oxygen uptake efficiency slope (OUES), ventilatory power (VP; systolic blood pressure/VE/VCO₂ slope) and circulatory power (CP; peak SBP x VO_{2max}) which is a surrogate for cardiac power in apparently healthy adults following an exercise program. **METHODS:** Participants (n=79, 34 males/45 females, age 51.3±1.5 years, body mass index 29.0±0.7 kg/m²) performed a maximal VO_{2max} test before and after ~6 months of exercise training to determine VO₂ at VT, OUES, CP, and VP. Statistical analysis used were matched paired t-tests. **RESULTS:** VO₂ at VT (ml/kg/min) increased in the total sample (Pre: 19.8±0.4 vs. Post: 20.7±0.4, $p = 0.001$), males (Pre: 20.7±0.7 vs. Post: 22.3±0.8, $p = 0.0024$), and females (Pre: 16.9±0.6 vs. Post: 18.5±0.8, $p = 0.0003$). CP (ml/kg/min-mmHg) increased in the total sample (Pre: 5428.9±136.0 vs. Post: 5655.6±123.4, $p = 0.001$), males (Pre: 5790.1±294.7 vs. Post: 6254.0±243.3, $p = 0.0142$), and females (Pre: 4130.0±175.5 vs. Post: 4808.6±197.5, $p = 0.001$). OUES increased in males only (Pre: 2.3±0.1 vs. Post: 2.5±0.1, $p = 0.0013$). VP (mmHg) did not increase in any group. **CONCLUSION:** VO₂ at VT and CP can be altered with exercise training, independent of sex, while the adaptability of OUES appears to be sex-specific. Additionally, VP is not influenced by exercise training. Future research should explore the sex-specific response of CPX-variables to exercise training.

1095 Board #329 May 29 3:30 PM - 5:00 PM

Dichotomy In The Mechanism Of Ramp-incremental Exercise Intolerance In Chronic Heart Failure

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(No relevant relationships reported)

Chronic heart failure (CHF) is a complex multifaceted disease that has wide ranging detrimental effects on each step in the delivery and utilization of O₂, irrespective of CHF etiology. Aerobic capacity (VO_{2peak}) is reduced and exercise tolerance is limited by fatigue and/or dyspnea. Exercise intolerance is the strongest predictor of mortality in CHF. Whether fatigue or symptoms is the primary mechanism of exercise intolerance in CHF is unknown.

PURPOSE: To use an innovative ramp-incremental cardiopulmonary exercise test (RI-CPET) to investigate whether fatigue or symptoms predominate as the mechanism of exercise limitation in CHF.

METHODS: Sixteen CHF patients (left ventricular ejection fraction (LVEF) = 28 ± 8 %) completed RI-CPET to intolerance that ended with measurement of maximal voluntary isokinetic power (MVIP) at VO_{2peak}. MVIP was measured during 4-5 s of maximal effort. At VO_{2peak} comparison of MVIP with peak RI-work rate (RI-WR_{peak}) identified fatigue (inability to increase MVIP above RI-WR_{peak}) or symptoms (MVIP > RI-WR_{peak}) as the primary mechanism of exercise intolerance. Breath-by-breath VO₂ was measured throughout.

RESULTS: At VO_{2peak} (n = 16; VO_{2peak} = 17.2 ± 5.2 ml·kg⁻¹·min⁻¹), MVIP was greater than RI-WR_{peak} (213 ± 132 vs. 109 ± 44 W; p = 0.002). However, two patterns of response emerged: (1) MVIP not different to RI-WR_{peak} (n = 6; 144 ± 66 vs. 115 ± 47 W; p = 0.547); (2) MVIP > RI-WR_{peak} (n = 10; 256 ± 145 vs. 105 ± 44 W; p = 0.002). There was no difference in VO_{2peak} (19.1 ± 4.9 vs. 16.1 ± 5.3 ml·kg⁻¹·min⁻¹; p = 0.268) or LVEF (28 ± 8 vs. 29 ± 7 %; p = 0.827) between these two sub-groups.

CONCLUSION: These data suggest that a maximum voluntary isokinetic measurement, at the end of a standard RI-CPET, may identify CHF patients in whom exercise intolerance is limited by the capacity of the neuromuscular system to generate power (the 'fatigue' group: MVIP ≤ RI-WR_{peak}) compared with those in whom exercise was limited with a substantial reserve in the power producing capacity of the neuromuscular system (the 'symptoms' group: MVIP > RI-WR_{peak}). This dichotomy in mechanism of RI-CPET exercise limitation was independent of VO_{2peak} or LVEF. This variability in the mechanism of exercise limitation, objectively identified using an innovative RI-CPET, may have implications for targeting treatment to optimize outcomes in CHF.

1096 Board #330 May 29 3:30 PM - 5:00 PM

6-minute Walk Work (6-mww) Better Correlates With Vo_{2peak} Than 6-minute Walk Distance (6-mwd)

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(No relevant relationships reported)

PURPOSE: Results from the 6-Minute Walk Test (6-MWT) are often used clinically as a surrogate measure of physiologic function (aerobic capacity) despite the fact that distance alone is not a determinant of work performed and hence not a measure of energy expenditure (Chung et al. Respir Med. 2001; 95: 618). Therefore, we hypothesized that expressing the distance covered during a 6-MWT relative to body weight (6-minute walk work, 6-MWW) would be more closely associated with VO_{2peak} than 6-MWT distance (6-MWD) alone.

METHODS: 187 adult survivors of a variety of cancer types (115 females) underwent the validated University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI) maximal exercise test, exercising to volitional fatigue. VO_{2peak} was estimated using ACSM walking equations. One week later subjects completed the 6-MWT as described by the American Thoracic Society (Am J Respir Crit Care Med. 2002;166:111). 6-MWW (m·kg) was calculated (6-MWD (m) X body weight (kg)). Means and standard deviations were generated for the variables of interest. Correlational analysis was performed to explore the relationship between 6-minute walk outcomes and estimated VO_{2peak}.

RESULTS: Subjects weighed 81.2 ± 23.7 kg, were 61.5 ± 13 years old, and covered 485 ± 107 m during the 6-MWT. 6-MWW averaged 38816 ± 12190 kg·m and cost 1.89 ± 0.68 L of O₂/min of activity. The correlation coefficient (r) between estimated VO_{2peak} and 6-MWD and 6-MWW were 0.479 and 0.758 respectively. Correlation

coefficients between gender and 6-MWD and 6-MWW were similar and moderate in males (0.517 and 0.537 respectively) and disparate in females (0.482 and 0.871 respectively).

CONCLUSIONS: The strong correlation between VO_{2peak} and 6-MWW suggests that this derived outcome measure provides a more clinically useful biomarker of physiologic status in a population of cancer survivors than 6-MWD. Because 6-MWD is a well-recognized biomarker of physical functional status, clinicians might report both 6-MWD and 6-MWW to create a more complete assessment of their patients with a history of cancer. The strength of these associations supports developing a predictive equation for VO_{2peak} based on 6-MWW. However, the gender disparity in r values supports the direct assessment of aerobic capacity rather than relying on a surrogate measure such as the 6-MWW.

1096b Board #331 May 29 3:30 PM - 5:00 PM

Cancer Exercise Rehabilitation Training - A Case Study

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(No relevant relationships reported)

Cancer exercise therapy has been shown to increase physical function, reduce fatigue and build self-confidence. There is a gap in the research pertaining to the implementation of a cancer therapy program in a setting that would be effective and easily replicated. **PURPOSE:** The purpose of this study was to show the effectiveness of the implementation of cancer exercise therapy with a breast cancer survivor in a local fitness facility. **METHODS:** The Rocky Mountain Cancer Rehabilitation Institute (RMCRI) (Colorado, USA) has developed a protocol for the assessment and implementation of a cancer exercise rehabilitation program. RMCRI's protocol utilizes a "phase" system to guide the exercise prescription for each participant very similar to cardiac rehabilitation treatment plans. The guidelines were implemented by the exercise physiologist who conducted this research. Additionally, the researcher also sat for and passed the ACSM's Certified Cancer Exercise Trainer certification exam prior to conducting the training. The exercise session consisted of 60 minutes of resistance and flexibility exercises specifically prescribed for the patient. The patient's heart rate and oxygen saturation were monitored during each session. The study was for 16 weeks three times per week. **RESULTS:** A pre and post fitness assessment was administered to the patient. The largest improvements were found in balance, muscular strength, core stability, and cardiorespiratory fitness. Balance improved by 75%, core stability improved by 100%, and cardiorespiratory endurance (VO_{2peak}) improved by 16.7%. There were also large percent increases in 1RM for leg extension (70%), leg press (68%), shoulder press (64%), and chest press (29%). QOL index measures also increased 33% during the intervention. **CONCLUSIONS:** The results of this case study suggest that successful implementation of an exercise therapy program can be effective in a health and fitness center. With the growing number of cancer survivors there will be an increased need for the development of cancer exercise training that is easy to implement in a local fitness facility. This study shows the relative ease of implementation in a community based fitness facility.

C-06 Thematic Poster - Athlete Nutrition I

Thursday, May 30, 2019, 9:30 AM - 11:30 AM
Room: CC-101A

1133 Chair: Nancy Clark, FACSM. Sports Nutritionist, West Newton, MA.

(No relevant relationships reported)

**1134 Board #1 May 30 9:30 AM - 11:30 AM
Examination of Low Energy Availability and Macronutrient Intake among Male and Female Recreational Athletes**

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(No relevant relationships reported)

Low energy availability (LEA) may be prevalent in both male and female recreational athletes and can be a catalyst for negative health consequences. **Purpose:** Examine the prevalence of LEA and macronutrient intakes (protein [PRO], carbohydrate [CHO], and fats) and differences between gender in recreational athletes. **Methods:** Data from a larger cross-sectional study was used to examine recreational athletes (n=103, age: 27.9±7.1 years; males: n=59, height: 175.3±9.5 cm, weight: 77.5±13.2 kg; female: n=44, height: 167.9±8.0 cm; weight: 71.4±15.2 kg). Athletes were moderately trained (exercised a minimum of 3-4 days/week. Data collection consisted of anthropometric data, surveys (eg, demographics, age, gender, etc.), resting metabolic rate, a 7-day online dietary log to measure energy intake (EI), and exercise logs to measure exercise energy expenditure (EEE). Basic descriptive stats, Chi-squares, and cross-tabulations were used to examine the proportion of participants classified as "at risk" for LEA (males: <20 kcal/kg/FFM; females: <30 kcal/kg/FFM) and met the micronutrient recommendation across gender. **Results:** Overall, 48.1% (n=50) of athletes demonstrated the following for males and females, respectively: LEA (26.0±10.4 vs. 28.4±14.9 kcal/kg/FFM; EI: 2287.9±943.4 vs. 1881.9±591.7 kcals, EEE: 589.8±399.1 vs. 423.1±199.8 kcals). Differences were found between LEA and gender (P<0.04), with females (28.8%) displaying higher risks than males (19.2%). No differences were found between LEA and PRO, CHO, or fat intake recommendations across gender. However, males overall consumed more than the recommendation for protein than females (15.5% vs. 11.7%; > 2 g/kg/day). Most recreational athletes (90.3%, n=93) reported low CHO intake (< 5 g/kg/day). Fat intake was adequately met by 64.1% (n=66) of athletes, however, 35.9% (n=37) of athletes with LEA consumed fats above the recommendation. **Conclusions:** Recreational athletes are moderately at risk for LEA. Most of these athletes demonstrated compromised low CHO intake compared to the recommendation, and despite LEA, over 1/3 of the athletes over consumed fat. Recreational athletes would benefit from proper nutritional education, specifically EI and macronutrient intake, which is necessary for proper nutritional fueling in recreational athletes.

**1135 Board #2 May 30 9:30 AM - 11:30 AM
Examination of Low Energy Availability and Macronutrient Intake among Female Collegiate Athletes**

Morgan M. Larson¹, Toni M. Torres-McGehee¹, Erin M. Moore², Kelly Pritchett³, Allison B. Smith¹. ¹University of South Carolina, Columbia, SC. ²University of South Florida, Tampa, FL. ³Central Washington University, Ellensburg, WA.
(No relevant relationships reported)

Low energy availability (LEA: ≤ 30 kcal/kg/FFM) is one component of the Female Athlete Triad and is a catalyst for negative health consequence. Female athletes may be at increased risk for LEA due to a multitude of risks: individual judgments, body size expectations, uniforms, lack of nutrition knowledge or pathogenic behaviors. **Purpose:** Examine the prevalence of LEA and macronutrient intakes (protein [PRO], carbohydrate [CHO], and fats) and differences between sport type and academic status (e.g., freshman, sophomore, junior, senior) in female collegiate athletes. **Methods:** Data from a larger cross-sectional study was used to examine 75 Female collegiate athletes (age: 19.5 ± 1.3 years; height: 170.4 ± 6.8 cm; weight: 65.6 ± 8.8 kg) across various sports [beach volleyball (n=18), softball (n=17), equestrian (n=28), and indoor volleyball (n=12)]. Data collection consisted of anthropometric data, surveys (e.g., demographics, health history, etc.), resting metabolic rate, a 7 day online dietary to measure energy intake (EI) and exercise logs to measure exercise energy expenditure (EEE). Basic descriptive stats and Chi-squares and cross-tabulations were used to

examine the proportion of participants classified as "at risk" for LEA and across sport and academic status. **Results:** Overall, 92% (n=69) of athletes demonstrated LEA (13.3±11.9 kcal/kg/FFM, EI: 1490.2±437.3 kcals, EEE: 874.4±490.8 kcals). Differences were found between LEA and PRO intake for both sport type (p<0.04) and academic status (p=0.04), with most equestrian athletes and freshman not meeting protein recommendations (<1.2 g/kg/day). Most athletes (98.7%, n=74) reported low CHO intake (< 5 g/kg/day) with 90.7% (n=68) of athletes with LEA had inadequate CHO intake. Fat intake was adequately met by 64% (n=48) of athletes, however, 26.7% (n=20) of athletes with LEA consumed fats above the recommendation. **Conclusions:** Majority of female athletes demonstrated compromised LEA and macronutrient intake (CHO and PRO). Proper nutritional education, specifically EI and macronutrient intake, is essential for adequate health status and performance in athletes. Healthcare professionals should be aware of recommendations for proper dietary intake, be a resource for education, and implementation of proper nutritional fueling for female athletes.

**1136 Board #3 May 30 9:30 AM - 11:30 AM
Athlete Iron Consumption: Timing Is Everything, But When Is Best?**

Rachel McCormick¹, Diego Moretti², Alannah McKay¹, Dorine W. Swinkels³, Rachel vanSwelm³, Debbie Trinder⁴, Gregory Cox⁵, Michael Zimmerman⁶, Marc Sim⁷, Carmel Goodman⁸, Brian Dawson¹, Peter Peeling¹. ¹The University of Western Australia, Crawley, Western Australia, Australia. ²Laboratory of Human Nutrition, Institute of Food Nutrition and Health, ETH, Zürich, Switzerland, Switzerland. ³Radboud University, Nijmegen, Netherlands. ⁴University of Western Australia, Fiona Stanley Hospital, Murdoch, Western Australia, Australia. ⁵Bond University, Gold Coast, Queensland, Australia. ⁶Laboratory of Human Nutrition, Institute of Food Nutrition and Health, ETH, Zürich, Switzerland. ⁷Edith Cowan University, Joondalup, Western Australia, Australia. ⁸The Western Australian Institute of Sport, Mt Claremont, Western Australia, Australia.
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(No relevant relationships reported)

PURPOSE: The influence of exercise timing on the subsequent inflammatory, hepcidin and iron absorption responses in endurance athletes was examined. **METHODS:** Sixteen endurance-trained runners (10 male, 6 female) with serum ferritin (sFer) < 50 µg/L completed a 90 min running protocol (65% vVO_{2max}) in the morning (AM), and the afternoon (PM), in a crossover design. An iron-fortified fluid labelled with stable iron isotopes (⁵⁷Fe or ⁵⁸Fe) was administered with a standardized meal 30 min following the exercise and control conditions during each trial, serving as a breakfast and dinner meal. Venous blood samples were collected pre-, immediately post-, and 3 h post- the exercise and control conditions for measures of sFer, Interleukin-6 (IL-6), and hepcidin-25. A final venous blood sample was collected 14 d after each trial to determine the erythrocyte iron incorporation. **RESULTS:** The immediate post-run levels of IL-6 were significantly increased from pre-run in both the AM and PM condition (both p=0.004). Hepcidin-25 levels increased 3 h following the AM run (p=0.012), returning to baseline by 12.5 h post-run. During the PM trial, hepcidin levels exhibited diurnal tendency, increasing from baseline to pre-run (p=0.002), before further increasing from pre- to 3 h post-run (p<0.001). Fractional iron absorption was greater at breakfast following the AM run, compared with both the rested condition (p=0.016) and dinner in the AM run trial (p=0.037). **CONCLUSION:** While exercise resulted in increased levels of inflammation and hepcidin, iron was best absorbed in the morning following exercise, indicating there may be a transient mechanism during the acute post-exercise window to promote iron absorption before the homeostatic regulation of hepcidin elevations become more influential.

**1137 Board #4 May 30 9:30 AM - 11:30 AM
Evaluation of a Method to Rapidly Assess Beverage Intake in Collegiate Athletes**

Samantha Kostelnik¹, Brittany Thorpe¹, Catherine Cockrill¹, Michelle Rockwell¹, Valisa Hedrick¹, Travis Thomas², Kevin Davy, FACSM¹, Brenda Davy, FACSM¹. ¹Virginia Tech, Blacksburg, VA. ²University of Kentucky, Lexington, KY.
(Sponsor: Brenda Davy, FACSM)
(No relevant relationships reported)

Fluid intake recommendations have been established for both general and athletic populations in order to promote adequate hydration. The Beverage Intake Questionnaire (BEVQ-15) is a food frequency questionnaire that rapidly measures habitual beverage intake and has been validated in children and adults. However, there is no beverage consumption questionnaire that has been validated in athletic populations.

PURPOSE: The purpose of this investigation is to evaluate the validity and reproducibility of the BEVQ-15 for determining habitual beverage intake in collegiate athletes.

METHODS: National Collegiate Athletic Association (NCAA) Division 1 collegiate athletes from a variety of sports from two universities in Virginia were recruited to participate. The study consisted of three sessions on nonconsecutive days within 2 weeks. At each session, the participants completed a 24-hr dietary recall, which was analyzed via NDSR. At the first and third sessions, participants completed the BEVQ-15. Validity was assessed using by comparing reported beverage intake determined by the BEVQ-15 to the average of three 24-hour recalls, using a Spearman's correlational analysis; reproducibility was assessed by comparing BEVQ-15 results from the two administrations, using a Pearson's correlational analysis.

RESULTS: Eighty-five collegiate athletes (60% female) participated in the study. Mean water and total beverage intake were 80.9±89.5 fl oz and 112.9±95.4 fl oz, respectively. Total beverage intake (fl oz, kcal) between the average BEVQ-15 administration and the recalls was associated (fl oz: $r=0.51$; kcal: $r=0.36$, both $p<0.01$). Correlations between the two BEVQ-15 administrations were significantly associated for water (fl oz: $r=0.80$; $p<0.01$) and total beverage intake (fl oz, kcal: $r=0.74$ and 0.77 , respectively; $p<0.01$).

CONCLUSIONS: These results suggest that the BEVQ-15 is a valid and reproducible method to assess water and total beverage intake in collegiate athletes. The BEVQ-15 is a practical tool (<5 minute completion time) which may be used to measure collegiate athletes' beverage intake. Additional research is needed to determine if the BEVQ-15 is sensitive to detect changes in athlete's beverage intake over time.

1138 Board #5 May 30 9:30 AM - 11:30 AM
Dietary Intake Of Calcium, Magnesium, And Zinc In Female And Male Athletes

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(No relevant relationships reported)

There are limited data on the micronutrient intake of athletes from various sports. Of particular interest are calcium (Ca), magnesium (Mg), and zinc (Zn) intakes among athletes due to their role in metabolic and physiological processes. **PURPOSE:** To determine differences in dietary Ca, Mg, and Zn intake among female and male runners (RN), triathletes (TA), CrossFit athletes (CF), rowers (CW), and general athletes (GA), 18 years of age and older. **METHODS:** This was a cross-sectional study, where 246 athletes (119 women, 127 men; 35±11 years of age) completed a food frequency questionnaire (FFQ) to determine average daily dietary micronutrient intake. We utilized one-sample t-test to compare dietary intake of Ca, Mg, and Zn in athletes with the Recommended Dietary Allowance (RDA) for each micronutrient. **RESULTS:** The results are shown in Table 1 below.

Sex	Sport	n	Ca (mg)	Mg (mg)	Zn (mg)
F	All	119	815.5±401.4 ($p<0.00001$)	349.3±123.2 ($p<0.05$)	10.1±4.1 ($p<0.00001$)
F	RN	50	920±578.3	384.3±137.6 ($p<0.01$)	11.3±5.3 ($p<0.001$)
F	TA	19	845.7±317.7	345.6±156.0	10.8±4.5 ($p<0.05$)
F	CF	10	809.2±151.4 ($p<0.05$)	372.6±107.2	9.6±1.4 ($p<0.05$)
F	CW	16	699.2±209.1 ($p<0.001$)	320.1±97.9	7.9±2.2
F	GA	37	764.2±264.4 ($p<0.0001$)	338.4±97.8	10.0±3.0 ($p<0.001$)
M	All	127	971.9±429.3	405.8±173.3	13.4±6.0 ($p<0.0001$)
M	RN	38	917.5±344.0	383.8±151.0	12.2±5.0
M	TA	27	1055±505.0	441.3±216.6	14.2±5.8 ($p<0.01$)
M	CF	6	1015.5±691.6	336.7±124.3	13.2±5.9
M	CW	16	1154.0±474.2	477.9±179.7	16.6±7.0 ($p=0.01$)
M	GA	23	802.8±297.1 ($p<0.05$)	379.6±129.5	10.8±4.1

CONCLUSIONS: All female athletes combined reported Ca intakes significantly below the RDA, while Mg and Zn intakes were significantly higher than the RDA. Significantly low dietary Ca was revealed in female CF, CW, and GA. All male athletes combined reported Zn intakes significantly higher than the RDA. Male GA reported Ca intakes significantly lower than the RDA. Further research is needed to explore the effect of low Ca intake on athletic performance in female and male athletes. This study was not funded.

1139 Board #6 May 30 9:30 AM - 11:30 AM
The Effect of Different Post-Exercise Beverages with Food on Voluntary Dietary Intake and Subsequent Performance

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(No relevant relationships reported)

PURPOSE: Recent evidence suggests that different beverages promote similar fluid recovery but alter nutrient provision when consumed voluntarily with food post-exercise (Campagnolo et al., 2017; McCartney et al., In Press). However, when preparing to undertake another bout of exercise, individuals may exhibit different dietary behavior (e.g. to reduce gastrointestinal distress, optimize performance). This study investigated the effect of consuming water or a carbohydrate (CHO)-electrolyte sports beverage ('Sports Drink') *ad libitum* with food during a 4h post-exercise recovery period on fluid restoration, nutrient provision, and subsequent endurance cycling performance.

METHODS: On two occasions, 16 trained cyclists, 8 male (M) (age: 31±9y; VO_{2max} : 54±6 mL·kg⁻¹·min⁻¹) and 8 female (F) (age: 33±8y; VO_{2max} : 50±7 mL·kg⁻¹·min⁻¹), lost 2.3±0.3% and 1.6±0.3% of their body mass (BM) (respectively) during 1h of fixed-intensity cycling. Participants then had *ad libitum* access to either Water or Sports Drink (103kJ·dL⁻¹; 5.8g CHO·dL⁻¹) and food for the first 195 min of a 4h recovery period. At the end of the recovery period, participants completed a cycling performance test (45 min fixed-intensity pre-load and an incremental test to exhaustion [peak power output, PPO]). Beverage intake; water/nutrient intake; and indicators of fluid recovery (BM, urine output, plasma osmolality [P_{osm}]) were assessed throughout trials. **RESULTS:** Participants returned to a similar state of positive fluid balance prior to recommencing exercise, regardless of the beverage provided (Water: +0.4±0.5 L; Sports Drink: +0.3±0.3 L, $p=0.529$). While Sports Drink increased post-exercise energy (M: +1.8±1.0MJ; F: +1.3±0.5MJ) and CHO (M: +114±31g; F: +84±25g) intake ($p<0.001$), this did not affect subsequent endurance cycling performance (Water: 337±40W [M] and 252±50W [F]; Sports Drink: 340±40W [M] and 258±47W [F], $p=0.242$).

CONCLUSIONS: Recovery beverage recommendations should consider the post-exercise environment (i.e. availability of food), an individual's tolerance for food/fluid, the immediate requirements for refueling (e.g. CHO demands of subsequent activity) and the athlete's overall dietary goals.

Campagnolo, N. et al. (2017) *Physiol. Behav* 171, 228-235. McCartney, D. et al. (In Press). *Appl Physiol Nutr Metab*.

1140 Board #7 May 30 9:30 AM - 11:30 AM
A Pilot Nutrition Education Intervention with Division I Women's Basketball Players

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(No relevant relationships reported)

Appropriate nutrition is important for both health and optimization of sport performance; however, many athletes do not have sufficient nutrition knowledge to engage in ideal nutrition practices. Few studies have been conducted to investigate the efficacy of a nutrition education intervention on athletes' nutrition knowledge, and even fewer have done so using a validated assessment tool. **PURPOSE:** To evaluate changes in nutrition knowledge of NCAA Division I women's basketball players after a sport-focused nutrition education intervention using a validated nutrition knowledge survey. **METHODS:** NCAA Division I women basketball players (N=8) completed a validated nutrition knowledge survey (Callella et al., 2017) that evaluated both general and sport nutrition. Athletes then participated in six, once weekly, 20-minute nutrition education sessions led by a Registered Dietitian. Topics included: hydration, carbohydrates, protein, fats, meal planning, and micronutrients/supplements. At the end of six weeks, the survey was re-administered. Scores were summed as +1 for a correct answer and +0 for no answer, an incorrect answer, a double-answer, or the "I don't know" option. Maximum possible score was 97. A paired-samples t-test was conducted to evaluate baseline versus follow-up scores. **RESULTS:** At baseline, athletes scored 40.5±18.0 out of 97 possible, 27.0±12.7 out of 64 possible, and 13.9±6.2 out of 33 possible for the total survey, general nutrition and sport nutrition sections, respectively. Significant average score increases were found for the total survey overall (62.2±11.7, $p=0.004$), within the general nutrition section (40.4±7.7, $p=0.015$), and within the sport nutrition section (21.9±5.9, $p<0.001$). **CONCLUSION:** The education intervention used in this pilot study succeeded in increasing nutrition knowledge of Division I women's basketball players. Future research should include intake assessments to determine whether eating habits improve after nutrition education.

This research was funded by the MSU College of Education via a Summer Research Fellowship.

1141 Board #8 May 30 9:30 AM - 11:30 AM
The Importance of Iron Testing for D3 Cross Country Runners

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(No relevant relationships reported)

PURPOSE: Iron is an important mineral carried throughout the body, which helps carry oxygen rich molecules via hemoglobin. For endurance athletes, blood iron levels may be an important predictor of performance. Previous research has shown that iron absorption rates are lower in athletes in comparison to sedentary individuals. The purpose of the current investigation was twofold: first, to measure pre-season blood iron levels in division III collegiate cross country runners to determine if iron deficiency existed, and secondly, improve blood iron levels with a five week nutrition intervention for subjects classified as low.

METHODS: Capillary puncture was utilized to measure blood iron levels during the week of pre-season practice in division III male (N=26) & female (N=20) cross country runners. Athletes were classified as low iron if the males were below 13.0mg/dL, and 12.0mg/dL for the females. If subjects were classified as low, they received a nutritional pamphlet as an intervention, and were retested five weeks later.

RESULTS: The researchers classified 26.92% of males as iron deficient, and 5.00% of females as deficient. After retesting the deficient subjects, a paired t-test was utilized to determine if significant improvements in blood iron occurred following the five week intervention. A p-value of 0.002 (2-tail) was yielded showing a significant improvement in hemoglobin levels from pre-season in comparison to 5 weeks following the intervention (12.28 +/- 1.09, 13.94 +/- 0.25 respectively).

CONCLUSIONS: After a five week intervention, iron levels in those previously deficient, were significantly improved. Iron is a significant mineral for athletes, especially runners who are greatly dependent on oxygen for their performance. Thus, making sure cross country runners are educated on good nutritional habits, allowing them to maintain the said desirable blood iron levels is key to optimize their performance. Lastly, meeting the recommended guidelines for iron is vastly important, and educating athletes can result in a substantial improvement in blood iron levels.

C-07 Thematic Poster - Clinical Exercise Physiology: Exercise and Type 2 Diabetes

Thursday, May 30, 2019, 9:30 AM - 11:30 AM
 Room: CC-101B

1142 Chair: R. Scott Rector, FACSM. University of Missouri, Columbia, MO.

(No relevant relationships reported)

1143 Board #1 May 30 9:30 AM - 11:30 AM
Impact Of A Clinical Exercise Program On Trajectories Of Hba1c And Weight In Older Veterans

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(No relevant relationships reported)

Purpose Gerofit is a clinical exercise program for Veterans ≥ 65 years, originally developed at the Durham VA Medical Center and offered at the Baltimore VA Medical Center (BVAMC) since 2013. Veterans receive individualized exercise programs and participation in the program is voluntary. We assessed hemoglobin A1C (A1C) and weight changes in Veterans with a diagnosis of diabetes who completed one year of exercise training in Gerofit. **Methods** Older Veterans with primary care at the BVAMC were referred to Gerofit. Functional assessments included measures of weight and were used in conjunction with patients' personally identified exercise goals to develop comprehensive exercise programs including cardiorespiratory, strength, and flexibility training. Clinical chart reviews were conducted to determine A1C and weight one year prior to starting Gerofit, time of enrollment, and one year into participation. Initial program enrollment eligibility did not exclude for elevated A1C, but was later modified to include pre-program A1C $\leq 10\%$. Veterans could attend Gerofit exercise sessions up to 3 days per week. **Results** Forty-four Veterans with diabetes (43 male, 73.5 \pm 5.6 years, 89% African American, BMI 32.9 \pm 5.0 kg/m²) completed 1 year

of Gerofit. On average, both weight and A1C increased in the year prior to initiating Gerofit (A1C 7.2 \pm 1.2 to 7.4 \pm 1.5%, weight +1.2 lbs.). Overall A1C declined to 7 \pm 1.1% (p < 0.05) and weight by -.04 \pm 41.5 (p = 0.73) 1 year into the program. Half the group (22/44) experienced a decrease in A1C, 2/44 had no change, and 17/44 increased A1C. The group that decreased A1C at 1 year started with a significantly higher A1C at time of enrollment compared to those that increased A1C at 1 year (7.8 \pm 1.6% vs. 6.8 \pm 1.2%). **Conclusion** Diabetic Veterans who participated in one year of Gerofit overall demonstrated a reversed trajectory of rising A1C and weight. Overall, the decline in A1C approached the clinically significant reduction of 0.5%. Those Veterans with a higher A1C at time of enrollment demonstrated a statistically and clinically significant reduction; reducing potential diabetes complications. Results demonstrate the importance of advocating for participation in a low level, multi-component exercise program for weight and diabetes management.

1144 Board #2 May 30 9:30 AM - 11:30 AM
Long-term Changes On Bdnf And Igf-1 In Patients With T2dm - Training At Different Intensities

João P. Magalhães, Pedro B. Júdice, Megan Hetherington-Rauth, Duarte neto, Catarina Matias, Luís B. Sardinha. *Faculdade de Motricidade Humana, Universidade de Lisboa, Lisbon, Portugal.*

(No relevant relationships reported)

A growing body of evidence suggests that exercise can influence the central nervous system through circulating growth factors that can cross the blood-brain barrier. Among these factors are the brain-derived neurotrophic factor (BDNF) and insulin-like growth factor-1 (IGF-1), which work simultaneously to improve brain plasticity and functioning. However, the long-term effects of different exercise intensities on BDNF and IGF-1 in patients with type 2 diabetes mellitus (T2DM) have never been examined. **PURPOSE:** Examine the impact of a 12-month randomized controlled trial of combined high-intensity interval training (HIIT) with resistance training (RT) vs. a combined moderate continuous training (MCT) with RT, on circulating levels of BDNF and IGF-1, in patients with T2DM. **METHODS:** Patients with T2DM (n=80) were randomized into three groups (Control, HIIT with RT, and MCT with RT). Exercise training was performed 3 days per week for 12 months, while supervised by exercise physiologists. Resting serum BDNF and IGF-1 levels were measured at baseline and 12-months. Within- and between-group changes in BDNF and IGF-1 were assessed using generalized estimating equations were used.

RESULTS: After adjustment for sex and baseline moderate-to-vigorous physical activity, there was no significant between-group changes for both HIIT and MCT on BDNF (MCT: $\beta = -0.05$, p=0.474; HIIT $\beta = -0.01$, p=0.950) and IGF-1 (MCT: $\beta = 1.73$, p=0.358; HIIT $\beta = 2.75$, p=0.173) in the intention-to-treat analyses. With similar results, the per protocol analysis (>70% adherence to prescribed sessions) showed no significant changes for both MCT and HIIT on BDNF (MCT: $\beta = -0.03$, p=0.723; HIIT $\beta = 0.03$, p=0.602) and IGF-1 (MCT: $\beta = 0.52$, p=0.829; HIIT $\beta = 1.84$, p=0.455).

CONCLUSIONS: These findings indicate that a 12-month intervention using a combination of HIIT with RT or MCT with RT had no significant impact on serum levels of both BDNF and IGF-1 in patients with T2DM. There is a heterogeneous and wide response to exercise on BDNF and IGF-1, especially when considering long-term interventions. Thus, future studies on the long-term effects of exercise are warranted to better understand the influence of these specific growth factors on brain health.

1145 Board #3 May 30 9:30 AM - 11:30 AM
Vascular Changes In Patients With T2DM Following 1-year Of Exercise, Irrespective Of Cardiorespiratory Fitness Improvement

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(No relevant relationships reported)

Micro- and macro-vascular changes occurring in patients with type 2 diabetes mellitus (T2DM) are major contributors to the development of cardiovascular disease, a leading cause of morbidity and mortality for these individuals. Increased cardiorespiratory fitness (CRF) from exercise training has been associated with improvements in metabolic and vascular health outcomes. Despite mean improvements in CRF from exercise training there remains a portion of participants having little or no improvement. **PURPOSE:** Given the importance of vascular function in people with T2DM, we assessed whether non-responders to CRF also failed to improve structural and functional arterial indices following a 1-year exercise intervention. **METHODS:** We assessed patients with T2DM (n=63) who participated in a three arm 1-year randomized controlled exercise intervention involving a control group, moderate continuous training or high intensity interval training combined with resistance training. Exercise responders were classified based on changes in CRF ($\Delta V_{O_{2max}} \geq 5\%$). Vascular structural and functional indices were measured using ultrasound imaging and applanation tonometry. Changes in vascular measures were compared

across control (n=22), exercise responders (n=15), and exercise non-responders (n=26) using generalized estimating equations. **RESULTS:** Compared to controls, both responders and non-responders had significant improvements in carotid intima-media thickness (responders: $\beta=-3.54$ [CI -6.40, -0.68], non-responders: $\beta=-5.59$ [CI -9.18, -2.01]) and peripheral arterial stiffness indices, such as carotid to distal posterior tibial artery pulse wave velocity (responders: $\beta=-0.16$ [CI -0.28, -0.04], non-responders: $\beta=-0.13$ [CI -0.24, -0.03]) and on the distensibility coefficient (responders: $\beta=0.00$ [CI 3.01e-5, 0.00], non-responders: $\beta=0.00$ [CI 1.41e-6, 0.00]), while only responders improved central arterial stiffness (carotid pulse wave velocity, $\beta=-0.06$ [CI -0.11, -0.01]). No improvements in the remaining vascular indices and hemodynamic variables were observed. **CONCLUSIONS:** Regardless of increasing CRF, a 1-year exercise intervention entails significant benefits for vascular function in patients with T2DM.

1146 Board #4 May 30 9:30 AM - 11:30 AM
Influence of High Intensity Body-Weight Circuit Training in Adults with Type II Diabetes.

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(No relevant relationships reported)

PURPOSE: To determine the effectiveness of a 15-week intervention of a minimal dose high-intensity bodyweight circuit (HIBC) program in persons with type 2 diabetes (T2D) on markers of metabolic function, autonomic balance, and body composition. **METHODS:** Three females (55±4yrs) and two males (64±1yrs) with T2D underwent assessments of glycosylated hemoglobin (HbA1c) and fasting plasma glucose (FG), insulin (INS), and lipids. Body composition was determined using dual-energy x-ray absorptiometry, aerobic fitness (submaximal treadmill test), blood pressure (SBP/DBP), and resting heart rate (RHR) were assessed. Participants completed 15-weeks of bodyweight circuit training (10 banded bodyweight squats, 5 modified pull-ups, 5 modified push-ups, 10 abdominal crunches). Participants completed as many cycles as possible in each session. Session duration progressed from 5-10 minutes, as tolerated, and session frequency progressed from 3-4 sessions per week. All assessments were repeated after 15 weeks of training. **RESULTS:** Body composition: Pre and Post changes in mean weight ($p=0.395$), body fat % ($p=0.632$), lean mass ($p=0.372$). Aerobic fitness: estimated $\text{VO}_{2\text{max}}$ ($p=0.232$), SBP ($p=0.062$), DBP ($p=0.90$), RHR ($p=0.727$). Metabolic biomarkers: FG ($p=0.942$), HDL ($p=0.271$), LDL ($p=0.671$), HbA1c ($p=0.810$), INS ($p=0.762$). **CONCLUSIONS:** The HIBC did not appear to be effective in improving markers of metabolic function or health-related physical fitness in the five participants. However, when removing a singular outlying participant, several factors demonstrate substantial improvements in several outcome measures. HIBC may be an appropriate and appealing intervention for those with T2D.

1147 Board #5 May 30 9:30 AM - 11:30 AM
Effects of Novel Compression Exercise Technology on Glycohemoglobin Levels and Weight in Type II Diabetics

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 Reported Relationships: C. Wernecke: Salary; Vaspar Systems.

The most potent lifestyle intervention for treatment of Type II Diabetes (T2D) is consistent exercise. However, for many patients with the condition, other comorbidities such as osteoarthritis, hypertension, and high body mass indexes prevent them from being able to exercise intensively and consistently enough to experience optimal metabolic benefits. Recent research has supported the use of compression exercise in physically limited populations and demonstrated physiologic responses at lower intensities (10-20% one repetition maximum vs. 70% for hypertrophic response in conventional resistance exercise). The combination of compression technology with core cooling further lowers the exertional requirements and has been used in cardiopulmonary rehabilitation populations to provide a safe and reliable exercise intervention. Compression exercise has also been shown to significantly increase muscle hypertrophy, with a greater growth in type II fibers (higher expressors of GLUT4). Therefore, this technology could directly address basal metabolism through increasing muscle protein turnover, increasing glucose storage in skeletal muscle mass, and improving glycemic control. This capacity to attenuate the insulin response combined with the accessibility of the platform suggests a clinical implication for diabetes management.

PURPOSE: To establish safe use of cooled compressive exercise in Type II Diabetics and to examine the effect of 6 months of training on biometabolic markers, especially Glycohemoglobin levels and weight.

METHODS: Thirty Type II Diabetics agreed to 3 training sessions a week for 6 months. Biometabolic markers via blood draw were analyzed at 0, 3, and 6 months.

RESULTS: Midpoint data from 16 participants at 0 and 3 months were analyzed with a two-tailed T-test, revealing significant differences in Glycohemoglobin and weight. There was an 8% average decrease in Glycohemoglobin levels (8.5±2.2 vs. 7.8±1.8 mg/dl, $p=0.002$) and an average weight loss of 3.6 lbs (211±50 vs. 208±48 lbs, $p=0.032$). **CONCLUSION:** The preliminary results of this study suggest exercise with compression and cooling contributes to a reduction in biometabolic markers of diabetes. This intervention has promise in contributing to effective management of T2D with a low physical burden.

1148 Board #6 May 30 9:30 AM - 11:30 AM
Impact Of Short-term Exercise Training And Diet On Glucose Effectiveness Between Prediabetes Phenotypes

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(No relevant relationships reported)

PURPOSE: Although exercise improves glucose effectiveness (GE) in adults with type 2 diabetes, the influence of exercise on GE across the prediabetes phenotypes is unknown. Additionally, the impact of dietary intake on GE after an exercise intervention is limited. The purpose of this study was to examine the effect of short-term exercise training and habitual dietary intake on GE in adults with impaired fasting glucose (IFG) compared with IFG plus impaired glucose tolerance (IFG+IGT). **METHODS:** Female subjects (Age 59.4±7.2 yrs.; BMI 34.4±1.4 kg/m²) were screened for IFG (n=7, FPG: 103.9±2.3 mg/dl; 2-hr glc: 116.7±7.2 mg/dl) and IFG+IGT (n=10 FPG: 99.1±3.5 mg/dl; 2-hr glc: 152.9±11.0 mg/dl) using ADA criteria (120 min 75g OGTT). Subjects underwent 12 bouts of exercise at ~70% of HR_{peak} for 60 min/d over 2-weeks. A 180 min, 75g OGTT was used to collect glucose and insulin to determine GE via a validated minimal model before and after training. $\text{VO}_{2\text{peak}}$ and body composition (BIA) were also tested. Energy expenditure during training was calculated using a linear regression equation based on $\text{VO}_{2\text{peak}}$ and heart rate. Subjects were also asked to record their diet before and after the intervention using 3-d food logs. **RESULTS:** Exercise training reduced BMI ($P<0.05$), but had no effect on lean body mass (LBM) or $\text{VO}_{2\text{peak}}$; and there was no difference in exercise energy expenditure in either group (all, $P>0.72$). However, adults with IFG+IGT increased GE post-training (within effect; $P=0.02$), and this rise in GE tended to be greater in IFG+IGT than IFG (0.23±0.08 vs. 0.00±0.08 mg/dl per min; $P=0.059$). Increased GE correlated with elevated LBM ($r=0.42$, $P=0.09$), but not reduced BMI ($r=-0.08$, $P=0.75$) or increased fitness ($r=0.02$, $P=0.95$). While dietary protein reduction was linked with increased GE ($r=-0.49$, $P=0.05$), no association was seen between GE and carbohydrates ($r=-0.24$, $P=0.37$), fat ($r=-0.17$, $P=0.53$) or total kcal ($r=-0.23$, $P=0.40$). **CONCLUSION:** Independent of weight loss and fitness, short-term exercise training increased GE in adult women with IFG+IGT but not those with IFG. The results also suggest dietary protein may modulate the exercise effect on GE. Future work is needed to examine how nutrition can optimize exercise induced glucose regulation in individuals with prediabetes.

1149 Board #7 May 30 9:30 AM - 11:30 AM
Effect of Weight Loss on Physical Function in Overweight and Obese Individuals

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(No relevant relationships reported)

Impaired physical function is a major health concern in obesity across the adult lifespan. Reducing weight and improving body composition may be critical for improving physical function in overweight and obese adults. **Purpose:** Investigate physical function before and during weight loss and study the relationships of body composition with changes in physical function. **Methods:** Data were obtained from women (n=127, age 49.3±12.8 years; weight 101.8±17.9 kg; BMI 37.8±6.6 kg/m²) and men (n=17, age 54.4±10.1 years; weight 131.9±31.9 kg; BMI 40.5±9.9 kg/m²) enrolled in a medical supervised comprehensive weight loss program at Wake Forest Baptist Health Weight Management Center. Mean follow up was 6.7 months. Body composition, grip strength, gait speed, chair rise time, and submaximal $\text{VO}_{2\text{max}}$ were determined before and at the end of follow-up. Paired samples t-tests analyzed changes between baseline and follow-up. Pearson correlations examined relationships between pre-and-post functional performance tests and fat free mass (FFM), and fat mass (FM). **Results:** Mean weight loss was 11.8±9.8 kg. Approximately 74.9% of weight loss was from fat mass: IFM (48.3±18.5 kg at baseline and 38.9±12.7 kg at follow-up, $p<0.001$) and FFM (57.9±10.6 kg at baseline and 55.7±10.9 kg at follow-up, $p<0.001$). Grip strength (29.3±8.1 to 32.9±11.2 kg, $p<0.001$), chair rise time (9.1±2.9 to 7.8±2.7 s, $p=.018$), gait speed (1.2±0.2 to 1.3±0.2 m/s, $p=.001$), and submaximal $\text{VO}_{2\text{max}}$ (32.7±3.9 to 34.7±4.5 ml/kg/min, $p<0.001$) all improved from baseline to follow-up, respectively. Gait speed

($r = -.292$, $p = .005$) grip strength ($r = -.215$, $p = .041$) and chair rise ($r = -.273$, $p = .009$) changes were correlated with FM changes but not FFM changes. **Conclusions:** A comprehensive weight loss generally improves physical function. This improvement is possibly mediated by FM losses rather than FFM changes.

1150 Board #8 May 30 9:30 AM - 11:30 AM
Sex-Specific HbA1c Responses to Structured Exercise Among Patients with Type 2 Diabetes

Diana Devitskaya¹, Cynthia Villalobos¹, J. Mark VanNess¹, Paul D. Vosti², Alexis C. King³, Courtney D. Jensen¹. ¹University of the Pacific, Stockton, CA. ²St. Joseph's Medical Center, Stockton, CA. ³University of Illinois at Urbana-Champaign, Champaign, IL.

(No relevant relationships reported)

In the United States, 1 in every 9 adult women and 1 in every 8 adult men have diabetes; 95% of these cases are Type 2 diabetes. The efficacy of exercise training as an intervention for treatment is likely attributed to a combination of biological and environmental factors, including age, physical fitness, and sex. Despite the large number of exercise trials observing the effects of physical activity on Type 2 diabetes, few studies compare the benefits of the intervention exclusive to the participants' sex. **PURPOSE:** To evaluate sex-specific glycated hemoglobin (HbA1c) changes to structured exercise among males and females with Type 2 diabetes. **METHODS:** 24 males and 40 females with Type 2 diabetes were enrolled in an exercise program involving aerobic activity, resistance exercise, and flexibility training. At the initial evaluation, subjects underwent a health history exam, multiple assessments of physical fitness, cardiometabolic testing, and an assessment of HbA1c. Following 10 weeks of bi-weekly exercise sessions, participants that remained active in the program were reassessed. A repeated measures ANOVA with Greenhouse-Geisser correction compared HbA1c levels at baseline and follow-up between sexes. **RESULTS:** Subjects were assigned to "completers" (N=39) or "non-completers" (N=28) based on adherence to the exercise program. At baseline, HbA1c levels did not differ between completers and non-completers ($p = 0.234$). Sex was not related to completion of the trial ($p = 0.660$) or baseline HbA1c ($p = 0.117$). The repeated measures ANOVA found HbA1c to improve with exercise ($F = 7.878$, $p = 0.008$) and an interaction effect with sex ($F = 6.734$, $p = 0.014$) whereby males decreased more than females (0.61 compared to 0.02). **CONCLUSION:** In our sample, a structured exercise program induced greater reductions in HbA1c among male participants versus female participants. These findings help illustrate clinical importance for personalizing sex-specific exercise programs for persons at risk for or diagnosed with Type 2 diabetes.

C-08 Thematic Poster - Oxygen Uptake Kinetics

Thursday, May 30, 2019, 9:30 AM - 11:30 AM
 Room: CC-102A

1151 Chair: John M. Kowalchuk. University of Western Ontario, London, ON, Canada.

(No relevant relationships reported)

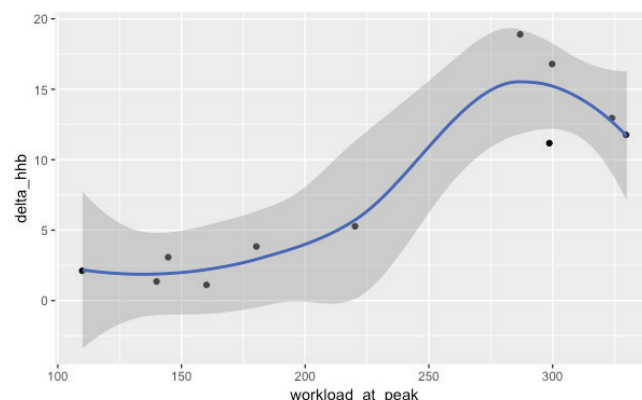
1152 Board #1 May 30 9:30 AM - 11:30 AM
Relationship Between Muscle Deoxygenation And Workload At Peak Exercise In Healthy Adults Using Near-infrared Spectroscopy

Ashley M. Goodwin¹, Jacqueline Montes¹, Ipek Ensari², Feliz Marie Hernandez¹, Kayla Coutts¹, Ashwini K. Rao¹, Carol Ewing Garber, FACSM². ¹Columbia University Irving Medical Center, New York, NY. ²Columbia University Data Science Institute, New York, NY. ³Teachers College, Columbia University, New York, NY. (Sponsor: Dr. Carol Ewing Garber, FACSM)
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(No relevant relationships reported)

Near-infrared spectroscopy (NIRS) is used to investigate muscle oxygenation, but the association of muscle deoxygenation (deoxygenated hemoglobin, deoxy[Hb+Mb]; ΔHHb) to workload during exercise needs further study. **PURPOSE:** To characterize the relationship between the change in muscle deoxygenation (ΔHHb) and maximal workload (MW) achieved during maximal cardiopulmonary exercise test (CPET). **METHODS:** 6 men and 5 women (mean ± SD: 39.09 ± 17.2 years [age]) underwent CPET on a recumbent cycle ergometer. ΔHHb in the vastus lateralis muscle was measured using NIRS, and MW as recorded in Watts. A polynomial model ($\Delta HHb \sim MW + MW^2 + \text{peak oxygen uptake; } \dot{V}O_{2\text{peak}}$) was compared to a semi-linear regression model (with an added interaction term between $\dot{V}O_{2\text{peak}}$ and MW) to

characterize the relationship. **RESULTS:** ΔHHb during CPET was strongly correlated with peak workload (0.881, $p = 0.0003$) and $\dot{V}O_{2\text{peak}}$ (0.934, $p = 0.0001$). The polynomial model explaining the relationship was significant (Adj. $R^2: 0.821$, $F(4,7) = 7.853$, $p = 0.009$); however, the point estimates were not . The semi-linear regression model was better able to characterize the overall trend (Adj. $R^2: 0.90$, $p = 0.0002$) and the drop in ΔHHb at the higher ends of MW, and indicated that $\dot{V}O_{2\text{peak}}$ had a significant effect ($B = 54.9$, $p = 0.019$), and interacted with MW ($B = -0.157$, $p = 0.04$). **CONCLUSION:** These preliminary results show that the linear increase in ΔHHb with incremental workload appears to attenuate and slightly decrease at greater MW, especially for those with higher exercise capacity. Supported by NIH Grant K01HD084690-01A1.



1153 Board #2 May 30 9:30 AM - 11:30 AM
The Oxygen Mean Response Time At Different Ramp-Incremental Cycling Slopes.

Rafael de Almeida Azevedo¹, Danilo Iannetta¹, Daniel Keir², Juan Murias¹. ¹University of Calgary, Calgary, AB, Canada. ²University of Health Network, Toronto, ON, Canada.

(No relevant relationships reported)

During a ramp-incremental (RI) cycling exercise, the measurement of oxygen uptake ($\dot{V}O_2$) at the level of the mouth has a time delay from the onset of exercise, which is defined as the mean response time (MRT). It has been shown that the MRT is best calculated using the steady-state $\dot{V}O_2$ from a bout of moderate-intensity exercise prior to the RI test, and then matching this $\dot{V}O_2$ to the time at which this metabolic rate occurs during the RI test. Previous research has used RI slopes of 25 and 30 $\text{W} \cdot \text{min}^{-1}$ to measure the MRT. In this context, it is known that the $\dot{V}O_2$ to work rate relationship is affected by the slopes of the ramp, which might affect the duration of the MRT. However, there is no empirical data to support this assumption. **PURPOSE:** To determine the influence of different RI slopes on the MRT. **METHODS:** Six healthy young men (age: 28 ± 10 years; height: 179 ± 6 cm; weight: 72 ± 5 kg; $\dot{V}O_{2\text{max}}$: $4.0 \pm 0.3 \text{ L} \cdot \text{min}^{-1}$) performed six RI cycling tests with slopes of 5, 10, 15, 25, 30 and 100 ($\text{W} \cdot \text{min}^{-1}$). The ramp-incremental test was preceded by a moderate-intensity step-transition (i.e., 6 min at 20 followed by 6 min at 100 W), from which the steady-state $\dot{V}O_2$ could be determined before the ramp $\dot{V}O_2$ vs power output relationship was established. The difference between the power output at the steady-state $\dot{V}O_2$ and the ramp-specific power output at a similar $\dot{V}O_2$ was transformed into time to calculate the MRT. **RESULTS:** The MRT for 5 (11 ± 6 s), 10 (16 ± 11 s), 15 (22 ± 12 s), 25 (26 ± 11 s), 30 (32 ± 13 s) and 100 (25 ± 10 s) $\text{W} \cdot \text{min}^{-1}$ showed a significant main effect ($P = 0.001$). Post-hoc comparisons showed shorter MRT for 5 compared to 25 ($P = 0.025$) and 30 ($P = 0.001$) $\text{W} \cdot \text{min}^{-1}$, and for 10 compared to 30 ($P = 0.015$) $\text{W} \cdot \text{min}^{-1}$. **CONCLUSION:** Different ramp-incremental slopes directly influences the MRT, where it appears that MRT progressively becomes greater with steeper ramp slopes, until a certain level is reached (i.e., $\sim 25 \text{ W} \cdot \text{min}^{-1}$) where there was no further lengthening of the MRT. From a practical perspective, less steep RI slopes will result in smaller adjustments in power output due to the shorter MRT. Thus, in RI slopes of 5 and 100 $\text{W} \cdot \text{min}^{-1}$ the power output adjustment would be ~ 1 and ~ 40 W, respectively.

- 1154** Board #3 May 30 9:30 AM - 11:30 AM
Skeletal Muscle Oxygen Kinetics During Exercise In Adults With Obstructive Sleep Apnea.
 Jeffrey E. Herrick¹, Shirpa Puri², Monira Aldhahi², Vivek Jain³, Lisa MK Chin⁴. ¹University of Lynchburg, Lynchburg, VA. ²George Mason University, Fairfax, VA. ³George Washington University, Washington DC, DC. ⁴National Institutes of Health Clinical Research Center, Bethesda, MD.
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 (No relevant relationships reported)

Obstructive sleep apnea (OSA) is associated with persistent and progressive nighttime sympathetic nervous system (SNS) arousal strain in response to both hypopnea and apnea events. This repetitive strain of nighttime activation of the SNS may promote daytime hyperactivity, possibly limiting microvascular reactivity.

PURPOSE: The purpose of this study was to examine the on-kinetic profile of muscle deoxygenation during sub-maximal walking in adults with OSA.

METHODS: Twelve adults with OSA (age=48±10years, BMI=29±5kg/m², Apnea-hypopnea index (AHI)=50±24) and 12 healthy non-OSA (NO) adults (42±8years, BMI=24±3kg/m²) completed two 6-minute bouts of submaximal exercise on a motorized treadmill, corresponding to 85% of anaerobic threshold. Using near-infrared spectroscopy (NIRS), concentration changes in deoxygenated hemoglobin-myoglobin (Δ [HHb]) was measured continuously from the left lateral gastrocnemius muscle. The two bouts were averaged to form a single Δ [HHb] response profile per subject. Indices of Δ [HHb] on-kinetics include the time constant (τ), Δ [HHb] amplitude (Δ [HHb]amp), and mean response time (MRT=time delay+ τ). In addition, the transition constant (K_t = Δ [HHb]amp/MRT) reflects the overall normalized rate of Δ [HHb] on-kinetics. Data were compared using age, BMI, gender, race, total physical activity and sleep duration as covariates for ANCOVA.

RESULTS: Both τ and MRT did not differ between the groups (OSA:19.8±8.2s, NO:19.4±4.4s, $p=0.835$; and OSA:28.9±7.2s, NO:24.4±5.9s, $p=0.515$ respectively). However, Δ [HHb]amp and K_t were lower in OSA compared to NO (OSA:2.8 ±2a.u., NO:8.7±5.3a.u., $p=0.011$; and OSA:0.101±0.07a.u/s, NO:0.354±0.17a.u/s, $p=0.002$, respectively). Further, the multivariate regression analysis showed that AHI was a strong predictor of and was negatively associated with Δ [HHb]amp as well as K_t ($p=0.015$ and $p=0.019$ respectively).

CONCLUSION: The lower normalized response rate of muscle deoxygenation may be reflective of impaired capability of the muscle to extract/utilize oxygen, which may contribute towards a decreased ability to sustain physical activity. Disease severity was also directly related to the normalized Δ [HHb] response rate, which has implications for physical activity participation in persons with OSA.

- 1155** Board #4 May 30 9:30 AM - 11:30 AM
Gemfibrozil And Oxygen-hemoglobin Binding Affinity In Humans
 Chad C. Wiggins, Paolo B. Dominelli, Sarah E. Baker, John-Rodger A. Shepherd, Koji Uchida, Michael J. Joyner, FACSM. Mayo Clinic, Rochester, MN. (Sponsor: Michael J. Joyner, M.D., FACSM)
 Email: wiggins.chad@mayo.edu
 (No relevant relationships reported)

Exercise tolerance, in humans, is determined primarily by the diffusive and convective components of oxygen transport. Each of these can be acutely altered by changing the oxygen binding affinity for hemoglobin (right-shifting the oxygen-hemoglobin dissociation curve (ODC)). The tradeoffs associated with any acute shift in the ODC and the associated effects on O₂ transport are very context-dependent. Lipid-lowering drugs such as fibrates directly permeate the erythrocyte membrane and alter the hemoglobin molecule effectively lowering (right-shifting) the oxygen binding affinity to hemoglobin, in vitro. **PURPOSE:** To determine if fibrates (gemfibrozil) are effective in therapeutic doses, in vivo, at altering O₂ binding affinity for hemoglobin, and oxygen uptake kinetics during moderate intensity exercise. **METHODS:** Five volunteers (3M/2W, age= 32.3 ± 2.3 years, BMI = 23.5 ± 1.6 kg/m², $\dot{V}O_{2max}$ = 42.5 ± 4.2 ml/kg/min) completed a single study visit in which we measured oxygen binding affinity (P_{50} and Hill's n), and oxygen uptake kinetics during moderate intensity exercise (power output that elicited 40% $\dot{V}O_{2max}$) at rest and following two separate 1,200mg doses of gemfibrozil (administered approximately 2h apart). **RESULTS:** Gemfibrozil did not alter oxygen-hemoglobin binding affinity with either dose (Baseline P_{50} = 26.8 ± 1.4, Hill's n = 2.5 ± 0.1; Dose #1 P_{50} = 27.0 ± 0.7, Hill's n = 2.5 ± 0.0; Dose #2 P_{50} = 27.5 ± 1.1 Hill's n = 2.5 ± 0.0). Oxygen uptake kinetics during exercise at a power output eliciting 40% $\dot{V}O_{2max}$ were not different following the administration of either dose of gemfibrozil (Baseline $\Delta\dot{V}O_2$ = 0.88 ± 0.32 L/min, τ = 22.1 ± 9.7s; Dose #1 $\Delta\dot{V}O_2$ = 0.88 ± 0.31 L/min, τ = 21.5 ± 9.7s; Dose #2 $\Delta\dot{V}O_2$ = 0.90 ± 0.31 L/min, τ = 19.7 ± 8.2s). **CONCLUSION:** Therapeutic doses of gemfibrozil administered acutely are not an effective allosteric modifier of oxygen binding affinity for hemoglobin, in vivo, therefore, there were no changes in the O₂ kinetics during moderate intensity exercise.

- 1156** Board #5 May 30 9:30 AM - 11:30 AM
Comparison of Oxygen Uptake Kinetics Between Kidney Transplant Recipients and Healthy Subjects
 Alessandro Patti, Daniel Neunhaeuserer, Sara Ortolan, Fausto Roman, Lucrezia Furian, Veronica Baiocco, Sara Rovai, Andrea Gasperetti, Andrea Ermolao. Padua University-Hospital, Italy, Padua, Italy.
 Email: alessandro.patti@studenti.unipd.it
 (No relevant relationships reported)

Aerobic exercise capacity is reduced in kidney transplant recipients (KTRs), with a progressive improvement after transplantation. KTRs show central exercise limiting factors such as chronotropic incompetence, anemia, heart or vascular diseases. Moreover, peripheral alterations at a muscular level are present in this population. It has been reported that slower oxygen uptake ($\dot{V}O_2$)-kinetics during a moderate constant load exercise, expressed as an increased time constant (τ), may reflect an impaired muscular oxidative metabolism.

PURPOSE: To analyze the $\dot{V}O_2$ -kinetics in a population of KTRs.

METHODS: two groups of KTRs enrolled 3 and 12 months (n=21 and 14, respectively) after transplantation and a control group of healthy young adults (n=16) underwent cardiopulmonary exercise testing at cycle-ergometer. The protocol consisted in two subsequent constant, moderate-load exercise phases with a final incremental test until exhaustion.

RESULTS: The τ was increased in KTRs compared to controls (50.4±13.11 s at 3 and 43.84±11.57 s at 12 months vs 28.91±8.37 s in controls; both $P<0.01$) while $\dot{V}O_{2peak}$ was reduced, but significantly higher in the group evaluated at 12 months (21.30±4.34 vs 26.36±7.96 ml/kg/min ($P=0.04$), vs 41.7±7.82 ml/kg/min in controls (both $P<0.01$)). Consistently with this result, an increased hemoglobin (Hb) concentration was found 12 months after transplantation (12.77±1.67 vs 14.55±1.74 g/dL ($P<0.01$)). Also, lower peak heart rate (HR) might affect KTRs' exercise capacity (79.67±12.16% of predicted at 3 and 84.29±11.49% at 12 months vs 93.38±5.21% in controls; both $P<0.01$). Among KTRs, the τ showed a moderate negative correlation with $\dot{V}O_{2peak}$ and oxygen uptake efficiency slope ($R=-0.51$ and $R=-0.57$, respectively), less depending on Hb and particularly on peak HR ($R=-0.33$ and $R=-0.13$, respectively). **CONCLUSION:** KTRs show slower $\dot{V}O_2$ -kinetics, reduced peak $\dot{V}O_2$ and HR when compared to a population of healthy young adults. $\dot{V}O_{2peak}$ and Hb seem to improve during the first year after transplantation. The reduced aerobic capacity of KTRs was associated with slower $\dot{V}O_2$ -kinetics, which seem to be less affected by the oxygen transport. These findings suggest that an impaired oxidative muscle metabolism could be a peripheral limiting factor contributing to decreased exercise capacity in KTRs.

- 1157** Board #6 May 30 9:30 AM - 11:30 AM
The Effect of Passive Stretch on Vascular Control during Exercise
 Lillie M. Huckaby, Andrew M. Alexander, Kaylin D. Didier, Shane M. Hammer, Camryn N. Webster, Thomas J. Barstow, FACSM. Kansas State University, Manhattan, KS.
 (No relevant relationships reported)

It has been demonstrated that daily stretching leads to an increase in blood flow to the skeletal muscle during exercise in rats; however, little is known about the effects of daily muscle stretching on adaptations of muscle blood flow in humans. **Purpose:** Therefore, the purpose of this study was to investigate the effect of passive stretch on vascular control (VC) during exercise. We tested the hypothesis that acute static stretch would not elicit changes in deoxygenated or total heme (deoxy-[heme], total-[heme] respectively) during exercise. Furthermore, we hypothesized that chronic stretch would elicit a decrease in oxygen extraction (deoxy-[heme]) through an increase in blood volume (total-[heme]). **Methods:** 4 healthy males (24.8 ± 3.6 yr, 179 ± 2.2 cm, 92.1 ± 7.8 kg) completed a controlled passive stretch of the plantar flexors. 2 subjects completed 2 days of a 30 min stretching protocol, while the other 2 subjects completed 2 days of a 10 min stretching protocol. Following the first two days of stretching, all subjects completed a moderate intensity (40% P_{peak}) plantar flexion constant load test to determine acute effects of stretching on VC. All subjects then continued with the 10 min stretching protocol for the remaining 5 days, resulting in 7 consecutive days of stretch. Following the 7th day of stretch, subjects completed another moderate intensity (40% P_{peak}) constant load test to determine the chronic effects of stretching on VC. Near-infrared spectroscopy was used to continuously measure deoxy-[heme] and total-[heme] during exercise. **Results:** Although no statistical differences were found, the 2 subjects who had completed the 30 min acute stretching protocol showed a marked decrease in deoxy-[heme] following acute stretching (5.13 ± 2.98μM to 1.40 ± 1.83μM), however no differences were observed in the 2 subjects who completed the 10 min acute stretching protocol. Following exercise in both the acute and chronic stretch protocols, no differences were observed in total-[heme]. **Conclusions:** The observed decrease in deoxy-[heme] lead us to believe that an acute static stretch of 30 minutes improves VC through better matching in the oxygen perfusion to extraction ratio during exercise. This VC enhancement was lost with chronic stretch, which could have been due to an insufficient stimulus on the microvasculature.

- 1158** Board #7 May 30 9:30 AM - 11:30 AM
Oxygen Utilization During The Contraction-relaxation Of Isometric Knee Extension Exercise
 Camryn N. Webster, Shane M. Hammer, Andrew M. Alexander, Kaylin D. Didier, Lillie M. Huckaby, Thomas J. Barstow, FACSM. *Kansas State University, Manhattan, KS.*
(No relevant relationships reported)

PURPOSE: Sufficiently high intramuscular pressures during contraction can lead to increased resistance to perfusive oxygen delivery and therefore increased fractional oxygen extraction in order to maintain muscle VO_2 . Near-infrared spectroscopy (NIRS) has been used to estimate fractional oxygen extraction via deoxygenated heme concentrations (deoxy-[heme]) and changes in microvascular hematocrit via changes in total heme concentrations (total-[heme]). We tested the hypotheses that during severe and extreme intensities 1) deoxy-[heme] would decrease during contraction compared to relaxation and 2) total-[heme] would be unchanged during the contraction-relaxation cycle.

METHODS: Four subjects (2 men, 24.0 ± 3.7 yrs, 81.9 ± 27.4 kg, 168.9 ± 10.2 cm) completed two isometric knee extension tests to failure at 40% (severe) and 70% (extreme) MVC. NIRS was placed on the right vastus lateralis to continuously measure deoxy-[heme] and total-[heme] during relaxation and contraction. Deoxy-[heme] and total-[heme] were averaged during the final 5 contraction-relaxation cycles and compared using paired t-tests.

RESULTS: Average deoxy-[heme] during contraction and relaxation at 40% was 44.8 ± 31.8 μM and 44.4 ± 31.6 μM , respectively. Average deoxy-[heme] during contraction and relaxation at 70% was 41.9 ± 24.5 μM and 40.1 ± 23.6 μM , respectively. Average total-[heme] during contraction and relaxation at 40% was 127.0 ± 106.4 μM and 124.2 ± 105.2 μM , respectively. Average total-[heme] during contraction and relaxation at 70% was 116.0 ± 89.4 μM and 115.0 ± 90.5 μM , respectively. Although statistical significance was not detected ($p=0.06$), all four subjects demonstrated an increase in deoxy-[heme] at 70% MVC, but not at 40%.

CONCLUSIONS: These data suggest that the contraction-relaxation cycle may result in fluctuations in fractional oxygen extraction during extreme but not severe isometric exercise. Furthermore, the contraction-relaxation cycle does not appear to alter microvascular hematocrit.

C-09 Thematic Poster - Taking Steps to Improve Walking and Walkability

Thursday, May 30, 2019, 9:30 AM - 11:30 AM
 Room: CC-102B

- 1159** Chair: Susan A. Carlson. *CDC / Division of Nutrition, Physical Activity, and Obesity, Atlanta, GA.*
(No relevant relationships reported)

- 1160** Board #1 May 30 9:30 AM - 11:30 AM
Step It Up! Prioritizing Community Supports for Walking in the United States
 Eric T. Hyde, John D. Omura, Kathleen B. Watson, Janet E. Fulton, FACSM, Susan A. Carlson. *Centers for Disease Control and Prevention, Atlanta, GA.* (Sponsor: Janet E. Fulton, FACSM)
 Email: mme7@cdc.gov
(No relevant relationships reported)

PURPOSE: *Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities* (Call to Action) calls on Americans to be physically active and for the nation to better support walking and walkability. The Call to Action presents five goals, along with related strategies and actions, to support walkability in the U.S. Our study assessed U.S. adults' perceived presence and prioritization of four community supports for walking related to the goals of the Call to Action.

METHODS: Data from a nationwide sample of U.S. adults who completed the 2016 *SummerStyles* survey were analyzed ($N = 4,043$). Participants were asked to identify which of the following four supports that encourage residents to walk were present in their community: walking groups, safe streets, access to walkable locations, and promotional campaigns. Participants were also asked which of these supports should be of highest priority for their community to encourage walking. We calculated prevalence of the presence and prioritization of supports overall and by demographic factors. Adjusted logistic regression analyses were conducted to examine the association between presence and prioritization of each support.

RESULTS: Overall, 46.5% of adults reported access to walkable locations, 29.2% reported safe streets, 12.9% reported walking groups, and 9.6% reported promotional

campaigns. The prevalence of these supports varied by sex, age, education, income level, and physical activity level. Access to walkable locations and safe streets were the two supports most often reported together (13.6%). Access to walkable locations (60.0%) and safe streets (50.6%) were most often selected as highest priority for communities, followed by promotional campaigns (23.6%) and walking groups (18.8%). For all supports, positive associations were observed between having the support and rating it as highest priority (range of adjusted prevalence ratios: 1.57-2.53).

CONCLUSIONS: The most commonly reported community supports for walking in the U.S. are access to walkable locations and safe streets. In addition, these two supports are most often selected as the highest priorities to encourage walking in communities. Establishing community supports for walking and improving resident awareness of them may help promote walking among U.S. adults.

- 1161** Board #2 May 30 9:30 AM - 11:30 AM
Do Older Adults Achieve Moderate Intensity When Walking At Their Self-selected Pace?
 Scott W. Ducharme¹, Elroy J. Aguiar¹, Aston K. McCullough¹, Christopher C. Moore¹, Colleen J. Sands¹, Marcos A. Amalbert-Birriel¹, Zachary R. Gould¹, John M. Schuna, Jr², Tiago V. Barreira³, Stuart R. Chipkin¹, Catrine Tudor-Locke, FACSM¹.
¹University of Massachusetts, Amherst, Amherst, MA. ²Oregon State University, Corvallis, OR. ³Syracuse University, Syracuse, NY (Sponsor: Catrine Tudor-Locke, FACSM)
(No relevant relationships reported)

Walking at a cadence of ≥ 100 steps/min consistently corresponds to minimally moderate intensity physical activity (PA). While current PA guidelines emphasize the importance of PA intensity for positive health outcomes, most young adults already naturally walk at cadences ≥ 100 steps/min. It is unknown whether older adults select these same cadences and intensities when they freely select their walking pace.

PURPOSE: To determine cadence and intensity of self-paced walking in older adults, and to evaluate the accuracy of using ≥ 100 steps/min to indicate moderate intensity in this population. **METHODS:** Twenty-six healthy, ambulatory older adults (10M, 16W; mean \pm SD; age = 68.3 ± 4.8 years; height = 1.67 ± 0.08 m; mass = 73.4 ± 12.3 kg) walked continuously for 5 min at their self-selected pace back and forth along a 13m pathway that included a 7m gait mat. Oxygen uptake (VO_2 ; mL/kg/min) was determined using indirect calorimetry and converted to absolutely-defined metabolic equivalents (METs; $\text{VO}_2/3.5$). Average cadence was quantified using the gait mat. Prevalence of cadences ≥ 100 and METs ≥ 3 was calculated as the number of participants above the respective thresholds divided by total participants ($n=26$). Classification Accuracy (ACC; true positive + true negative / total participants) determined the accuracy of ≥ 100 steps/min indicating ≥ 3 METs. **RESULTS:** The majority of participants (23/26, 83.3%) walked at a cadence ≥ 100 steps/min (cadence = 113 ± 9 steps/min), and many (20/26, 76.9%) achieved moderate intensity (METs = 3.43 ± 0.59). A cadence of ≥ 100 steps/min was a strong indicator of moderate intensity during self-paced walking (i.e., ≥ 3 to < 6 METs, ACC = 80.8%). **CONCLUSION:** Most healthy older adults attain at least moderate metabolic intensity during self-paced walking. These findings further suggest that "going for a walk" can be recommended, even in the absence of specific PA intensity guidelines. However, these results are preliminary and include only healthy, ambulatory, and relatively young (i.e., only one participant >75 years old) older adults. Future studies should continue to explore self-paced walking in a more representative sample of older adults, and include more of the oldest adults (i.e., >75 years), or those with disease or ambulatory limitations. **FUNDING:** NIH-NIA-5R01AG049024

- 1162** Board #3 May 30 9:30 AM - 11:30 AM
Association between the National Walkability Index and Walking Among U.S. Adults
 Kathleen B. Watson¹, Geoffrey P. Whitfield¹, John V. Thomas², David Berrigan³, Janet E. Fulton, FACSM¹, Susan A. Carlson¹.
¹Centers for Disease Control and Prevention, Atlanta, GA.
²Environmental Protection Agency, Washington D.C., DC.
³National Cancer Institute, Washington D.C., DC. (Sponsor: Janet E. Fulton, FACSM)
 Email: iyr4@cdc.gov
(No relevant relationships reported)

Step It Up! The Surgeon General's Call to Action to Promote Walking and Walkable Communities calls on Americans to work together to increase walking and improve walkability. No universal tool exists to measure community walkability; therefore, the Environmental Protection Agency created the National Walkability Index (NWI), a measure based on environmental features that affect the likelihood of whether people will walk as a mode of transportation. It is unknown, however, how strongly NWI is associated with transportation and leisure walking.

PURPOSE: To describe the association between the NWI and transportation and leisure walking among U.S. adults.

METHODS

We used data from the 2015 Cancer Control Supplement of the National Health Interview Survey (NHIS) to assess adults' past week participation in transportation and leisure walking for ≥ 10 minutes ($n=33,672$). NWI scores were linked to HIS data based on the block group of the respondent's residence. NWI scores were categorized into national level quartiles. Logistic regression analyses were used to describe the association between NWI quartiles and transportation and leisure walking.

RESULTS

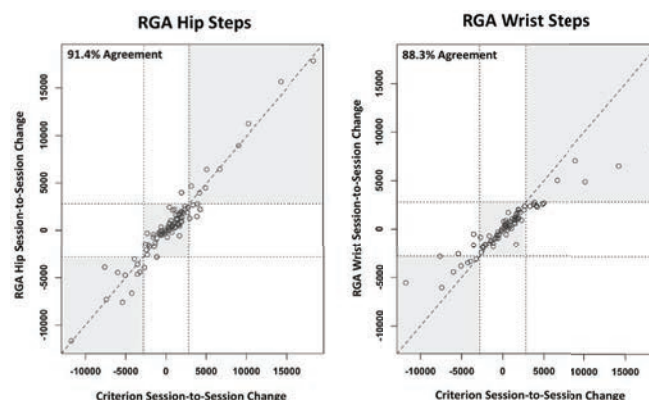
NWI quartiles exhibited significant linear and quadratic trends ($p<0.05$) with transportation walking and a significant linear trend ($p<0.05$) with leisure walking. Prevalence of transportation walking increased 23 percentage points and leisure walking increased 5 percentage points from least to most walkable communities (see Table).

Table. Prevalence of walking, adjusted for selected characteristics ¹ , by National Walkability Index quartiles ²				
	National Walkability Index (NWI)			
	Least walkable	Below average walkable	Above average walkable	Most walkable
NWI range	(1.00-5.75)	(>5.75-10.50)	(>10.50-15.25)	(>15.25-20.00)
Transportation walking (% , 95% CI)	24.5 (22.7, 26.5)	27.7 (26.4, 29.0)	38.0 (36.2, 39.9)	47.7 (44.6, 50.7)
Leisure walking (% , 95% CI)	49.5 (47.2, 51.9)	52.5 (51.1, 53.9)	52.3 (50.6, 54.0)	54.9 (52.3, 57.4)

¹Prevalence adjusted for sex, age, race/ethnicity, education, region, and rural/urban status
²NWI encompasses density, land use mix, and proximity to transit

CONCLUSIONS

NWI is a free and publicly available standardized tool to measure community walkability. Our findings suggest NWI is positively associated with transportation and leisure walking, although, the association was stronger for transportation walking. These findings may be useful to researchers and to public health, transportation, and planning professionals and other relevant stakeholders, as they promote transportation-related walking and walkability in communities.



CONCLUSIONS: These data show that RGA's worn on the wrist and hip are sensitive in detecting change in steps in free living settings and both detect changes in steps in free-living settings. This device can be employed for interventions designed to increase walking behavior.

Funded by: NIH: F31HL129802

1164

Board #5

May 30 9:30 AM - 11:30 AM

Assessing Walkability By Questionnaires: Construct, Validity, And Reliability

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(No relevant relationships reported)

PURPOSE: To determine the psychometrics of the walkability questionnaires, including their construct, validity, and reliability. **METHODS:** Using keywords "walkability," "measurements," "scales," "NEWS," etc., a comprehensive literature search was conducted, and identified questionnaires were reviewed and analyzed. **RESULTS:** Over 200 research publications were found and 27 questionnaires, including 14 different versions of Neighborhood Environment Walkability Scales (NEWS), focusing mostly on urban settings, were used for the final analysis. Ten key components were found in forming the construct of walkability, including residential density, land use mix-density, land use mix-access, street connectivity, walking/cycling facilities, aesthetics. Furthermore, 209 subcomponents were nested within the key components; e.g., "Residential Density" is consist of subcomponents of detached single-family residences, townhouses, apartments with different floors and so on. For validity, about 80% of questionnaires have reported it. The most used validation method (about 70%) was the "contracted groups", in which various levels of walkability and conditions neighborhoods were compared, with an effect size ranging from -0.65 to 3.81, followed by the correlational (with objective environmental attributes) approach (20%), with the validity coefficients ranging from 0.45 to 0.87. Finally, intra-rater/test-retest reliability was often (about 75%) computed for the reliability of the questionnaire, with a range from 0.25 to 0.99. **CONCLUSION:** A set of questionnaires with sound psychometric quality has been developed to assess the walkability in urban settings and more tools to evaluate walkability in a small community, rural settings are urgently needed.

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Board #6

May 30 9:30 AM - 11:30 AM

The Effect of Environmental Changes on Hospital Employee Walking Duration

Ryan Doyel, Joseph Dadabo, Prakash Jayabalan. *Northwestern University Feinberg School of Medicine / Shirley Ryan AbilityLab, Chicago, IL.*

(No relevant relationships reported)

Purpose

Employee health is known to be associated with work-related physical exertion. The objectives of this study were to assess the effect on employee daily steps taken by transitioning a free-standing rehabilitation hospital to a larger facility and to compare step count differences across age, sex, and occupations.

Methods

Data from personal fitness devices linked to an employer-sponsored wellness program assessed the number of steps taken in two specific months (July and November) in the year prior to and in the year following the move to a rehabilitation facility three-times

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Board #4

May 30 9:30 AM - 11:30 AM

A Research-grade Accelerometer Is Sensitive In Detecting Step Changes In Free-living Settings

Albert R. Mendoza¹, John Staudenmayer², Patty S. Freedson, FACSM². ¹California State University, East Bay, Hayward, CA.

²University of Massachusetts-Amherst, Amherst, MA. (Sponsor: Patty S. Freedson, FACSM)

(No relevant relationships reported)

Research-grade wearable accelerometers (RGA) are valuable tools to monitor steps. Despite the broad appeal of such devices, there is limited evidence as to how well RGA detect change in steps in free-living settings. **PURPOSE:** To determine the sensitivity of RGA in detecting change in steps compared to changes in directly observed steps (criterion) in free-living settings.

METHODS: Thirty-two participants were directly observed and video-recorded on three separate days for 2-hours each day in free-living settings. Participants wore commonly used hip- and wrist-worn RGA's. Criterion steps were assessed using a validated direct observation (DO) method applied to the video recordings. Session-to-session step differences (session 1 - session 2, session 2 - session 3, session 1 - session 3) were calculated. Linear-mixed models were used to determine within-subject standard deviation of criterion measured session-to-session changes in steps and to identify significant changes in steps (greater than ± 1 SD of within-subject SD). DO classified pairs of sessions for each participant based on whether steps changed (i.e., greater than ± 1 SD of within-subject SD). The same classification method was applied to the RGA's and percent agreement between the two methods was then calculated.

RESULTS:

the size of the original. Participant data were only included for those enrolled in the program in these specific months pre- and post-move. Daily step counts accounted for activity both during and outside of work.

Results

Participants ($n=70$) had significantly less average daily steps for both July (9708 steps vs. 8008 $p=0.02$) and November (8839 vs. 7779 $p=0.006$) following the move to the new rehabilitation facility. Groups with significant step reduction included women compared to men ($p=0.03$), those aged 21-35 years ($p=0.03$), and the occupations of health care assistants (HCAs) and nursing ($p=0.01$), for both months. However, medical providers (physicians and nurse practitioners) had a trend towards increased step counts, regardless of age group or sex.

Conclusion

Transitioning a rehabilitation facility to a larger building does not necessarily lead to increased employee work-related physical activity. In our study, the transition to a larger facility was associated with a reduction in employee daily steps taken with relation to age, gender, and occupation. These findings may reflect strategic planning within the new workspace, which optimizes efficiency specifically for nurses and HCAs, allowing occupational duties to be confined to a smaller area. This could lead to employees having less daily work-related physical exertion, although this will be investigated further in future studies.

1166 Board #7 May 30 9:30 AM - 11:30 AM Perceived Neighbourhood Walkability and Different Types of Physical Activity in Canadian Men and Women

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(No relevant relationships reported)

Purpose:

Few Canadian studies have examined whether associations between neighbourhood walkability and physical activity differ by gender. We estimated associations between perceived neighbourhood walkability and physical activity among urban Canadian men and women.

Methods:

This study included cross-sectional survey data from the 'Alberta's Tomorrow Project' (2008; $n=9101$), in which the International Physical Activity Questionnaire captured weekly physical activity and the Neighbourhood Environment Walkability Scale abbreviated version (NEWS-A) captured self-reported neighbourhood characteristics. NEWS-A subscale scores were standardized and overall walkability scores computed. Sociodemographic characteristics were also captured. Covariate-adjusted generalized linear models estimated the associations between physical activity participation and minutes (transportation walking: TW, recreational walking: RW, moderate-intensity: MPA, and vigorous-intensity: VPA) and walkability scores. Odds ratios (ORs) were estimated for participation and beta coefficients (Bs) were estimated for minutes of physical activity, with 95% confidence intervals (95CIs).

Results:

Overall walkability was positively associated with participation in TW (OR 1.05; 95CI 1.04, 1.06), RW (OR 1.02; 95CI 1.01, 1.03), MVPA (OR 1.02; 95CI 1.01, 1.03) and VPA (OR 1.02; 95CI 1.01, 1.03) and minutes of TW (B 1.14; 95CI 0.59, 1.69). In men, positive associations were found between lack of parking and MPA participation (OR 1.14; 95CI 1.06, 1.23) and residential density and TW minutes (B 8.31; 95CI 2.85, 13.78). In women, RW participation was associated with land use mix diversity (OR 1.11; 95CI 1.04, 1.17) and infrastructure and safety for walking (OR 1.15; 95CI 1.09, 1.21) and MPA participation associated with traffic safety (OR 0.91; 95CI 0.86, 0.96). Notably, residential density was negatively associated with RW minutes among women only (B -3.69; 95CI -6.62, -0.76).

Conclusions:

Neighbourhood walkability is associated with participation and time spent in different physical activities for men and women. Modifying perceptions, possibly via improving neighbourhood urban design, has the potential to increase physical activity in Canadian adults.

1167 Board #8 May 30 9:30 AM - 11:30 AM US Vision Zero Plans: Opportunity to Support Safer Walking and Bicycling

Kelly R. Evenson, FACSM¹, Carmen C. Cuthbertson¹, Rebecca B. Naumann¹, Samantha Schilsky¹, Camden Spade¹, Seth LaJeunesse². ¹UNC-Chapel Hill, Chapel Hill, NC. ²Highway Safety Research Center, Chapel Hill, NC.

(No relevant relationships reported)

Vision Zero is defined by a systems perspective to equitably reduce fatalities and serious injuries from road traffic crashes to zero. Recently, United States' (US) cities

began developing Vision Zero plans to address safety for all road users, including pedestrians/bicyclists. **PURPOSE:** We described the content of these plans to identify areas for improvement and facilitate creation of new plans. **METHODS:** We identified, collected, and analyzed 14 US Vision Zero plans published from 2014-2017. An extensive quantitative and qualitative coding tool was developed to identify elements of high quality plans. **RESULTS:** In total, 13 municipal and 1 county plan were abstracted. Nine of 14 plans described public participation in plan development, with 6 holding public meetings, 5 using surveys, 5 using map mark-ups, and 1 using social media. Most ($n=13$) plans had a vision statement and included goals/objectives to achieve the vision ($n=12$), but few included timelines to accomplish the goals ($n=3$). The goals to reach zero fatalities/serious injuries targeted the year 2020 ($n=1$), 2025 ($n=3$), 2028 ($n=1$), and 2030 ($n=6$), while 3 plans did not set a target date. All plans described the number of local-area crashes, but only half ($n=7$) reported the crash type, including involvement of a pedestrian/bicyclist. Plans included policy (11 traffic calming, 10 walking/bicycling to school, 9 Complete Streets, 5 no right turn on red), engineering (9 slow zones, 3 shared space for all road users), and educational (12 school education on pedestrian/bicyclist safety, 11 mass media/educational campaign on safety/speeding, 2 crosswalk ambassadors) strategies to address safety of pedestrians/bicyclists. Three of 14 plans proposed funding strategies for their implementation activities. Nine plans mentioned an evaluation plan for measuring progress, but most evaluation descriptions were brief. **CONCLUSION:** The assessment of US Vision Zero plans indicates that improvements could be made by involving the public more deliberately in plan development, including a clearer vision statement with connection to a target goal date and evaluation plan, and identifying funding sources for implementation activities. A number of target strategies could improve safety for pedestrians/bicyclists and should eventually be evaluated for their impacts.

C-10 Thematic Poster - The Spine and Spinal Cord Injury

Thursday, May 30, 2019, 9:30 AM - 11:30 AM
Room: CC-104B

1168 Chair: Joshua F. Yarrow. VA Medical Center, Gainesville, FL.

(No relevant relationships reported)

1169 Board #1 May 30 9:30 AM - 11:30 AM Neuromuscular Impairment Following Chronic Moderate-Severe Contusion in Spinal Cord Injured Rats

Hui Jean Kok¹, Jacob C. Oster², Christine F. Conover³, Drew B. Fletcher², Elisabeth R. Barton², Joshua F. Yarrow¹. ¹University of Florida; North Florida/South Georgia Veterans Health System, Gainesville, FL. ²University of Florida, Gainesville, FL. ³North Florida/South Georgia Veterans Health System, Gainesville, FL.
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(No relevant relationships reported)

Muscle atrophy and neuromuscular impairment are consequences of spinal cord injury (SCI) that impede quality of life and functional recovery.

PURPOSE: To examine time course changes in muscle fiber type distribution, fiber cross-sectional area (fCSA), and other histologic characteristics of muscle pathology occurring in rats in response to moderate-severe contusion SCI.

METHODS: Twenty-four 4-month old male Sprague-Dawley rats received SHAM surgery or T9 laminectomy plus moderate-severe (250 kilodyne) contusion SCI by a computer-guided impactor. Body weight and Basso-Beattie-Bresnahan (BBB) hindlimb locomotor rating scores were measured weekly. Animals were euthanized and soleus were harvested at 2-weeks, 1-month, 2-months, or 3-months post-surgery. Soleus fiber-type distribution, fCSA, and muscle-nerve bundle morphology were assessed by immunofluorescent staining, imaged using an epifluorescent microscope, and quantified with semi-automatic muscle analysis using segmentation of histology (SMASH).

RESULTS: At 1-week post-surgery, SCI animals exhibited near-complete hindlimb paralysis (indicated by BBB scores <3), with minimal improvement in voluntary hindlimb locomotor function thereafter. Body weight, soleus mass, and median fCSA were significantly lower in SCI vs SHAM animals ($p<0.01$ at all timepoints). A slow-to-fast fiber-type shift was observed in SCI animals, with a progressive ~20% decrease in the number of type I fibers, ~8% increase in type IIa fibers, and ~5% increase in hybrid type I/IIa fibers at each consecutive timepoint, along with the emergence of unstained type IIx/b muscle fibers (~30% of total) at 3-months. In addition, muscle fiber splitting was present in SCI animals at 2-months, as well as reduced

neurofilament staining in SCI muscle-nerve bundles. Furthermore, evidence of growth related remodeling occurred in SHAM muscles from increased centrally nucleated fibers across timepoints but not in SCI.

CONCLUSION: Deterioration in motor ability accompanying SCI produced muscle atrophy and progressive impairments in muscle oxidative capacity that may have resulted from repetitive denervation-reinnervation cycles. These factors may have contributed to muscle pathology resulting in limited capacity for muscle growth and remodeling.

1170 Board #2 May 30 9:30 AM - 11:30 AM
Does Reduced Blood Flow Affect the Rate of Muscle Loss in Rats Post Spinal Cord Injury

Michael C. Reynolds, Christine F. Conover, Dana M. Otzel, Russell D. Wnek, Kinley H. Buckley, Micah Flores, Ean G. Phillips, Darren T. Beck, Danielle McCullough, Joshua F. Yarrow. *North Florida/South Georgia Veterans Healthcare System, Gainesville, FL.*

(No relevant relationships reported)

Muscle atrophy is a major sequela occurring after spinal cord injury (SCI) that results from disuse. Additionally, other secondary complications of SCI (e.g., alterations in muscle blood flow) may contribute to muscle loss. **PURPOSE:** To determine the time course of muscle blood flow changes in relation to muscle atrophy in a rodent severe contusion SCI model. **METHODS:** Sixty-three 4-months-old (skeletal-mature) male Sprague-Dawley rats received SHAM surgery (T9 laminectomy) or severe (250 kdynes) contusion SCI using a computer-guided impactor. At 1-, 2-, and 4-weeks (wk) post-surgery, an intravenous catheter was implanted into the tail vein of SHAM and SCI animals. Colored microspheres (15µm diameter) were then infused into the circulation, allowing for the measurement of regional blood flow (ml/min/g tissue mass). Subsequently, the animals were euthanized and the mass of the dissected right and left soleus, gastrocnemius, and plantaris were taken. Concentrations of the colored microspheres within each muscle were determined via spectrophotometry, following chemical digestion of the muscle. Muscle blood flow calculations were then averaged across the contralateral hindlimbs for the aforementioned muscles. SCI vs SHAM comparisons were made at each time point using independent samples t-tests and Pearson's correlation coefficients. **RESULTS:** SCI animals exhibited 23-41% lower soleus mass, 17-27% lower gastrocnemius mass, and 16-29% lower plantaris mass vs SHAM, at all time points ($p < 0.001$). Soleus and gastrocnemius blood flow (corrected for tissue mass, ml/min/g) was 51% lower ($p < 0.001$) and 25% lower ($p < 0.05$) after SCI, respectively, at 1-wk only. Additionally, a positive relationship between soleus mass and blood flow (corrected for mass) was identified at 1-wk ($r = 0.687$, $p < 0.01$). No significant alterations in plantaris blood flow were identified at any time point. **CONCLUSION:** Hindlimb muscle atrophy and reduced muscle blood flow occurred within 1-wk of severe contusion SCI. Thereafter, muscle blood renormalized in comparison with SHAM animals. Further research is needed to determine whether the reductions in muscle blood flow occurring after SCI contribute to muscle loss and/or whether prevention of blood flow deficits preserves muscle mass.

1171 Board #3 May 30 9:30 AM - 11:30 AM
Effects of Activity-Based Rehabilitation on Cancellous Bone Loss Following Contusion Spinal Cord Injury in Rats

Russell D. Wnek, Christine F. Conover, Dana M. Otzel, Michael C. Reynolds, Kinley H. Buckley, Micah Flores, Ean G. Phillips, Joshua F. Yarrow. *North Florida/South Georgia Veterans Health System, Gainesville, FL.*
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(No relevant relationships reported)

Severe cancellous bone loss occurs after spinal cord injury (SCI), which increases fracture risk. Bodyweight-supported treadmill training (TM) and passive Cycle training are activity-based rehabilitation therapies that improve neuromuscular plasticity after SCI. However, the skeletal adaptations to these therapies remain unknown.

PURPOSE: Determine whether TM or Cycle training alter the rate of cancellous bone loss in a rodent severe contusion SCI model. **METHODS:** 16-wk old male Sprague-Dawley rats received: 1) SHAM surgery (T9 laminectomy) (n=9), 2) T9 laminectomy plus severe contusion SCI (n=8), 3) SCI+TM (n=14), or 4) SCI+Cycle (n=7). TM and Cycle were initiated 1-wk post-SCI and consisted of two 20 min bouts/day for 3 wks. For TM, 40% bodyweight support was provided and the paralyzed hindlimbs were manually positioned into plantar stepping (3.5 m/min, increasing 0.1 m/min/day). For Cycle, the paralyzed hindlimbs were secured to pedals on a motor-driven bike and moved passively through a cycling motion that mimicked normal gait patterning (12 rotations/min). Distal femur cancellous bone was quantified before surgery (baseline), and at 2- and 4-wk post-surgery via *in vivo* microCT. Outcomes are reported as percent change from baseline. **RESULTS:** Across all groups, cancellous bone volume (cBV/TV) was reduced 52-75% at 2-wk and 54-84% at 4-wk, compared with baseline ($p < 0.01$). cBV/TV loss was 22% greater in SCI at 2-wk and 29% greater at 4-wk vs

SHAM ($p < 0.01$), characterized by 28% lower trabecular number (Tb.N) and 90% higher trabecular separation (Tb.Sp) ($p < 0.01$) and a higher trabecular pattern factor (Tb.Pf) ($p < 0.05$) that indicates a less connected trabecular network. At 2-wk, neither TM nor Cycle prevented SCI-induced bone deficits. However, at 4-wk SCI+Cycle displayed 25-30% higher cBV/TV, 23-24% higher trabecular thickness (Tb.Th), 17-22% higher Tb.N, and lower Tb.Pf vs SCI and SCI+TM ($p < 0.01$). Ultimately, no differences in cancellous bone outcomes were present between SCI+Cycle and SHAM at 4-wk, except for 16% higher Tb.Th in SCI+Cycle ($p < 0.01$). **CONCLUSION:** Our data indicate Cycle better attenuated cancellous bone loss in rodents after severe SCI. The higher cBV/TV and Tb.Th in SCI+Cycle at 4-wk also suggests that this modality stimulated bone formation; although, further investigation is needed.

1172 Board #4 May 30 9:30 AM - 11:30 AM
Trabecular Bone Integrity at the Proximal Tibia Following a Contusion Spinal Cord Injury in Rats

Aaron S. Gomez, Christine F. Conover, Ean G. Phillips, Taylor E. Bassett, Micah Flores, Russell D. Wnek, Joshua F. Yarrow. *Malcom Randall VA Medical Center, Gainesville, FL.*

(No relevant relationships reported)

Bone loss following spinal cord injury (SCI) is a major contributor to bone fracture risk, particularly at the proximal tibia. **PURPOSE:** To determine longitudinal changes in trabecular bone integrity at the proximal tibia in a rodent contusion SCI model. **METHODS:** 16-week old male Sprague-Dawley rats (n = 28) were randomized to receive no surgery (Non-Surgical Controls), T9 laminectomy (SHAM), or T9 laminectomy plus severe (250 kdynes) contusion SCI using a computer-guided impactor and were euthanized 2- or 4-weeks (w) post-surgery. Hindlimb locomotion was assessed weekly using the BBB locomotor scale and trabecular bone integrity at the proximal tibia was assessed weekly using *in vivo* microCT. Comparisons were made using one-way ANOVAs and post-hoc analyses were done when appropriate. **RESULTS:** SCI animals exhibited significant losses in hindlimb locomotor function [BBB score < 6 (0-21 scale); $p < 0.01$ vs SHAM at all time points]. Percent cancellous bone volume (cBV/TV) was 32% lower at 2-w and 42% lower at 4-w in SCI vs SHAM animals ($p < 0.01$). This bone loss was exemplified by progressively lower trabecular thickness (Tb.Th) and trabecular number (Tb.N) at 2- and 4-w ($p < 0.01$) and higher trabecular separation (Tb.Sp) ($p < 0.01$ at 4-w only). No differences in trabecular pattern factor (Tb.Pf), an inverse indicator of trabecular network connectedness, were present at 1-w. However, Tb.Pf was higher at 2- and 4-w in SCI vs SHAM ($p < 0.01$). Structure model index (SMI) was higher at 2- and 4-w in SCI vs SHAM ($p < 0.01$), indicating transition from rod- to plate-shaped trabecular spicules. Similarly, in SCI animals, cBV/TV was 48-75% lower, Tb.Th was 15-27% lower, Tb.N was 36-62% lower across the 4-w period in comparison with Non-Surgical Controls ($p < 0.01$ for all), while Tb.Sp was progressively higher in SCI animals ($p < 0.05$ for 2- and 4-w). Higher Tb.Pf and SMI were also found in SCI vs Non-Surgical Controls at all timepoints ($p < 0.05$). Only cBV/TV was lower in SHAM vs Non-Surgical Controls across the 4-w period ($p < 0.01$). **CONCLUSION:** Our findings indicate that trabecular bone integrity at the proximal tibia was significantly impaired in rats following a severe contusion SCI due to both bone loss and diminished bone quality. As such, our rodent model may be useful to examine effectiveness of strategies intended to prevent SCI-induced bone loss.

1173 Board #5 May 30 9:30 AM - 11:30 AM
Testosterone and Resistance Training Improves Muscle Quality Following Spinal Cord Injury

Matthew E. Holman, Ashraf S. Gorgey, FACSM. *Hunter Holmes McGuire VA Medical Center, Richmond, VA.* (Sponsor: Ashraf S. Gorgey, FACSM)

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(No relevant relationships reported)

Spinal cord injury (SCI) adversely effects muscle quality and testosterone levels. Following SCI, resistance training (RT) has been shown to increase muscle cross-sectional area (CSA). Testosterone replacement therapy (TRT) in other populations has also been shown to improve muscle quality. **PURPOSE:** To examine if the combination of RT and TRT (TRT+RT) can maximize the beneficial effects to muscle quality following SCI. **METHODS:** Twenty-two SCI subjects were randomized into two intervention groups for 16-weeks: TRT+RT (n = 11), or TRT (n = 11). Muscle quality was assessed by measuring peak torque at speeds of 0, 60, 90, and 180°/sec (PT-0°, PT-60°, PT-90°, PT-180°), knee extensor CSA (KE-CSA), specific tension (ST), and contractile speeds (rise time [RTi], and half-time to relaxation [$\frac{1}{2}$ TiR]) for each limb prior to testing and following the intervention. 2x2 mixed models with subject identifiers added as random effects and post-hoc Tukey-Kramer HSD tests identified pairwise differences within interactions ($P < 0.05$). **RESULTS:** Following the intervention period, participants in the TRT+RT group increased PT-0° (48.4%, $P = 0.017$), KE-CSA (30.8%, $P < 0.001$), ST (8%, NS), and RTi (17.7%, $P = 0.012$). PT-0° decreased (17%, NS), KE-CSA slightly increased (10%, NS), ST decreased (20%, NS), and RTi also slightly decreased (9%, NS) in the TRT group. Changes to

PT-60°, PT-90°, PT-180°, and ½TiR for each group were similar following the 16-week intervention. **CONCLUSION:** Mechanical stress induced via RT combined with TRT maximizes enhancements of muscle quality when compared to TRT interventions alone in men with complete SCI. Our study shows that TRT+RT increases both muscle size, strength, and also improves muscle contractile properties.

1174 Board #6 May 30 9:30 AM - 11:30 AM
Intervertebral Disc And Vertebral Health In Long-term Runners

Ulrike H. Mitchell, Robert E. Larson, Jennifer A. Bowden, Bruce Bailey. *Brigham Young University, Provo, UT.* (Sponsor: Allen Parcell, FACSM)
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(No relevant relationships reported)

Intervertebral disc (IVD) and bone health is strongly associated with nutrient flow and loading. Running places repeated substantial axial forces on the lower back, which likely influence its tissue health. Two theories exist: 1) cyclic loading is correlated to improved IVD and vertebral health parameters, because it brings about hypertrophic changes that make the tissue stronger, and 2) mechanical overload produces localized trauma and tissue damage, which outpaces the tissue's ability to repair itself and leads to accelerated degradation. Both theories are based on sound research, but the implications contradict. **PURPOSE:** To determine if long-term runners exhibit different IVD and bone health parameters compared to matched sedentary controls. **METHODS:** 10 male runners with an average of 25 year history of running (average 84km/week) and 5 age and sex-matched sedentary controls received Magnetic Resonance Imaging (MRI) and DXA scans. MRI T1 and T2 imaging techniques were used to obtain morphological characteristics, including the level of disc degeneration (Pfirrmann grading system). Diffusion-weighted imaging was used to calculate the apparent diffusion coefficient (ADC), which represents a mean estimate of water diffusion. The DXA scan was used to obtain bone mineral density (BMD) of the lumbar spine and femoral neck. **RESULTS:** The groups were not different in age, height or weight, but in BMI ($p=0.03$) and total fat mass ($p=0.005$). On average the sedentary controls demonstrated significantly greater L5 vertebral heights ($p=0.009$). The runners exhibited greater L5/S1 mid-IVD height ($p=0.03$) and less disc degeneration, but this difference was not significant. There was no difference in ADC. There was no difference in BMD. There was no difference in Z-scores, but on average the runners' Z-score was below 0 in the lower spine and above 0 in the femoral neck, while this was reversed in the sedentary subjects. **CONCLUSIONS:** This small sample seems to indicate that long term running is correlated with better IVD morphology, but smaller lumbar vertebral height. Running is not correlated with significantly higher BMD. The latter might change with an increased subject number, as all the runners' BMD numbers are consistently higher in respect to femoral neck and shaft and consistently lower in respect to L1-L4 vertebrae.

1175 Board #7 May 30 9:30 AM - 11:30 AM
Thorax and Spine Abnormalities in Health Sciences Students

Sergio Márquez-Gamiño, Karla S. Vera-Delgado, Cipriana Caudillo-Cisneros, Fernando Sotelo-Barroso, Montserrat G. Vera-Delgado. *Universidad de Guanajuato, León, Mexico.*
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(No relevant relationships reported)

PURPOSE: To evaluate trunk and thorax alterations prevalence in health sciences students.

METHODS: 293 recently admitted students to the Health Sciences Division of the University of Guanajuato, in Central Mexico, were clinically assessed for scapular girdle, spine alignment and thorax deformities.

RESULTS: In 208 women, and 85 men no previous diagnostic, symptomatology nor orthosis use were detected. Two of the participants had thorax asymmetry, corresponding to 0.7%. By contrast, 14.0% (41) presented dorsal hump. Also, the scapular girdle exhibited higher alterations indexes. For example, the shoulder blades were asymmetric in 19.5 (57) and 3.1% (9) for the right and left sides, respectively. Shoulders descended occurred in 23.5 (69), 4.4 (13), and 0.7% (2) (right, left, and both, in such order). Lumbar hump was observed in 45 (15.4%) students. No scoliosis was detected.

CONCLUSIONS: The structural problems detected involved the upper body and are quite important due to its implications for low back pain development. In fact, they can progressively evolve to cause nerve compression and its derived musculoskeletal conditions (MEC). In their practice, health professionals are exposed to risk behaviors for MEC, between others long standing periods, abnormal postures, patient's mobilization, etc. The information obtained can support new ways to train and physically fit the health sciences students as preventive measures for MEC development.

C-11 Free Communication/Slide - Mental Health, Affect and Pain

Thursday, May 30, 2019, 9:30 AM - 11:30 AM
 Room: CC-306

1176 Chair: Debra A. Stroiney. George Mason University, Fairfax, VA.

(No relevant relationships reported)

1177 May 30 9:30 AM - 9:45 AM
The Effectiveness of Acute Resistance Exercise Training among Young Adults with Analogue Generalized Anxiety Disorder

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(No relevant relationships reported)

Evidence has supported positive effects of acute aerobic exercise and exercise training among adults with analogue and clinical Generalized Anxiety Disorder (GAD). However, the effects of acute resistance exercise (RE) are untested. **Purpose:** This study investigated the effects of acute RE, compared to quiet rest (QR), on worry among young adults with analogue GAD (AGAD) and otherwise healthy young adults (OH). **Methods:** Twenty-three young adults (25.3 ± 4.5 years; 15 female, 8 male) were block randomized by AGAD status (Psychiatric Diagnostic Screening Questionnaire GAD subscale score ≥ 6 , and Penn State Worry Questionnaire (PSWQ) ≥ 45) to acute RE or 30-min QR. RE consisted of two sets of 8-12 repetitions of eight exercises performed at moderate intensity in a laboratory, supervised by a researcher. Appropriate resistance for each exercise was determined following three weekly familiarization sessions prior to the acute RE. Worry was assessed at baseline and pre-post condition with the PSWQ. Two AGAD status X two Condition X two Time RM-ANOVA examined differences between RE and QR. Significant interactions were decomposed with simple effects analysis. Hedges' d effect sizes quantified magnitude of change. Potential moderation by sex, depression status, and sleep quality was also explored. **Results:** As expected, baseline worry was significantly greater among AGAD participants ($p \leq 0.001$). There were no baseline differences between conditions. The three-way interaction for worry was statistically significant ($F_{(1,19)}=18.50$, $p \leq 0.001$). Decomposition of the interaction showed a significant reduction in worry from pre- to post-RE for AGAD (mean difference $=-2.86$, $p \leq 0.04$), and a significant increase in worry from pre- to post-QR for AGAD (mean difference $=4.17$, $p \leq 0.01$). Compared to QR, RE resulted in a large magnitude improvement ($d=0.98$) among AGAD participants. Among OH participants, there were no significant changes in worry in either condition. Worry response to RE was not significantly moderated by sex, depression status, or sleep quality (all $p > 0.05$). **Conclusion:** Preliminary findings support both positive effects of acute RE on worry, the hallmark symptom of GAD, and the need for future investigations of the acute and chronic effects of RE among participants with analogue GAD.

1178 May 30 9:45 AM - 10:00 AM
State Anxiety and Worry Responses to a Single Sprint Before and After Sprint Interval Training

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(No relevant relationships reported)

There has been continued interest in the anxiolytic effects of diverse and non-traditional exercise modes. However, the acute and chronic effects of sprint interval training (SIT) on anxiety and worry are not well known, and the degree to which chronic SIT changes the acute response to a single sprint is untested.

PURPOSE: This study quantified state anxiety and worry responses to a single sprint (Wingate), state anxiety and worry responses to three weeks of SIT, and, the extent to which chronic SIT changed acute responses to a single sprint.

METHODS: Eighteen healthy young adult males (25.2 ± 3.6 y) completed a single 30s Wingate at 7.5% body mass before and after a 3-wk SIT intervention comprised of nine sessions of 4-6 sprints. Acute and chronic effects of SIT on state anxiety, worry, and worry engagement were assessed with the State subscale of the State-Trait Anxiety Inventory and the Penn State Worry Questionnaire, respectively. Paired t -tests quantified pre-training acute responses and training responses (i.e., baseline to post-SIT); magnitude of change was quantified with standardized mean difference (d). RM-ANOVA examined differences between pre-training and post-training acute responses. The magnitude of change in acute responses was quantified with Hedges' d effect sizes.

RESULTS: At pre-training, state anxiety was significantly increased ($t_{17}=-2.34$, $p\leq 0.032$) and worry engagement was significantly decreased ($t_{17}=3.14$, $p\leq 0.006$) following a single sprint. Small-to-moderate magnitude reductions were found for worry engagement ($d=0.37$) and worry ($d=0.18$), and a small-to-moderate magnitude increase was found for state anxiety ($d=0.36$). No statistically significant changes were found for state anxiety, worry, or worry engagement following SIT (all $p>0.23$); however, small magnitude reductions were found for state anxiety ($d=0.11$), worry ($d=0.26$), and worry engagement ($d=0.21$). Following SIT, a statistically non-significant small magnitude attenuation ($d=0.14$) of state anxiety response to a single sprint was found.

CONCLUSION: Findings provide proof of principle that even a single high-intensity sprint can acutely perturb state anxiety and improve worry. Short-term SIT may elicit improved resting levels of anxiety and worry and response to a single high-intensity sprint in healthy young men.

1179 May 30 10:00 AM - 10:15 AM

The Effects of a Physical Activity Program on Mood States in College Students

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(No relevant relationships reported)

College students are at risk for adverse mental and physical health. Physical activity (PA) can reduce risks and promote positive mental health; however, less than half (49.9%) of college students meet the ACSM recommendations for PA (American College Health Association, 2017), reporting barriers such as lack of motivation, energy and time. Evidence-based, person-centered PA programs can overcome such barriers to enhance mood states and overall health. **PURPOSE:** To implement and evaluate a PA program (#cubwell) designed to enhance mood states and promote continued PA in college students. **METHODS:** College students ($n=10$) participated in #cubwell for 5 wks. Students completed pre and post measures of perceived health, PA (Godin), intrinsic motivation (IMI), and mood states (POMS2), and a post program evaluation. Additionally, participants recorded Feeling Scale (FS) and Felt Arousal Scale (FAS) ratings before, during and after each weekly PA session. **RESULTS:** Participants experienced significant ($p<0.05$) increases in positive feelings (FS) and energy levels (FAS) during each of the #cubwell PA sessions. Intrinsic motivation increased from pre ($M=34.8$) to post ($M=37.4$), but the difference was not significant ($p>0.05$). Ratings of perceived health and mood states remained unchanged from pre to post. On the evaluations, participants reported feeling more autonomous, confident and connected; and that they enjoyed learning new workouts, exercising at their own pace/abilities (i.e., modifications provided), engaging in structured activities, and connecting with new people. **CONCLUSION:** While notable positive feelings and energy levels were experienced by the participants during the PA sessions, pre and post measures of perceived health and mood states did not differ. Confounding factors such as participant illness and campus mourning (i.e., deaths of two students the week before) may influence results. Also, the study was conducted from beginning to mid-semester, which is likely a more stressful time for students. Possibly, PA provided a coping strategy during those stressful times. Additional research with larger samples may provide greater insight into benefits of the program on mental health and wellness.

1180 May 30 10:15 AM - 10:30 AM

The Relationship Between Self-reported Lifestyle Habits and Depressive Symptoms in Older Adults 'At Risk' for Dementia

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(No relevant relationships reported)

PURPOSE: Depressive symptoms are now well-established as an independent risk factor for dementia, however the association between health-related lifestyle habits and depressive symptom severity remains unclear. As such, this study aimed to investigate the relationship between self-reported physical activity levels, sleep behaviour and diet quality, and self-reported depressive symptoms in older adults 'at risk' for dementia. **METHODS:** Participants aged ≥ 50 years were recruited from the Healthy Brain Ageing Clinic at the Brain and Mind Centre, The University of Sydney, and underwent comprehensive psychiatric, medical and neuropsychological assessments. Self-reported symptoms of depression were assessed via the 15-item Geriatric Depression Scale. Participants completed questionnaires to quantify volume of physical activity, and to characterise sleep behaviour and diet quality. **RESULTS:** A total of 90 participants (mean age=66yrs) with subjective and/or objective cognitive impairment were recruited. Depressive symptoms were correlated with somnolence ($r=0.342$, $p=0.001$), greater symptoms of insomnia ($r=0.270$, $p=0.010$), larger meal portion size ($r=0.232$, $p=0.029$), and a lower intake of protective foods ($r=-0.355$, $p=0.001$).

Of note, a trend between a higher number of bouts of moderate intensity physical activity and lower depressive symptoms was observed but did not reach significance ($r=-0.208$, $p=0.052$). Based on significant univariate correlations and age, a stepwise multiple regression analysis was performed. The regression model was statistically significant [$R^2=0.286$, $F(3,86)=11.483$, $p<0.001$], and showed that age, somnolence and frequency of protective foods consumed each contributed 4%, 12% and 8% to the variance in depressive symptom severity, respectively. **CONCLUSIONS:** Outcomes of this study demonstrate that age, somnolence and the intake of protective foods account for a considerable proportion (28.6%) of depressive symptom severity in older adults 'at risk' for dementia. These results support recent research highlighting the benefit of non-pharmacological interventions for depressive symptom management. Further research looking at the longitudinal relationship, underlying mechanisms and the possibility of a bidirectional relationship is now warranted.

1181 May 30 10:30 AM - 10:45 AM

Active Older Women Differentiated RPE while Affective Responses Remained Stable During Spontaneous or Prescribed Walking

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(No relevant relationships reported)

Purpose: To compare psychophysiological responses and walking speeds between spontaneous, self-selected and prescribed conditions in elderly active women.

Methods: Seventeen older active women participated in this investigation (66.9 \pm 5.0 yrs). The study consisted of six experimental sessions of 20-min walking: 1. spontaneous (S) where subjects performed their usual walking speed unaware that research data were being collected; 2. self-selected (SS) where subjects were instructed to walk at their "preferred intensity"; 3. self-selected reproduction (SR) where subjects used the same instructions as SS; 4. Prescribed Exertion (PE) where subjects walked at easy (PEE), moderate (PEM) and hard (PEH) exertion. The last three sessions were counterbalanced. Psychophysiological (RPE - OMNI scale, and affective valence (AV) - Feeling Scale) and heart rate (HR) were measured immediately after exercise, and distance was recorded to calculate average walking speed. One way ANOVA examined differences in dependent variables between conditions and post-hoc Tukey tests were used to decompose significant main effects ($p<0.05$). **RESULTS:**

Psychophysiological and WS across the different walking conditions (mean; SD)						
	S	SS	SR	PEE	PEM	PEH
HR (bpm)	130.5 \pm 14.6	136.2 \pm 7.7	138.9 \pm 6.0	114.8 \pm 7.3abc	138.6 \pm 4.4d	147.7 \pm 4.9abde
AV (FS -5 - +5)	4.6 \pm 0.6	4.8 \pm 0.3	4.6 \pm 0.5	4.6 \pm 0.5	4.5 \pm 0.5	4.8 \pm 0.4
RPE (0 - 10)	6.2 \pm 1.7	6.2 \pm 0.8	6.5 \pm 0.8	4.3 \pm 0.7abc	6.1 \pm 0.8d	8.4 \pm 0.6abcde
WS (m/s)	1.42 \pm 0.15	1.43 \pm 0.12	1.43 \pm 0.10	1.14 \pm 0.09abc	1.40 \pm 0.07d	1.61 \pm 0.07abcde

S: spontaneous; SS: self-selected; SR: self-selected reproduction; PEE: prescribed exertion-easy; PEM: prescribed exertion-moderate; PEH: prescribed exertion-hard. *Differ from S; *Differ from SS; *Differ from SR; *Differ from PEE; *Differ from PEM (all $p<0.05$).

Conclusion: Active older women were able to discriminate between different prescription instructions designed to produce low, moderate and hard exertion. Interestingly, the spontaneous and self-selected intensities elicited similar walking speeds as the prescribed moderate exertion session. Public health strategies may use simple exertional cues to help guide individuals in producing moderate intensity exercise, which may lead to health-fitness benefits. The pleasurable feeling associated with this intensity may in turn improve exercise adherence.

1182 May 30 10:45 AM - 11:00 AM

Bodily Pain in U.S. Navy Explosive Ordnance Disposal Technicians: Exploring Biobehavioral Relationships

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(No relevant relationships reported)

Pain is a complex experience which may interact with biological, psychological, and social factors. Evidence supports a relationship between bodily pain and depression in which one may augment the other. This connection was shown in U.S. Marines

but not yet studied in U.S. Navy Explosive Ordnance Disposal (EOD) Technicians. Characterizing EOD and understanding these interactions is a key aspect of managing warfighter health and performance.

PURPOSE: The primary purpose is to assess bodily pain and medication (med) use in EOD Technicians. The secondary purpose is to evaluate associations between bodily pain and biobehavioral correlates, such as depression, anxiety, and posttraumatic stress disorder (PTSD). **METHODS:** Eighty-four EOD Technicians self-reported bodily pain (0–10 scale), pain med use, and symptoms of depression, anxiety, and PTSD. One-way analysis of variance evaluated the relationship between med type and bodily pain. Pearson product-moment correlations examined associations between pain and biobehavioral measures. **RESULTS:** Self-reported bodily pain: none = 6.9%, mild = 69.4%, moderate = 22.2%, severe = 1.4%; \bar{x} = 2.4/10 for bodily pain. Of those reporting pain, 67.4% were taking meds, which represents 36.9% of all participants. Higher pain was reported in those taking prescription meds compared to over-the-counter meds or no meds [$F(4, 67) = 8.72, p < .001$]. Positive relationships were found between pain and depression ($r = .34$), anxiety ($r = .33$), and PTSD ($r = .53$) symptoms (all $p < .01$). **CONCLUSION:** Most EOD Technicians reported some level of pain contrasted with roughly half the general population (55.7%). Compared to U.S. Marines, pain ratings were similar; however, EOD Technicians reported over twice the prevalence of pain med use. Additionally, findings indicate that EOD Technicians using prescription meds reported higher pain. With respect to biobehavioral correlates, the relationship between pain and depression in EOD Technicians was similar to reports in Marines. Combined with the associations observed between pain, anxiety, and PTSD, this reinforces the premise that pain and behavioral health are interrelated. These findings may be useful for clinicians when evaluating military members for potential comorbidities, particularly following trauma when symptoms may be most severe.

1183 May 30 11:00 AM - 11:15 AM

Pain Sensitivity And Psychological Variables Affect Delayed Onset Muscle Soreness (DOMS)

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Delayed onset muscle soreness (DOMS) is an acute muscle pain condition occurring after eccentric muscular activity in some but not all people. Physiological and psychological factors may affect DOMS. **PURPOSE:** To investigate whether individual pain sensitivity and psychological variables levels predict DOMS. **METHODS:** Thirty two participants completed pain-related psychological questionnaires and quantitative sensory testing (QST) and thereafter the DOMS protocol was carried out for the upper extremity. The second session was held 24 h later, participants completed the DOMS-related interference questionnaire and QST was then reapplied. To compare QST parameters and psychological variables between those developing DOMS and those who did not, independent sample t-tests were conducted. Multiple regression analyses were used to determine the predictive role of QST and psychological variables on DOMS intensity. **RESULTS:** Out of the 32 participants, 17 showed a DOMS response. Participants who developed DOMS had higher trait anxiety ($p=0.010$), depression ($p=0.025$), and stress ($p=0.034$) scores, compared to those who did not develop DOMS. Trait anxiety predicted the intensity of DOMS ($r=0.63, P<0.000$). Additionally, those who developed DOMS demonstrated a higher systemic pain sensitivity at baseline, expressed by a lower pressure pain threshold in the muscle that was exercised and in a remote muscle, and by a lower pain inhibition efficiency ($P<0.02$). No correlation was found between the level of pain sensitivity at baseline and the intensity of DOMS. **CONCLUSIONS:** The endogenous ability to regulate pain has a significant impact on pain development in DOMS. Development of DOMS is affected by baseline systemic pain sensitivity as well as psychological and personality traits. Our findings highlight the contribution of physiological and psychological factors to the development of DOMS.

1184 May 30 11:15 AM - 11:30 AM

Acute Pain And Fatigue Responses To Resistance Exercise Among Gulf War Veterans With Chronic Pain

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(No relevant relationships reported)

The chronic effects of exercise training have previously been explored in Persian Gulf War Veterans (GV) with chronic musculoskeletal pain (CMP). However, the

effect of a single bout of resistance exercise on pain and fatigue has not been reported. The magnitude and direction of those effects over several months of a progressive resistance exercise training (RET) program is also unknown.

PURPOSE: To examine changes in pain and fatigue in response to acute bouts of resistance exercise across 16 wks of RET among GV with CMP. It was hypothesized that perceived pain and fatigue would decrease after each training session and the magnitude of this change would increase over the course of the intervention.

METHODS: GV who met criteria for widespread CMP ($n=22; 50\pm7$ years) completed 16 wks of RET. Training intensity started at 25% and 35% of estimated one-rep-maximum (1RM) and systematically progressed over the course of the intervention. Pre and post exercise pain and fatigue scores on a 0-100 visual analog scale were examined for the first RET session of each training wk. Data gathered during 1RM testing (baseline, mid-program, and end-program) were excluded, resulting in analysis of 13 training wks. Hypotheses were tested with separate 2 (time: pre, post) x 13 (program length: wk 1-13) repeated measures ANOVA models.

RESULTS: Average pre-exercise pain and fatigue were 27.8 ± 2 and 21.8 ± 3 , respectively. Pre-exercise trend line slopes were 0.04 and 0.02 for pain and fatigue, respectively. Significant interaction effects for pain, $F = 2.80, p = .006$, partial eta squared = 0.12, and fatigue, $F = 2.23, p = .03$, partial eta squared = 0.10, models were found. Relative to pre-exercise, post-exercise scores were lower following earlier training sessions (e.g., wks 1-5) and higher following later training sessions (e.g., wks 10-13).

CONCLUSION: Contrary to our hypothesis, post-exercise pain and fatigue appeared to increase across wks 1-13, which could be related to the progression of exercise intensity over the course of the program. However, the stability of the pre-exercise scores across wks 1-13 suggests that weekly pre-exercise pain and fatigue were not exacerbated by acute responses to RET.

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C-12 Free Communication/Slide - Older Adults

Thursday, May 30, 2019, 9:30 AM - 11:30 AM
Room: CC-202C

1185 **Chair:** Melissa A. Whidden, FACSM. *West Chester University, West Chester, PA.*

(No relevant relationships reported)

1186 May 30 9:30 AM - 9:45 AM

Breaking3: Performance Characteristics Of A Sub-three-hour Septuagenarian Marathoner

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Purpose: In this case study we characterize the physiological profile of an elite 70-year old endurance runner who ran 2:55:18 at the Scotiabank Toronto Marathon on Oct 21, 2018, breaking his own American record for a 70-year old male by over two-minutes. **Methods:** The athlete underwent a familiarization visit, health screening, and performance-testing. During the screening visit, a resting electrocardiogram and a fasted venous blood sample for biochemical analysis were obtained, and dual energy X-ray absorptiometry was performed to assess body composition. Performance testing consisted of graded treadmill running and indirect calorimetry for determination of maximum oxygen uptake ($\dot{V}O_{2max}$), running economy testing (RE: 12-16 km/hr, 0% grade, 5 minutes each), and lactate threshold (LT; blood draws during running via venous catheter). **Results:** Height was 176.5 cm, weight was 64.2 kg, and he exhibited exceptional cardiometabolic health for his age (body fat: 19.1%, blood pressure: 122/75 mmHg, blood glucose: 86 mg/dL, total cholesterol: 173 mg/dL, LDL: 84 mg/dL, HDL: 66 mg/dL, and triglycerides: 135 mg/dL). The only medication he reported taking was daily low-dose aspirin. His $\dot{V}O_{2max}$ was 46.9 mL/kg/min (max heart rate: 156, 104% age-predicted HR_{max} , RPE 19 out of 20). This $\dot{V}O_{2max}$ is exceptional for a 70-year old, but lower than what is expected for a performance-matched younger runner. He reached his LT at ~14 km/hr, which corresponded, to a $\dot{V}O_2$ of 44.0 mL/kg/min or 93.8% of his $\dot{V}O_{2max}$, and a heart rate of 147, or 94% of HR_{max} . Near $\dot{V}O_{2max}$ levels of oxygen consumption were reached during the final stage of RE testing (16 km/hr, 46.0 mL/kg/min) and blood lactate also plateaued at 14.4 mmol/L. Running economy at the submaximal speeds was comparable to elite younger runners.

Conclusion: Running a marathon in 2:55:18 requires a running speed of ~14.5 km/hr, a speed which is faster than this elite masters athlete's laboratory-measured LT speed

(14km/hr). Our data indicate that his ability to maintain a remarkably high percentage of his measured $\dot{V}O_{2\max}$ (>90%) enable him to compete with performance-matched younger runners who have much higher $\dot{V}O_{2\max}$ values.

1187 May 30 9:45 AM - 10:00 AM

Body Fat Is More Strongly Associated Than Lean Mass With Physical Function In Middle-aged Women

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PURPOSE: Research in older adults suggests that percent body fat is more strongly associated with physical function compared to lean mass when examining relationships between body composition and functional performance. Poor physical function has been associated with increased risk for disability and loss of independence in older women; however, the component of body composition most strongly associated with physical function in middle-aged females is incompletely characterized. Poorer physical function earlier in the lifespan may predispose people to decreased quality of life in older age. The purpose of this study was to examine the strength of the associations between lean mass and percent fat on objectively measured physical function performance in middle-aged females.

METHODS: Eighty females (ages 52.58 ± 6.10 yrs) were assessed for body composition (lean mass, percent fat) via dual-energy x-ray absorptiometry, physical activity and sedentary time via accelerometer (steps per day, minutes per day), and physical function via Timed Up-And-Go, 30-Second Chair Stand, Transfer Task, Six-Minute Walk, and Lift and Carry.

RESULTS: Measures of lean mass (total lean mass, lean mass index) were not related to any measures of physical function (all $p > 0.05$), while percent fat was related to Timed Up-And-Go ($r = .32$), 30-Second Chair Stand ($r = -.35$), Transfer Task ($r = .53$), and Six-Minute Walk ($r = -.48$) performance (all $p \leq 0.05$) but not Lift and Carry performance ($r = .22$, $p = .06$). Hierarchical linear regression analyses revealed: (1) age, steps per day, and percent fat were related to Transfer Task, 30-Second Chair Stand, and Six-Minute Walk performance, explaining 40%, 25%, 25% of the variance, respectively (all $p \leq 0.05$); (2) age, sedentary minutes per day, and percent fat were related to Timed Up-And-Go, explaining 18% of the variance, $p \leq 0.01$; (3) age, and average steps per day, but not percent fat, were associated with Lift and Carry performance, explaining 11% of the variance.

CONCLUSIONS: In middle-aged women, percent fat was more strongly associated with physical function performance compared to total mass, lean mass, or lean mass index. This suggests that reducing percent fat via intervention may be an effective method for improving functional performance among women in this age group.

1188 May 30 10:00 AM - 10:15 AM

Age-related Differences in Rectus Femoris Muscle Size and Hip Flexion Maximal and Rapid Torque Characteristics

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(No relevant relationships reported)

Previous studies have reported that decreases in muscle size of the rectus femoris (RF) may contribute to age-related deficits in leg extension strength. However, we are aware of no studies that have examined the contribution of RF muscle size to age-related differences in hip flexion strength, and more specifically, the age-related differences in maximal and rapid torque characteristics. **PURPOSE:** To determine the effects of age on RF muscle size (cross-sectional area [CSA]) and hip flexion maximal and rapid torque characteristics in young and old men. **METHODS:** Fifteen young (age = 25 ± 3 yr; body mass = 86 ± 17 kg; height = 176 ± 5 cm) and 15 old (73 ± 4 yr; 83 ± 10 kg; 173 ± 6 cm) men underwent two diagnostic ultrasound assessments followed by two isometric maximal voluntary contractions (MVCs) of the hip flexors on an isokinetic dynamometer. RF CSA (cm^2) was measured on the right leg using a portable B-mode ultrasound imaging device and linear-array probe. For each MVC, participants laid supine with the knee- and ankle-joints immobilized using custom-built stabilizing apparatuses. All MVCs were performed on the right leg at a hip joint angle of 20° above the horizontal plane. Participants were instructed during each MVC to flex the thigh at the hip "as hard and fast as possible" for 3-4 s. Isometric MVC peak torque (PT; Nm) was calculated as the highest mean 500 ms epoch during the entire 3-4 s MVC plateau. Rate of torque development (RTD; $\text{Nm} \cdot \text{s}^{-1}$) was calculated as the peak of the first derivative of the torque signal. **RESULTS:** There were no differences between the young and old men for body mass ($P = 0.624$) and height ($P = 0.156$). The old men exhibited lower CSA (old = 10.05 ± 1.82 cm^2 ; young = 12.16 ± 2.59 cm^2 ; $P = 0.015$), PT (old = 117.22 ± 17.42 Nm; young = 144.16 ± 29.72 Nm; $P = 0.005$), and RTD (old = 1129.62 ± 374.77 $\text{Nm} \cdot \text{s}^{-1}$; young = 1718.26 ± 633.04 $\text{Nm} \cdot \text{s}^{-1}$; $P = 0.005$) than the young men. Significant relationships were observed between CSA and PT ($r = 0.520$; $P = 0.003$) and RTD ($r = 0.534$; $P = 0.002$). **CONCLUSION:** These findings

demonstrated that RF muscle size and hip flexion PT and RTD decrease in old age. The significant relationships observed between CSA and PT and RTD in the young and old men perhaps suggest that these age-related declines in RF muscle size may play an important role in the lower hip flexion maximal and rapid torque values observed in older adults.

1189 May 30 10:15 AM - 10:30 AM

The Effects Of 5-week Cup-tap Or Lower-limb-strength Exercise On Proprioception And Mobility In Community-dwelling Elderly

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(No relevant relationships reported)

There is strong evidence to support strength or balance training for a duration of 6 to 12 weeks as an exercise intervention to improve proprioception and mobility in community-dwelling elderly. However, it is unknown if a shorter duration of exercise can be effective in improving proprioception and mobility in this population. **PURPOSE:** To determine whether a 5-week program of cup-tap balance control or lower limb strength exercise can improve proprioception and mobility in healthy community-dwelling older people. **METHODS:** Sixty-eight healthy community-dwelling elderly (19M, 49F, 70.91 ± 6.61 yrs old, range 55-90 yrs old) were randomly allocated into 3 groups: cup-tap balance control exercise group (CTE), lower limb strength exercise group (LSE) or education group (EC). A 60 minutes per session, twice weekly cup-tap or strength exercise program was delivered for 5 weeks duration. Key outcome measures included ankle proprioception measured by using the active movement extent discrimination apparatus (AMEDA), and mobility assessed by using the Timed Up and Go test (TUG) and the 30-second Sit to Stand test (30STS). **RESULTS:** ANOVA analysis showed that there was no significant difference in baseline measures: ankle proprioception ($F = 1.605$, $p = 0.209$), TUG ($F = 0.473$, $p = 0.625$), and 30STS ($F = 1.201$, $p = 0.307$) among the 3 groups. Paired t-tests used for examining pre- and post-intervention differences indicated that 1) for the CTE group, the performance of 30STS and the ankle proprioception were significantly improved ($p = 0.005$, $p = 0.016$ respectively); 2) for the LSE group, both TUG and 30STS were significantly improved ($p = 0.023$, $p = 0.03$ respectively); and 3) no significant changes were observed for the EC group. In addition, Pearson's correlation analysis showed that 30STS and TUG performances were moderately correlated ($r = -0.598$, $p < 0.001$) and TUG was significantly correlated with age ($r = 0.416$, $p < 0.001$). **CONCLUSION:** The current findings suggest that the proprioception and mobility of older people can be improved by a short duration of balance control or strength training exercise. However, we suggest that the exercise program must be target-specific with respect to different impairments associated with the aging process for optimal results.

1190 May 30 10:30 AM - 10:45 AM

Lower-Extremity Torque Capacity and Physical Function in Mobility-Limited Older Adults

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Skeletal muscle weakness and an increase in fatigability independently contribute to age-related functional decline. **PURPOSE:** The objective of this study was to examine the combined contribution of these deficiencies (i.e., torque capacity) to physical function, and then to assess the functional implications of progressive resistance training (PRT) mediated-torque capacity improvements in mobility-limited older adults. **METHODS:** Seventy mobility-limited (Short Physical Performance Battery (SPPB) ≤ 9) older adults (~ 79 yrs) were recruited and randomized to either PRT or home-based flexibility 3 days/week for 12 weeks. Torque capacity was defined as the sum of peak torques from an isokinetic knee extension fatigue test. Relationships between torque capacity and performance-based and patient-reported functional measures were examined using partial correlations adjusted for age, sex, and body mass index. **RESULTS:** Skeletal muscle torque capacity explained ($P < 0.05$) 10 and 28% of the variance in six-minute walk distance and stair climb time, respectively. PRT-mediated torque capacity improvements were paralleled by increases ($P < 0.05$) in self-reported activity participation (+20%) and advanced lower extremity function (+7%), and associated ($P < 0.05$) with a reduction in activity limitations ($r = 0.44$) and an improved SPPB score ($r = 0.32$). **CONCLUSION:** Skeletal muscle torque capacity, a composite of strength and fatigue, may be a proximal determinant of physical function in mobility-limited older individuals. To more closely replicate the musculoskeletal

demands of real-life tasks, future studies are encouraged to consider the combined interaction of distinct skeletal muscle faculties to overall functional ability in older adults.

Supported by a grant from Astellas Pharma Inc.

1191 May 30 10:45 AM - 11:00 AM

Muscularity Of Non Sedentary Elderly Over Three Decades Trends

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Purpose: To describe and analyze the muscular trend, related to circumferences of non-sedentary women over three different decades. **Methods:** The present study is part of the Mixed Longitudinal Project of Physical Fitness and Aging. Sample composed only women's, 50 years-old and older and participated in at least one evaluation between 1998 and 2017, totalizing a sample of 6367 individuals. The circumferences (cm) analyzed were: contracted and relaxed leg and arm. To analyze the trend, the sample was divided into age groups: 50 to 59 years, 60 to 69 years and 70 years old and over. Polynomial regression models were estimated. In the modeling process, the mean of each one of the anthropometric variables was considered as dependent variable and the years of evaluation as independent variable. For each variable, the model with the highest statistical significance and the best accuracy measure (r^2) was selected. **Results:** Leg circum. (cm) presented a positive trend in the age group of 50 to 59 years, and a negative trend in the age groups of 60 to 69 years, and in the 70 years and over group. The contracted arm circum. (cm) presented a positive tendency in the age groups of 50 to 59 years and 60 to 69 years. On the other hand, the circum. of the relaxed arm (cm) presented a positive tendency only in the 50 to 59 years-old group. In the age group of 50 to 59 years, the mean leg circum. was 35.77 cm, the mean arm circum. contracted was 30.68 cm and the mean arm circum. relaxed was 30.43 cm. In both cases, there was an increase of 0.01 cm every year. In the age group of 60 to 69 years, mean leg circum. was 35.11 cm, and there was a decrease of 0.01 cm in every year; the mean of the contracted arm circum. was 29.97 cm, with an increase of 0.01 cm every year. In the age group of 70 years and over, mean leg circum. was 34.81 cm, with a decrease of 0.01 cm every year. **Conclusion:** Over the three decades analyzed, the younger elderly showed a positive tendency for the muscularity indices; while older groups presented mixed results.

Table. Trend analysis of circumference among non-sedentary elderly according to age group.

	50 to 59 years			60 to 69 years			70 years and over		
	Model	r^2	β	Model	r^2	β	Model	r^2	β
Leg Circumference (cm)	$y = 35.77 + 0.01x$	0.50	0.0011	$y = 35.11 - 0.01x$	0.53	0.0008	$y = 34.81 - 0.01x$	0.53	0.0007
Arm contracted circumference (cm)	$y = 30.68 + 0.01x$	0.35	0.0091	$y = 29.97 + 0.01x$	0.25	0.0325	$y = 29.29 - 0.03x$	0.19	0.0683
Arm relaxed circumference (cm)	$y = 30.43 + 0.01x$	0.66	0.0007	$y = 29.79 + 0.01x$	0.01	0.9710	$y = 28.97 - 0.04x$	0.20	0.1275

a: first-order regression model; b: second-order regression model; c: third-order regression model.

1192 May 30 11:00 AM - 11:15 AM

Health and Lifestyle Behaviors of U.S. Master's World Cup Field Hockey Players

Karen A. Croteau, FACSM¹, Nina Eduljee¹, Laurie Murphy¹, Lisa Ahearn². ¹Saint Joseph's College of Maine, Standish, ME. ²Plymouth State University, Plymouth, NH.

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine health status and lifestyle behaviors of U.S. master's field hockey athletes. **METHODS:** Participants were 122 athletes (72 females, 50 males) who competed for the U.S. in the Master's Field Hockey World Cup in 2018. Mean age was 50.12±8.28 (range = 35-71). Participants completed the 42-item Health and Wellbeing of Master's Field Hockey Athletes Survey. **RESULTS:** Mean BMI was 24.9±3.1 (range = 15.6-35.5). Participants rated their health as very good/excellent (86.9%), had no major health conditions (61.5%) or medication use (70.5%), and had at least one injury (53.3%). Perceived stress was rated at rare or not at all by 56.6% of participants. Participants consumed ≥2 fruits (68.9%) and ≥2 vegetables per day (83.6%), daily breakfast (68%), ≤1 sugar-sweetened beverages (86.9%) and ≥7 cups of water (54.0%) per day, and ≤2 alcoholic beverages per week (59.8%). Participants reported ≥7 hours of sleep per night (65.5%) and no/little restless sleep (52.4%). Just under half of participants reported sitting ≥5

hours per day (46.7%). Exercise frequency at ≥3 days per week and ≥30 minutes was cited by 95.9% and 98.4% of the sample. **CONCLUSION:** Master's field hockey athletes practice lifestyle behaviors conducive to positive health.

1193 May 30 11:15 AM - 11:30 AM

Effects of Tai Chi Exercise Versus BINGO on Fine Motor Functions in Older Adults

Saira Talwar¹, Chih-Chia Chen², John Lamberth², Yonjoong Ryuh², Poram Choi², Morgan Hommel², Zhujun Pan². ¹University of Wisconsin - Milwaukee, Milwaukee, WI. ²Mississippi State University, Mississippi State, MS. (Sponsor: Scott Strath, FACS)

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(No relevant relationships reported)

Tai Chi exercise (TC) improves gross motor skills in older adults; however, fine motor skills, which enhance performance of daily living activities (ADLs), have not been thoroughly examined. **PURPOSE:** The purpose of this study was to investigate the effects of TC versus BINGO on fine motor skills in older adults. **METHODS:** Twenty-seven self-ambulatory older adults (age: 76 ±9.00; female: N = 26) with no restrictive health conditions and MMSE score ≥ 21, completed this study. Participants engaged in 1-hour, twice-per-week TC or BINGO sessions for 8 weeks (wk). Fine motor skills were assessed using the unilateral Jebsen Taylor Hand Function Test (JTHFT), including 7 ADL-like tasks; less time (s) to complete a task reflected better performance. Repeated measures 2x4 [2(TC x BINGO) x 4(Baseline x Intra-intervention x Post x Retention)] ANOVA was used with alpha of 0.05; data was analyzed separately for each hand. **RESULTS:** There were no significant group differences ($p > 0.05$). Significant time main effects were found for 6 tasks using the dominant hand (DH) and 7 tasks using the nondominant hand (NH) (Table 1). Significant time x group interaction was found for simulated feeding using the DH ($p = 0.001$). TC improved by 1.69 s across the 8-wk intervention, with a 1.23 s improvement after 4 wk. BINGO improved by 0.07 s across the 8 wk. Significant time x group interaction was also found for lifting large, heavy objects using the NH ($p = 0.039$). TC improved by 0.65 s across the 8 wk intervention, with a 0.50 s improvement after 4 wk. BINGO improved by 0.09 s across 8 wk. **CONCLUSION:** This study was one of the first to explore the effects of TC on fine motor functions. TC does not demand precise finger movements such as those required for BINGO; however, improvements specific to tasks requiring eye-hand coordination, manual dexterity, wrist range of motion, and hand grip strength were noted 4 wk into the TC intervention. TC may improve fine motor functions in older adults. Supported by MSU College of Education.

	Group	Time		Group*Time	
		F-value	P-value	F-value	P-value
1. Writing	Dominant Hand	0.764	0.390	1.963	0.127
	Nondominant Hand	0.010	0.919	3.182	0.029*
2. Simulated Page Turning	Dominant Hand	1.256	0.273	21.993	< 0.001*
	Nondominant Hand	1.423	0.244	27.764	< 0.001*
3. Small Objects	Dominant Hand	0.259	0.615	10.510	< 0.001*
	Nondominant Hand	2.356	0.137	7.144	0.006*
4. Simulated Feeding	Dominant Hand	3.539	0.072	10.346	< 0.001*
	Nondominant Hand	4.004	0.056	6.174	0.009*
5. Stacking Checkers	Dominant Hand	0.370	0.549	2.928	0.039*
	Nondominant Hand	0.239	0.629	6.147	0.009*
6. Large, Light Objects	Dominant Hand	2.145	0.155	6.597	0.001*
	Nondominant Hand	1.385	0.250	7.295	< 0.001*
7. Large, Heavy Objects	Dominant Hand	2.895	0.101	4.240	0.021*
	Nondominant Hand	3.828	0.062	14.508	< 0.001*

Table 1. Main effect F-values (Group: F(1,25); Time and Group*Time: F(3,25)) and P-values of Jebsen-Taylor Hand Function Test for dominant and nondominant hand; * $p < 0.05$.

C-13 Clinical Case Slide - Leg and Tibia

Thursday, May 30, 2019, 9:30 AM - 10:50 AM
Room: CC-305

1194 Chair: Mark R. Hutchinson, FACSM. *University of Illinois at Chicago, Chicago, IL.*
(No relevant relationships reported)

1195 Discussant
Jay Hertel, FACSM. *University of Virginia, Charlottesville, VA.*
(No relevant relationships reported)

1196 Discussant
Sean Engel. *University of Minnesota, Minneapolis, MN.*
(No relevant relationships reported)

1197 May 30 9:30 AM - 9:50 AM
Leg Pain in a 23 Year Old Football Player
Kyle H. Yost, Valerie Cothran, Ralph F. Henn. *University of Maryland Medical System, Baltimore, MD.*
Email: kyleyost08@gmail.com
(No relevant relationships reported)

HISTORY

A 23 year old male reported getting kicked in the leg during a collegiate football game. He noted immediate pain in his lateral calf after attempting a tackle. He did not feel or hear a pop. He had a noticeable limp walking off the field. There was no pain in the ankle or foot, but he noted pain with ankle movement. He had pain with weight-bearing but denied any numbness or tingling.

The next day, he developed worsening pain that was unbearable with any change of position or movement. The pain was greatest along the mid-lateral leg but extended along the entire leg anterior and laterally. He had limited ability to move his toes and foot which was a new symptom.

PHYSICAL EXAMINATION

General: Alert and oriented in mild distress at rest.

Left leg

Edema: Anterior and lateral leg without pitting.

Compartments: Diffusely tender but not tense.

Tenderness: Diffuse, anterior and lateral compartments more than fibula and posterolateral.

Range of motion: DF 0 degrees, PF 30 degrees. Pain was worse with initiation. He tolerated gradual passive stretch of the anterior, more than the lateral.

Pain with inversion and eversion.

Strength: 1/5 anterior tibialis, EHL, EDL, Peroneals with pain, 2/5 GS/PT with pain.

Neurovascular: Intact, 2+ PT/DP pulses, cap refill < 2 sec.

DIFFERENTIAL DIAGNOSIS

1. Gastrocnemius Strain
2. Compartment Syndrome
3. Popliteus Strain
4. Fibular Fracture
5. High Ankle Sprain

TESTS AND RESULTS

XRays

1. Fluoroscopic imaging of the tib-fib and ankle were negative.

2. Tib-fib and Ankle xrays were negative for fracture and stress view demonstrated stable joint.

Compartment Testing

Diastolic pressure: 74

Left lower leg anterior compartment: 20

Left lower leg lateral compartment: 28

Left lower leg posterior superficial compartment: 27

Left lower leg posterior deep compartment: 26

MRI

1. Nondisplaced fracture of the middle third of the fibula.

2. Acute grade 1 muscular injury of the peroneal muscles of the lateral compartment.

FINAL WORKING DIAGNOSIS

Midshaft fibular stress fracture

TREATMENT AND OUTCOMES

1. Patient was admitted to the hospital for observation for one night.

2. Patient was discharged and allowed to weight bear as tolerated in the tall CAM boot for two weeks.

3. At two weeks, he was weaned out of the boot and allowed to progress into activities.
4. At six weeks, he was participating in football without any limitations.

1198 May 30 9:50 AM - 10:10 AM
Lower Extremity Pain - Field Hockey

Jessica Traver, Lyle Micheli, FACSM. *Boston Children's Hospital, Boston, MA.* (Sponsor: Lyle Micheli, MD, FACSM)
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(No relevant relationships reported)

Lower Leg Pain – Field Hockey

HISTORY: A 20-year-old collegiate field hockey player 1 year, 2 months out from bilateral anterior/lateral/deep posterior compartment fasciotomies for chronic exertional compartment syndrome, recurrence of pain along her bilateral medial legs and medial/plantar foot numbness. Worsening over previous 6 months. Pain is daily, constant. Had MRI/MRA arterial duplex performed at onset of symptoms and was told it was negative. No improvement with neuropathic pain medication, physical therapy, hydrodissection.

PHYSICAL EXAMINATION: Examination revealed healed surgical incisions. Mild scar hypertrophy along medial incisions with moderate tenderness to palpation. Full knee/ankle ROM. Pain reproduced with resisted ankle plantar flexion after 30 seconds, numbness along medial/plantar aspect of foot in tibial nerve distribution. Easily palpable dorsalis pedis/posterior tibialis pulses.

DIFFERENTIAL DIAGNOSIS:

1. Recurrent chronic exertional compartment syndrome
2. Saphenous nerve compression neuropathy
3. Popliteal Artery Entrapment Syndrome

TEST AND RESULTS:

1. Repeating compartment pressure testing: normal compartment pressures
2. EMG/NCS: normal without evidence of compression neuropathy
3. MRA (PRISMA 3T) study: forced plantarflexion demonstrates bilateral compression of the popliteal arteries at the popliteal fossa between the medial and lateral heads of the gastrocnemius muscle.

FINAL/WORKING DIAGNOSIS:

Popliteal Artery Entrapment Syndrome

TREATMENT AND OUTCOMES:

1. Referred to plastic surgery colleagues.
2. Underwent bilateral popliteal artery releases 1 year, 8 months after index surgery.
3. Improvement of both pain and numbness along medial aspect of foot.
4. Last seen at 3 months post-operatively. Full, painless ROM. No pain with resisted plantarflexion. Normal sensation. Anticipate return to sport over the next 6 weeks.

1199 May 30 10:10 AM - 10:30 AM
Pain And Function: A Ten(din)uous Link In The Runner

Peter Francis, Isobel Thornley, Ashley Jones. *Leeds Beckett University, Leeds, United Kingdom.*
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(No relevant relationships reported)

HISTORY: A male runner (30-years, 10-km time: 33-min 46-sec) had been running with suspected insertional achilles tendinopathy (AT) for 2.5 years when the pain reached a threshold that prevented running.

PHYSICAL EXAMINATION: Diagnostic ultrasound (US), prior to a high volume stripping injection, confirmed right sided medial insertional AT.

DIFFERENTIAL DIAGNOSIS: Right sided medial insertional AT.

TEST AND RESULTS: The athlete failed to respond to the injection and ceased running for a period of 5-weeks. At the beginning of this period, the runner completed the Victoria institute of sports assessment-achilles questionnaire (VISA-A) and the foot and ankle disability index (FADI), prior to undergoing an assessment of bi-lateral gastrocnemius medialis (GM) muscle architecture (muscle thickness (MT) and pennation angle (PA); US), muscle contractile properties (maximal muscle displacement (Dm) and contraction time (Tc); Tensiomyography (TMG)) and calf endurance (40 raises/min). VISA-A and FADI scores were 59%/100% and 102/136 respectively. Compared to the left leg, the right GM had a lower MT (1.60 cm vs. 1.74 cm), a similar PA (22.0° vs. 21.0°), a lower Dm (1.2 mm vs. 2.0 mm) and Tc (16.5 ms vs. 17.7 ms). Calf endurance was higher in the right leg compared to the left (48 vs. 43 raises).

FINAL/WORKING DIAGNOSIS: Right sided medial insertional AT.

TREATMENT AND OUTCOMES: The athlete began a metronome guided (15-BPM), 12-week progressive eccentric training protocol using a weighted-vest (1.5kg increments per week), whilst receiving 6-sessions of shockwave therapy concurrently (within 5-weeks). On returning to running, the athlete kept daily pain (VAS) and running scores (miles*RPE). Foot and ankle function improved according to scores recorded on the VISA-A (59% vs. 97%) and FADI (102 vs. 127/136). Improvements in MT (1.60 cm vs. 1.76 cm) and PA (22.0° vs. 24.8°) were recorded via US. Improvements in Dm (1.15 mm vs. 1.69 mm) and Tc (16.5 ms vs. 15.4 ms) were recorded via TMG. Calf endurance was lower in both legs and the asymmetry between legs remained (L: 31, R: 34). Pain intensity (mean weekly VAS scores) decreased

between week-1 and week-12 (6.6 vs. 2.9), while running scores increased (20 vs. 38) during the same period. The program was maintained up to week-16 at which point weekly mean VAS was 2.2 and running score was 47.

1200 May 30 10:30 AM - 10:50 AM

Medial Lower Leg Pain in a Middle-Aged Triathlete

Allison N. Schroeder, Stephen Schaaf, Kentaro Onishi.
University of Pittsburgh Medical Center, Pittsburgh, PA.

(Sponsor: Tom Best, FACSM)

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(No relevant relationships reported)

HISTORY: A 43-year-old triathlete presented with left distal medial lower leg pain that started gradually about 2-3 weeks prior to presentation. He denied inciting trauma and described the pain as a 5/10 sharp pain provoked by walking, running, and ankle dorsiflexion and plantarflexion movements. He endorsed mild left distal medial leg swelling but denied leg weakness or numbness and previous injury to this area. He was taking ibuprofen and had seen a chiropractor who performed several treatments including grastin, massage, taping, and a compression sleeve with minimal relief. He was training for his first full Ironman triathlon, scheduled for 12 days from presentation.

PHYSICAL EXAMINATION: Gait was non-antalgic. No visible swelling or ecchymoses of the left lower leg. Only tender to palpation in the left distal medial leg near the myotendinous junction of the medial gastrocnemius. Full ROM at the knee and ankle, but left end-range ankle dorsiflexion was painful. Strength was 5/5 about the knee and ankle, but he had pain with toe raises and toe walking on the left.

DIFFERENTIAL DIAGNOSIS:

1. Gastrocnemius strain or tear
2. Soleus strain or tear
3. Plantaris strain or tear
4. Achilles tendon injury
5. Posterior tibialis strain or tear
6. Fascial defect/muscle herniation
7. Deep posterior compartment syndrome
8. DVT

TEST AND RESULTS: Limited diagnostic ultrasound of the left distal medial leg revealed a near tear of the plantaris tendon near the myotendinous junction with evidence of disruption of tendon fibers and surrounding anechoic fluid. There was neovascularization on color doppler and tenderness to sonopalpation.

FINAL/WORKING DIAGNOSIS: Plantaris Tendinopathy

TREATMENT AND OUTCOMES: He was encouraged to continue symptomatic treatments with his chiropractor and could also consider kinesiotaping. His goal was to complete the full Ironman, even if he was slower than anticipated and called about one week later to ask if there were additional treatment options. He wished to proceed with experimental sonographically-guided injection of dextrose hyperosmolar solution to the site of pathology of his plantaris tendon, which was performed 4 days prior to the Ironman triathlon. By race day, his pain had improved, and he was able to complete the full Ironman within his original goal time.

C-14 Clinical Case Slide - Neurologic Injuries

Thursday, May 30, 2019, 9:30 AM - 10:50 AM

Room: CC-304E

1201 Chair: Cindy Y. Lin. University of Washington Medical Center, Seattle, WA.

(No relevant relationships reported)

1202 Discussant

William F. Micheo, FACSM. University of Puerto Rico, San Juan, PR.

(No relevant relationships reported)

1203 Discussant

David Olson, FACSM. University of Minnesota, St. Paul, MN.

(No relevant relationships reported)

1204 May 30 9:30 AM - 9:50 AM

Post-concussion Syndrome With Retrograde Amnesia in a Pediatric Patient

Andrew Alexander, Weston Northam, Kevin Carneiro, Jason Mihalik. University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Kevin Guskiewicz, FACSM)

Email: andrew_alexander@med.unc.edu

(No relevant relationships reported)

HISTORY: A 14-year-old female with a history of pervasive developmental disorder (PDD), mild speech abnormalities, dyslexia, hearing loss and migraines sustained a concussion after falling on a slip and slide. The patient hit her head but did not lose consciousness. At clinic 3.5 weeks post injury, she complained of a headache with varied intensity. Reading provoked headaches and blurred vision. The patient experienced photophobia, phonophobia and dizziness. She took more naps during the day and had mood lability. The patient was amnesic to the event and had severe memory lapses. She forgot how to do simple math problems, the names of her family, friends, boyfriend, and that she was a cheerleader.

PHYSICAL EXAMINATION: Neurologic: 1) Slow eye movements that provoked headache, 2) Accommodation (blurred vision) and convergence (diplopia) insufficiencies, and 3) Undershooting and eye strain with vertical and horizontal saccades. Tenderness to palpation on right side of the neck and suboccipital region. Patient named current president when asked, but unable to name previous or first president. Otherwise, normal neurologic and musculoskeletal exam.

DIFFERENTIAL DIAGNOSIS:

- 1) Post-concussion syndrome with retrograde amnesia
- 2) Anxiety disorder exacerbated by trauma
- 3) Malingering

TESTS AND RESULTS:

CT head and neck:

— Normal

Neuropsychology Evaluation:

— Test of Memory Malingering - adequate effort

— ImPACT: deficits in Verbal Memory, Visual Memory, Visual Motor Speed, and Reaction Time

— Behavior Rating Inventory of Executive Functioning: Normal

Revised Children's Anxiety and Depression Scale:

— Clinically insignificant

Sensory Organization Test:

— No significant balance problems

FINAL/WORKING DIAGNOSIS:

Post-concussion syndrome with retrograde amnesia. Underlying PDD, and comorbidities at baseline described earlier likely contributing to headache and cognitive difficulties.

TREATMENT AND OUTCOMES:

1. Physical therapy for cervicogenic headaches
2. Vestibular therapy for dizziness and vestibulo-oculomotor dysfunction
3. Neuro-optometry evaluation and rehabilitation
4. All deficits and symptoms greatly improved 2 months post-injury. Vision rehabilitation will be continued prior to return-to-sport.

1205 May 30 9:50 AM - 10:10 AM

Headache, Vision Loss And Loss Of Consciousness-WrestlingJaron Santelli. *University of Maryland School of Medicine, Baltimore, MD.**(No relevant relationships reported)***HISTORY**

JJ is a 20 y/o male with 2 episodes of acute posterior neck pain with radiation into his occiput followed by acute loss of vision bilaterally and brief loss of consciousness vs. presyncopal like episode. The first event occurred while wrestling and the second while bench pressing. There was no preceding chest pain, shortness of breath, or other symptoms. All symptoms resolved approximately 15 minutes after each event.

At the time of the visit he was asymptomatic and unable to reproduce symptoms with head movement. No recent illness. No cardiac or pulmonary past medical history.

PHYSICAL EXAMINATION

The examination is overall unremarkable with normal pupillary and extra ocular muscle exam, no visual deficits, normal visual acuity, no midline cervical tenderness, and negative Spurling's test. JJ had a normal extensive neurologic exam including cranial nerves, coordination, sensation and strength. Cardiovascular and pulmonary exams are also normal.

DIFFERENTIAL DIAGNOSIS

Vertebral Artery Dissection

TIA/CVA

Vasovagal Syncope

Dehydration

TESTS AND RESULTS

CBC, CMP, TSH, EKG all unremarkable

CTA head and neck: bilateral hypoplastic vertebrobasilar system

MRI: negative for ischemia

Transcranial Doppler: nonspecific changes

FINAL WORKING DIAGNOSIS

Hypoplastic Vertebrobasilar system

TREATMENT AND OUTCOMES

At time of the diagnosis, there was no evidence of ischemia as a result of the occurrences. Possible treatment options for hypoplastic vertebrobasilar systems without ischemia include aspirin and lifestyle modifications. Activity modifications have been made to include proper hydration, training to the start of symptoms but no further and reducing the activities that induce valsava unnecessarily. Since these modifications have been put in place, there have been no new events. Follow up plans include repeat MRI at 6 months.

1206 May 30 10:10 AM - 10:30 AM

After Lightning Strikes: A Case Of Anoxic Encephalopathy In A 30 Year Old Soccer PlayerMichael Harbus, Miguel X. Escalon. *Mount Sinai School of Medicine, New York, NY.**(No relevant relationships reported)*

History: A 30 year old male with a past medical history of hypothyroidism was out playing soccer when he was struck by lightning. After the lightning strike, the patient experienced cardiac arrest, and CPR was performed. Spontaneous circulation was achieved after a 17 minutes of CPR, and the patient was admitted to a burn unit for partial thickness burns of his left anterior chest, abdomen, and right medial lower calf. During the patient's stay on the burn unit, he was noted to have severe cognitive deficits secondary to an anoxic brain injury sustained during his cardiac arrest, and also had a PEG tube placed after developing aspiration pneumonia. Following the burn unit, the patient was transferred to an acute rehab facility to address the severe cognitive deficits he had developed. Upon arrival at the acute rehabilitation facility, the patient was a Rancho Los Amigos level three.

Physical Exam: The patient was lying comfortably in bed. He was able to mimic behavior, but was unable to follow commands consistently. On ocular exam, the patient had a left pupil that was fixed and dilated, and sub-conjunctival hemorrhages. Abdominal exam was significant for an in-place PEG tube. Integumentary was significant for partial thickness wounds on his anterior chest and right lower extremity. The patient demonstrated full active range of motion of his upper and lower extremities.

Differential Diagnosis:

Anoxic encephalopathy

Encephalopathy secondary to electrocution

Toxic metabolic encephalopathy

Tests and Results: -Labs on admission were significant for the following: White blood cell count of 5.0; hemoglobin of 10.3; blood urea nitrogen of 55; AST of 42 and ALT of 70. -CT head on admission showed no evidence of intracranial hemorrhage, lobar infarct, hydrocephalus, or midline shift.

Final Diagnosis: Anoxic encephalopathy secondary to lightning strike

Treatment and Outcomes: The patient was started on amantadine to stimulate increased attention and wakefulness, and seroquel and trazadone to help address the patients nocturnal agitation and promote sleep. At the end of his 5 week stay on the acute rehabilitation unit, the patient had advanced to a Rancho Los Amigos level eight. He was fully oriented to his environment, tolerating an oral diet, engaging in appropriate conversation, and ambulating with a walker.

1207 May 30 10:30 AM - 10:50 AM

She's Only Weak Because She Doesn't Play SportsBrian Vernau. *Children's Hospital of Philadelphia, Philadelphia, PA.**(No relevant relationships reported)*

HISTORY: 8 year-old female presents to pediatric sports medicine for evaluation of clumsiness and muscle weakness. She had been following with the school physical therapist for about one year for concerns about balance, coordination, and core strength. School initially had a concern about her confidence and speed on stairs and not keeping up in gym class. She was referred due to continued coordination issues. Per mother, her difficulty with stairs started when she was pushed down the stairs by a peer. She typically places both feet on the step when she climbs stairs. Her core weakness had been attributed to deconditioning and disinterest in sports. Mom feels the school PT is cutting into education time and would like it to stop. She has always been clumsy, which is present in the rest of the family as well.

The patient endorses mild hip and gluteal muscle soreness that has been attributed to growing pains. She falls a lot but no significant injuries. She has always been a toe walker. No handwriting difficulties. Normal developmental milestones per mother.

PHYSICAL EXAMINATION: Genu valgum. Holds thighs together during gait with poor hip swing. Intermittent toe walking with pes cavus. Full pain free ROM about the hips and knees. Mild heel cord tightness. Ligamentous laxity throughout. No tenderness to palpation about the lower extremities. Muscle tone diffusely decreased other than mild increased tone at ankles and feet without atrophy. Strength testing reveals 3/5 straight leg testing, using hands under thighs to move legs. Otherwise, she is 4/5 strength throughout other than 5/5 strength with ankle plantarflexion, great toe extension. DTRs 1+ throughout. Gower's sign negative, but she does walk hands up to feet before standing with difficulty.

DIFFERENTIAL DIAGNOSIS: Muscular dystrophy - Beckers, limb-girdle, spinal muscular atrophy, facioscapulohumeral muscular dystrophy, Myositis, Other myopathy

TEST AND RESULTS: CMP, lipids, TSH unremarkable CK 235, Genetic testing:

Spinal Muscular Atrophy Type 3 **FINAL WORKING DIAGNOSIS:** Spinal Muscular Atrophy Type 3

TREATMENT AND OUTCOMES: She has started nusinersen (Spinraza) therapy and continues with physical therapy. She remains ambulatory 3 months into treatment. Starting to use AFOs for toe walking.

C-15 Rapid Fire Platform - Muscle Fatigue and Force DevelopmentThursday, May 30, 2019, 9:30 AM - 10:50 AM
Room: CC-Hall WA21208 **Chair:** R. Andrew Shanely. *Appalachian State University, Kannapolis, NC.**(No relevant relationships reported)*

1209 May 30 9:30 AM - 9:40 AM

Tropomyosin-based Effects Of Acidosis On Thin-filament Regulation During Muscle FatigueBrent Scott¹, Mike Woodward¹, Thavanareth Prum², Jeffrey R. Moore², Edward P. Debold¹. ¹*University of Massachusetts Amherst, Amherst, MA.* ²*University of Massachusetts Lowell, Lowell, MA.*

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(No relevant relationships reported)

Skeletal muscle fatigue is defined by a loss in the force and velocity generating capacity of a muscle. A portion of the loss in function is attributable to effects of acidosis (i.e. low pH) on the regulatory proteins, troponin and tropomyosin (Tm), which regulate the binding of myosin and actin in a calcium (Ca⁺⁺) dependent manner. However, the relative role of the regulatory proteins is not clear, nor are the mechanisms underlying the effect acidosis has on them. **PURPOSE:** To determine the role of Tm in the acidosis-induced depression of muscle function using isolated muscle proteins in an in vitro motility assay.

METHODS: To test this idea we expressed 3 mutant constructs of Tm with the 2 amino acid residues affected by low pH (histidine residues) replaced with alanine residues (H153A, H276A, H153A/H276A). These constructs were compared to a wild-type Tm, to test the hypothesis that acidosis-induced charge changes of the histidine amino acid governs tropomyosin's pH-dependent decrease in maximal velocity and Ca^{++} -sensitivity. The effect on RTF function was determined by assessing the impact of acidosis on myosin's ability to move regulated actin filaments (RTF) in the motility assay as a function of increasing level of Ca^{++} . This was done separately for the wt-Tm and each structural variant.

RESULTS: A two-way ANOVA (pH x Tm construct) revealed that acidosis significantly ($p < 0.05$) depressed the maximal sliding velocity of the RTFs across all versions of Tm, but that the magnitude of the depression was similar among the wt and all of the Tm mutants. Acidosis did not significantly depress the sensitivity to Ca^{++} under the unloaded conditions of this assay ($p > 0.05$).

CONCLUSIONS: These data suggest that the histidine residues in tropomyosin do not mediate the acidosis-induced depression in contraction velocity observed during muscle fatigue. However, it is possible that these residues are more important in mediating the depression in force, therefore we are currently testing the impact of these mutations in Tm on the acidosis-induced depression in the Ca^{++} -sensitivity using a loaded in vitro motility assay. Supported by: 2018 UMass UMOVE Initiative

1210 May 30 9:40 AM - 9:50 AM

Is Fatigue-induced Loss Of Power Associated With a Change In The Curvature Of The Force-velocity Relation?

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(No relevant relationships reported)

In skeletal muscles, the ability to generate power is reduced during fatigue. Maximal power (P_{\max}) is determined by the force-velocity relationship, which can be closely approximated by the Hill equation, containing three key parameters: 1) Maximal isometric force (F_{\max}), 2) Maximum contraction velocity (V_{\max}) and 3) Force-velocity curvature. **PURPOSE:** To investigate the possible association between the fatigue-induced loss of power and changes in curvature of the force-velocity relation in muscles with different fiber type composition. **METHODS:** The force-velocity relationship was measured before and during development of fatigue in isolated rat soleus (slow-twitch) and EDL (fast-twitch). Muscles were incubated in Krebs-Ringer solution at 30°C and stimulated electrically at 60 Hz for 0.75 s (soleus) or at 150 Hz for 0.2 s (EDL) to obtain serial concentric contractions leading to fatigue. The Force-velocity relationship was measured at different stages of fatigue and after 1 hour of recovery. Force-velocity data were fitted to the Hill equation, and curvature was determined as the ratio of the curve parameters a/F_0 (inversely related to curvature). **RESULTS:** At the end of the fatiguing protocol, maximal power had decreased by $58 \pm 5\%$ (soleus) and $69 \pm 4\%$ (EDL) compared to initial values in non-fatigued muscles. Curvature increased in both muscle types as judged from the decrease in a/F_0 of $81 \pm 20\%$ (soleus) and by $31 \pm 12\%$ (EDL). At the end of the fatiguing protocol, the calculated contributions to the total loss of P_{\max} was $25 \pm 10\%$ from F_{\max} , $17 \pm 3\%$ from V_{\max} and $58 \pm 14\%$ from a/F_0 (soleus) and $64 \pm 6\%$ from F_{\max} , $16 \pm 3\%$ from V_{\max} and $20 \pm 9\%$ from a/F_0 (EDL). Complete recovery of a/F_0 was observed following one hour of rest in both muscle types. **CONCLUSIONS:** Increased curvature of the force-velocity relationship occurs during fatigue in both slow and fast twitch muscles. Particularly in slow-twitch muscles, this increase in curvature is strongly associated with fatigue-induced loss of power.

1211 May 30 9:50 AM - 10:00 AM

The Effect Of Low Frequency Fatigue On Dynamic Muscle Function

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(No relevant relationships reported)

Following fatiguing contractions, muscle contractile function is decreased more at low frequency stimulation compared to high frequency stimulation. This low frequency fatigue (LFF) is well investigated in isometric contraction models, but the effects on dynamic muscle function are less clear. Furthermore, the degree of LFF induced in dynamic contractions by different contraction modes (concentric, isometric, eccentric) has not been compared.

Purpose: To investigate the effect of LFF induced by different types of fatiguing contractions on dynamic muscle function.

Methods: Soleus muscles from Wistar rats were dissected out and incubated in Krebs-Ringer solution. The force-velocity relationship was assessed by a series of brief concentric contractions elicited at 20 and 80 Hz before and 1 h after fatiguing

contractions. Fatigue was induced using 3x 5s of either concentric, eccentric or isometric contractions at 60 Hz. Force-velocity data were fitted to the Hill equation. In some experiments, muscles were exposed to supraphysiological concentration of caffeine to assess the influence of calcium release.

Results: After fatigue induction, both maximal force, velocity and power parameters were more severely decreased at 20 Hz of stimulation compared to 80 Hz of stimulation for all 3 types of fatiguing protocols. Isometric contractions caused a smaller decrease in maximal power compared to concentric contractions and tended to cause a smaller decrease compared to eccentric contractions. Caffeine alleviated the effects of LFF on both maximal force, velocity and power.

Conclusion: LFF can be induced by different types of muscle contraction and affects both maximal isometric force, maximal velocity and maximal power during concentric contractions. These effects can be mitigated by caffeine, indicating an impaired calcium release during LFF.

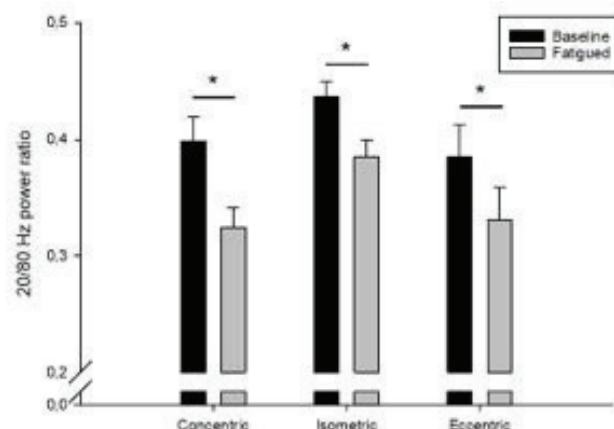


Figure 1: 20/80 Hz power ratio. *significant difference between baseline and fatigued state.

1212 May 30 10:00 AM - 10:10 AM

Comparison of Agonist and Antagonist Muscle Fatigue on Coactivation and Force Production

Cameron S. Mackey, Jesus A. Hernandez-Sarabia, Micheal J. Luera, Alejandra Barrera-Curiel, Jason M. DeFreitas. *Oklahoma State University, Stillwater, OK.*

(No relevant relationships reported)

Little research has been done on whether the fatigue status of a muscle influences its magnitude of coactivation during antagonistic contractions. We hypothesized that a fatigued antagonist would coactivate less, thereby increasing agonist force production. **PURPOSE:** To compare the effects of antagonist fatigue on muscle activation and force producing capabilities of the biceps brachii (BB) and triceps brachii (TB). **METHODS:** Fifteen healthy, college-aged men and women volunteered for this study ($n = 15$; mean \pm SD: age = 25 ± 3 yrs). Surface electromyography (sEMG) was recorded from the BB and TB during elbow extension (EXT) and flexion (FLX) maximal voluntary contractions (MVC) prior to and immediately following EXT or FLX fatigue protocols. Fatigue was induced with intermittent, submaximal contractions, each held at 70% MVC for 10-s with 5-s rest periods. The protocol continued until 70% of the pre-MVC could not be achieved. The amplitude of each EMG signal was assessed as the root-mean-square (RMS; V) and normalized to the value obtained during that muscle group's pre MVC. Separate 2-way (time [pre and post] \times condition [FLX-fatigue and EXT-fatigue]; "within-within") repeated measures ANOVAs were performed for each dependent variable: FLX force (N), EXT force (N), agonist activation, and antagonist coactivation (%). **RESULTS:** There was a significant time \times condition interaction observed for FLX force ($p = 0.005$) and EXT Force ($p \leq 0.001$), but not for BB activation ($p = 0.648$), TB activation ($p = 0.084$), nor coactivation during the FLX ($p = 0.076$) or EXT ($p = 0.681$). Post-hoc tests revealed that FLX fatigue had no effect on EXT force ($p = 0.307$). However, EXT fatigue did significantly affect FLX force ($MD = -35.96$ N; $p \leq 0.001$). Surprisingly, FLX fatigue affected the magnitude of TB coactivation during FLX MVCs ($MD = +8.3\%$; $p = 0.015$), but EXT fatigue did not ($MD = +1\%$; $p = 0.696$). Neither the FLX fatigue condition ($p = 0.30$), nor the EXT fatigue condition ($p = 0.21$) influenced the magnitude of BB coactivation during EXT MVCs. **CONCLUSION:** Contrary to our hypothesis, EXT fatigue had a negative effect on FLX force, not a positive effect. Also unexpected was that EXT fatigue had no effect on TB coactivation during FLX, but FLX fatigue did. More research is needed to determine the factors that influence the magnitude of antagonist coactivation.

1213 May 30 10:10 AM - 10:20 AM

Effects Of Intermittent Fasting And High Intensity Training On Regulators Of Muscle Mass And Metabolism

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(No relevant relationships reported)

Diet-induced obesity can lead to higher intramuscular fat deposition and inflammatory cell accumulation, ultimately having a negative impact on skeletal muscle morphology and function leading to mitochondrial dysfunction and insulin resistance. Intermittent fasting (IF) and high intensity interval training (HIIT) are both effective strategies for losing weight, specifically fat mass. However, the effects on skeletal muscle, specifically genes that regulate mitochondrial function, energy homeostasis, and muscle atrophy are unknown. **PURPOSE:** To investigate the effects of IF and/or HIIT on molecular markers of skeletal muscle mass and metabolic function in diet-induced obesity. **METHODS:** Eight week old mice (C57BL/6, n=39) had ad libitum access to an obesogenic diet (60% fat, 30% sugar) for 12 weeks. They were then randomly allocated to three intervention groups: IF (fasting for 2 alternate days/week), HIIT (3 days/week), combined IF+HIIT (2 alternate fasting days and 3 days HIIT) or control (CON) for a further 12 weeks. Extensor digitorum longus (EDL) muscle weight and expression of PGC1 α , AMPK, citrate synthase (CS), muscle atrophy F-box (MAFbx), and muscle RING Finger-1 (MuRF1) genes were measured at the end of the intervention period. Data was analysed using ANOVA. **RESULTS:** Muscle weights were similar between groups at the end of the intervention period (CON: 9.5 \pm 1.3mg, HIIT: 9.2 \pm 0.8mg, IF: 9.2 \pm 0.4mg, IF+HIIT: 9.7 \pm 0.8mg, p>0.05). PGC1 α and CS gene expression was significantly lower in the IF group compared to the CON (PGC1 α : 0.8 \pm 0.1 vs 1.0 \pm 0.2, CS: 0.8 \pm 0.2 vs 1.0 \pm 0.4, p<0.05). AMPK gene expression was also significantly lower in the IF group, but only compared to the IF+HIIT group (0.9 \pm 0.1 vs 1.0 \pm 0.1, p<0.05). MAFbx and MuRF1 gene expression was significantly higher in the HIIT group (1.7 \pm 0.8 & 2.2 \pm 0.9) group compared to CON (1.0 \pm 0.4 & 1.0 \pm 0.2), IF (0.9 \pm 0.2 & 0.8 \pm 0.2), and IF+HIIT (1.4 \pm 0.3 & 0.9 \pm 0.2, p<0.01). **CONCLUSIONS:** Intermittent fasting reduced gene expression markers of mitochondrial biogenesis and energy homeostasis, while HIIT appeared to increase markers of atrophy at the end of the intervention period. The combination of IF and HIIT did not show any synergistic effects within the muscle.

1214 May 30 10:20 AM - 10:30 AM

Muscle Fibertype Composition Affects Contractile Rate of Force Development (RFD) in vivo

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(No relevant relationships reported)

Differences in muscle fiber type composition across human skeletal muscles are paralleled by comparable differences in electrically evoked contractile Rate of Force Development (RFD), with muscles dominated by type II fibers expressing higher RFD (more steep Force-Time curves) than type I dominated muscles (Harridge et al. 1996). However, little is known about the relationship between muscle fiber type composition and RFD when examined in single heterogeneous muscles in vivo (Maffiuletti et al. 2016, Rodriguez-Rosell et al. 2018). **PURPOSE:** To examine the association between fiber type composition and isolated single-joint RFD for the human quadriceps muscle. **METHODS:** Nine untrained male subjects (physical education students) without prior experience in systematic resistance training were recruited for the study (24.2 \pm 7.3 (SD) yr). Maximal isometric gravity-corrected knee extensor torque (MVC) was obtained at 1000 Hz sampling rate at 70° knee joint angle (0° = full knee extension) (KinCom 500H, Chattecx Corp). RFD was analyzed in the early (0-30 and 50 ms) and late (0-100 and 200 ms) phases of rising muscle force (Aagaard et al. 2002). Muscle biopsy samples (VL) were analyzed for fiber type composition and cross-sectional area (CSA) (Andersen & Aagaard 2000). Linear regression analysis was performed using Pearson product-moment method. **RESULTS:** Fiber CSA was 4535 \pm 1271, 5084 \pm 1865 and 4502 \pm 1970 μ m² for type I, IIA and IIX fibers (\pm SD), respectively, while fiber type area percentage was 48.5 \pm 3.1, 35.5 \pm 2.5 and 15.9 \pm 1.7 %. RFD correlated positively (p \leq 0.01) with type II fiber area percentage (0-30 ms: r=0.79; 0-50 ms: r=0.83; 0-100 ms: r=0.81 and 0-200 ms: r=0.78) (0 ms = onset of force). No relationship was observed between MVC and fibertype composition. **CONCLUSIONS:** Rapid force capacity (RFD) of the human knee extensors was strongly and positively associated with the area weighted proportion of type II myofibers, which explained 63-69% and 61-66% of the variance (r²) in RFD during the early (0-30/50 ms) and later (0-100/200 ms) phases of rising muscle force, respectively. In consequence, resistance training aiming to preferentially increase type II myofiber CSA is expected to result in amplified gains in RFD.

1215 May 30 10:30 AM - 10:40 AM

Effects Of Doublet Stimulation On Dynamic Muscle Contractility In Muscles With K⁺-suppressed Excitability

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(No relevant relationships reported)

PURPOSE: Obtaining optimal dynamic muscle contractility demands activation frequencies higher than those needed to produce maximal isometric force. However, such high activation frequencies increase cellular efflux of K⁺ potentially leading to impaired muscle excitability. *In vivo* stimulation frequencies are often low (*sub-tetanic*), and only contain brief bursts of high frequencies (*supra-tetanic*) in the form of doublets. In the present study, we examined how dynamic muscle contractile performance in fast twitch fibers responds to high constant stimulation frequency or doublets and how this response was modulated by a suppression of excitability through increased extracellular [K⁺]. **METHODS:** Dynamic contractions were elicited in isolated rat EDL muscles stimulated either by constant frequency trains of *tetanic* (150 Hz), by *supra-tetanic* (300 Hz) frequencies, or by a *sub-tetanic* frequency (50 Hz) with or without an initiating doublet (300 Hz). Muscles were incubated at 30°C in Krebs Ringer buffer at 4 or 11 mM K⁺. **RESULTS:** Increasing frequency from 150 Hz to 300 Hz increased maximal power (P_{max}) by 15 \pm 3 %, maximal velocity (V_{max}) by 8 \pm 3 %, and rate of force development (RFD) by 23 \pm 3 % at 4 mM K⁺, but at 11 mM K⁺ these increases were attenuated (V_{max} increased by 5 \pm 2 %) or abolished. When using *sub-tetanic* frequency trains, addition of a high frequency doublet induced increases at both 4 and 11 mM K⁺ in maximal force (F_{max}) (15 \pm 3% and 6 \pm 2 %), P_{max} (62 \pm 13 % and 23 \pm 3 %), V_{max} (35 \pm 3 % and 22 \pm 2) and RFD (59 \pm 7 % and 31 \pm 4 %). These relative doublet-induced increases were significantly higher at 4 mM K⁺ than at 11 mM K⁺. However, the absolute level of dynamic contractile function (with or without doublets) was equal or better at 11 mM K⁺ than at 4 mM K⁺ because an increase in [K⁺] *per se* potentiated the dynamic contractile parameters at the *sub-tetanic* stimulation frequency. **CONCLUSION:** These results show that the improved contractility achieved with high constant stimulation frequency is strongly attenuated when excitability is suppressed by high extracellular [K⁺]. However, when using doublets to initiate a train of *sub-tetanic* frequency, thus, mimicking an *in-vivo* like activation pattern, contractile improvements may be achieved both at normal and at high extracellular [K⁺].

1216 May 30 10:40 AM - 10:50 AM

Relationship Between Rate of Force Development and Correlates of Muscle Contraction for A Normative Data Set.

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(No relevant relationships reported)

PURPOSE: As a performance measure, rate of force development (RFD) is largely underinvestigated, yet has a profound influence on explosiveness, joint stabilization, and rehabilitation. As a result, little is known about the meaningfulness of RFD and its relationship to neuromuscular function in general. The purpose of this study was to present a normative database for RFD, and to investigate relationships between RFD and factors of muscle contraction. **METHODS:** Two hundred participants completed a series of squat exercises at a speed of 10 degrees per second using a multi-joint, isokinetic dynamometer. Normative data was generated for RFD (M = 2070.2 N*s-1, SD = 1076.0) and presented in the form of percentile ranks. Correlations were examined between RFD and factors of muscle contraction, including force, power, time to peak force, time to peak power, position of peak force, and position of peak power. **RESULTS:** Significant positive correlations were observed between RFD and force (r = .441, p = .000) and power (r = .649, p = .000); significant negative correlations were observed between RFD and time to peak force (r = -.653, p = .000), time to peak power (r = -.655, p = .000), peak force position (r = -.181, p = .010), and peak power position (r = -.552, p = .000). **CONCLUSIONS:** The result is a novel, normative database providing a relative scale of RFD, and relating RFD to correlates of muscle contraction. 4.4482216152605 = 9.80665 * 0.45359237

C-29 Free Communication/Poster - Energetics

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1239 Board #1 May 30 9:30 AM - 11:00 AM
Characteristics Of The Fecal Microbiota In Professional Martial Arts athletes: Comparison Between Different Competitive Levels

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(No relevant relationships reported)

PURPOSE: Recent evidences suggest that the athletes have distinct microbial features compared to the sedentary subjects. However, few data have been assessed for the gut microbiota characteristics of athletes at different levels of competition. The aim of this study is to investigate whether gut microbiome is significant difference between higher and lower-level athletes. **METHODS:** Fecal microbiota communities were analyzed by using hypervariable tag sequencing of the V3-V4 region of the 16S rRNA gene among 28 professional hard martial arts athletes, including 12 higher-level and 16 lower-level athletes. **RESULTS:** The gut microbial richness and diversity (Shannon diversity index ($p = 0.019$) and Simpson diversity index ($p = 0.001$)) were significantly higher in higher-level athletes than in lower-level ones. Genera *Phascolarctobacterium*, *Parabacteroides*, *Anaerostipes*, *Anaerotruncus*, *Bifidophila*, *Cloacibacillus*, *Desulfovibrio*, *Flavonifractor* and *Oscillibacter* were enriched in the higher-level group. Interestingly, the genera *Parabacteroides* abundance was significantly correlated with time reported exercising during an average week. Further analysis of the functional prediction revealed that three energy metabolism and methane metabolism were markedly over-represented in the gut microbiota of the higher-level athletes. **CONCLUSIONS:** This study provides the first insight into the gut microbiota characteristics of professional hard martial arts athletes. The higher-level athletes have increased diversity and high metabolic capacity of the gut microbiome, which may be positively influential to their performances. This study was supported by China Postdoctoral Science Foundation (grant number 194837) and SZSM201612071.

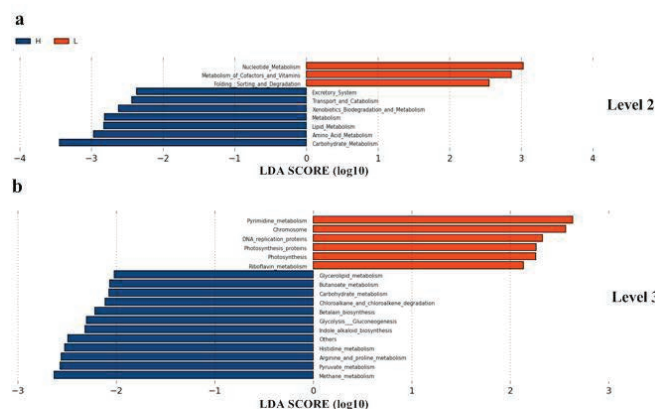


Figure 1. Functional predictions for the fecal microbiome of the higher-level (H) and the lower-level (L) groups. (a) Comparison between the higher-level athletes enriched and lower-level athlete enriched markers on level 2 of KEGG functional category. (b) Comparison between the higher-level athletes enriched and the lower-level athletes enriched markers on level 3 of KEGG functional category. LDA, linear discriminant analysis.

1240 Board #2 May 30 9:30 AM - 11:00 AM
Relative Exercise Intensity And Energy Expenditure Of Exercising On The Freebouncer™

Jared Hartung, Paul Mutch, John P. Porcari, FACSM, Kimberly Radtke, Abigail Ryskey, Carl Foster, FACSM. *University of Wisconsin-La Crosse, La Crosse, WI.* (Sponsor: John Porcari, FACSM)

(No relevant relationships reported)

The Freebouncer™ Fitness and Rehab machine incorporates a spring-loaded platform attached to a metal frame and is designed to provide a low-impact total body aerobic workout. The Freebouncer™ has characteristics similar to mini-trampolines, which have been shown to improve aerobic fitness and positively affect body composition. To date, no research has evaluated the intensity of exercising on the Freebouncer™. **PURPOSE:** To examine the relative intensity of exercising on the Freebouncer™ and determine if it meets ACSM guidelines for improving cardiorespiratory fitness and body composition. **METHODS:** Fourteen apparently healthy volunteers (9 M, 5 F; mean age = 22.6 yrs) completed an incremental maximal exercise test on a treadmill to determine maximal HR (HRmax) and maximal oxygen consumption (VO₂max). After practice, they then completed a 12-minute interval workout on the Freebouncer™, alternating 30 seconds of squats and bursts with 15 seconds of less vigorous exercises. **RESULTS:** It was found subjects exercised at an average of $75 \pm 12.74\%$ of HRmax and $48.0 \pm 4.54\%$ of VO₂max. Average RPE was 12.3 ± 1.35 . Males burned an average of 10.9 ± 1.57 kcal/min and females burned an average of $6.6 \pm .90$ kcal/min. **CONCLUSION:** Collectively these data suggest that exercising on the Freebouncer™ provides a "moderate-intensity" workout that would result in significant improvements in aerobic capacity and body composition if the product is used regularly.

1241 Board #3 May 30 9:30 AM - 11:00 AM
Can Intensity In Strength Training Promote Changes In Caloric Expenditure? Systematic Review And Meta-analysis

Aylton Figueira Junior¹, Daniel Rodrigues¹, Ruy Calheiros Neto², Aquiles Yañes³, Thiago Ferreira², Roberta L. Rica¹, Nelson Cavas Jr⁴, Gustavo Allegretti João¹, Danilo Sales Bocalin⁵. ¹Universidade São Judas Tadeu, Sao Paulo, Brazil. ²Faculdades Metropolitanas Unidas - FMU, Sao Paulo, Brazil. ³Universidade Mayor, Santiago, Chile. ⁴Universidade ibirapuera, Sao Paulo, Brazil. ⁵Universidade Federal do Espírito Santo, Espírito Santo, Brazil.

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(No relevant relationships reported)

Strength training (ST) is considered an important strategy for maintaining body weight, as it promotes an increase in total energy expenditure (EE). However, the combination and manipulation of variables (intensity and volume) allows different training methods. **PURPOSE:** This review aimed to investigate the effect of ST on EE in adults by a systematic literature review and subsequent meta-analysis. **METHODS:** A search was performed on the electronic databases Virtual Library for Health Studies (BVS), PubMed and Science Direct using the following keywords: strength training (resistance training; strength training; strength training method) and energy expenditure (energy metabolisms; energy expenditure; caloric expenditure, caloric cost) with "AND" and "OR" combination. Manual searches of references were also conducted for additional relevant studies. After evaluating the inclusion and exclusion criteria, the selected studies were analyzed according to strength training methods and the training variables used to measure EE. **RESULTS:** The study identified two ST methods from literature review: circuit training (CT) and traditional training (TT). The training density was significantly higher in the CT method when compared with the TT method (TT = 330.61 ± 147.32 vs. CT 749.24 ± 583.70 , $\Delta = -442.32$; IC 95% [-833,17, -51,46] t (-2,52), $p < 0.05$). Meta-analysis showed a significant effect in increases in EE in favor of the TT when compared with CT (-0.99 [95% CI: -1.96, -0.02], $p < 0.01$) with I^2 of 89% ($p < 0.01$). After adjusting for bias risk, no significant differences were found in EE associated with intensity (-0.40, 95% CI [0.98, 0.18], $p = 0.18$). **CONCLUSIONS:** Therefore, the present review and meta-analysis allowed to conclude that the intensity does not seem to be associated to the increase of EE in ST.

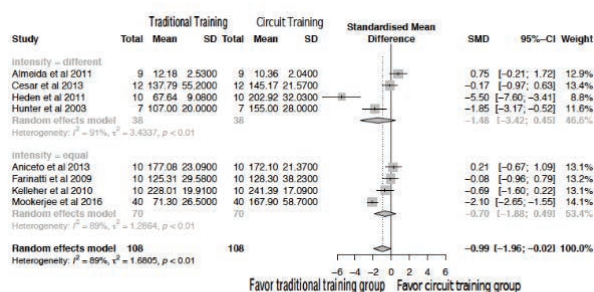


Fig. 2 Forest Plot of the energy expenditure effect of the traditional training method as compared to the circuit training method; confidence interval (CI); standardized mean difference (SMD), standard deviation (SD)

1242 Board #4 May 30 9:30 AM - 11:00 AM Net Energy Efficiency during Synchronous and Asynchronous Arm Cranking at Three different Body Postures

Haejung Jang¹, Somi Yun¹, Jaemyung Kim¹, Eunjin Hwang¹, Ah Reum Jung¹, Hee Jin Lee¹, Dae Taek Lee¹, Ikjin Kwon².

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(No relevant relationships reported)

PURPOSE: This study examined the net energy efficiency (Ee) during synchronous (Syn) and Asynchronous (Asyn) submaximal arm cycling at three different body postures.

METHODS: Nine healthy young men (25.1±3.1 yrs, 177±5 cm, 79.5±12.1 kg, 25.5±3.4 kg/m²), who were not familiar with arm ergometer prior to study, were tested for estimating maximal aerobic capacity (VO₂max) during asynchronous arm cranking on an arm ergometer in 3 body postures; upright (UP; 20.8±2.2, 179±14), recline (RC; 21.1±3.4, 168±17), and forward-bent (BF; 21.4±2.8 ml-O₂/kg/min, 167±17 beat/min of maximal heart rate). Based on VO₂max, 70% of work intensity was determined for each posture. All participants underwent 6 submaximal arm cranking tests (3 postures by 2 arm cranking modes; Syn or Asyn). They cranked at 50 rpm for 10 min at each test. During tests, their oxygen uptake (VO₂) and mechanical work rate was measured. Ee was calculated from work rate divided by energy expenditure, and compared between 2 modes and 3 postures.

RESULTS: The average VO₂ was 15.3±2.3, 14.3±2.9, 17.0±2.9, 15.5±1.6, 15.7±3.2, and 16.2±2.1 ml-O₂/kg/min at UP-Syn, RC-Syn, BF-Syn, UP-Asyn, RC-Asyn, and BF-Asyn, respectively ($p > 0.05$). Their work rate was ranged from 58.3±6.6 to 61.7±7.9 kilojoule. No differences in Ee were found between Syn (20.4±2.5) and Asyn (19.8±1.7%) in UP. Ee was higher during Syn (21.7±2.7) than Asyn (19.0±2.6%) in RC ($p < 0.05$). Ee was not different between Syn (16.9±2.3) and Asyn (17.8±2.2%) in BF. When comparing Ee during Asyn between postures, no differences were found. Ee during Syn in both UP ($p < 0.05$) and RC ($p < 0.005$) was higher than BF.

CONCLUSIONS: Ee during Syn arm cranking at RC showed the highest, while that during Syn cranking at BF did the lowest. In UP, the arm cranking mode did not affect Ee. In RC, Syn cranking was highly efficient than Asyn. Ee was less than 18% in BF at two cranking modes. It is certain that Ee was dependent on the body posture and the arm cranking mode.

1243 Board #5 May 30 9:30 AM - 11:00 AM Urine Lactate after Continuous and Interval Cycling Exercise Bouts Eliciting Different Blood Lactate Concentrations

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(No relevant relationships reported)

Post-exercise urine lactate (UL) has been suggested as a novel exercise biomarker of lactate production. The few studies examining the association between post-exercise peak blood lactate (BL) and UL have reported moderate to high linear correlations. However, these studies have not considered BL concentration during exercise.

Also, the range of BL values was narrow (about 10 mmol/L), thus limiting the predictive value of UL. **PURPOSE:** To examine the association between UL and BL concentrations during continuous and interval exercise of equal mean power.

METHODS: Eleven healthy young males performed four trials in random, counterbalanced order, one week apart. All trials included 20 min of cycling with equal mean power output, performed either continuously (CON) or in the form of interval training including 48 x 10 s (HIIT10), 16 x 30 s (HIIT30), or 8 x 60 s (HIIT60) bouts at a power output corresponding to 100% of VO₂max. Recovery intervals during the HIIT trials included cycling at 15% of VO₂max for 150% of the exercise bout time. Capillary BL concentration was measured at rest and every 5 min during exercise, and UL concentration was measured in urine samples obtained pre- and 1 hour post-exercise, with controlled hydration. BL and UL results were analyzed using 2-way ANOVA with repeated measures (trial x time). The association between incremental area under the blood lactate curve (BL-AUC) and UL concentration was determined using linear and exponential functions.

RESULTS: BL increased compared with baseline in all trials from the first 5 min of exercise ($p < 0.01$). BL-AUC increased from CON to HIIT10, HIIT30 and HIIT60 (61.7 ± 21.2, 83.4 ± 29.0, 97.8 ± 34.0, 147.4 ± 44.2 mmol/L x min, respectively, $p < 0.01$). However, post-exercise UL increased from baseline only in HIIT60 (from 1.2 ± 1.0 to 22.5 ± 23.3 mmol/L, $p < 0.001$). Exercise BL ranged from 3.0 to 17.7 mmol/L, while post-exercise UL ranged from 0.2 to 76.4 mmol/L. The best function describing the BL-AUC and UL relationship was exponential ($r = 0.68$, $p < 0.05$).

CONCLUSIONS: The lack of increase in UL despite an increase in BL and their exponential association suggest that there may be a threshold above which BL cannot be disposed within the body and is excreted by the kidneys.

1244 Board #6 May 30 9:30 AM - 11:00 AM The Autonomic Balance Of Master Athlete During Stress Is Associated To Antioxidant Profile

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(No relevant relationships reported)

There is a lack in the literature regarding the relationship between autonomic function, as measured by markers of heart rate variability, and the redox balance of master athletes. **PURPOSE:** The redox profile and autonomic responses to stress were measured in master athletes and untrained controls, and the relationships between markers of HRV and redox balance were determined. **METHODS:** Participants ($n = 55$) were 16 master athletes (52.75±9.7yrs, minimal of 20 yr. of lifelong athletic training), 19 age-matched (49.5±10.5yrs) and 20 young controls (22.42±3.8yrs). The volunteers remained seated for 15-min in early morning, with the final 10-min being considered for baseline HRV recordings (Polar RS800X Heart Rate Monitor®), and then were submitted to a cold pressure test (CPT) by immersing the right hand in cold water (3-4 °C) for two minutes in which HRV was measured. The pro-and anti-oxidant status were determined in blood after 8-hour fasting by using commercial kits. A two-way ANOVA with repeated measures and Pearson's moment correlation enabled for comparisons and correlations.

RESULTS: The autonomic profile of master athletes was better than age-matched controls and similar to young control group. No significant correlations were observed between redox profile and HRV parameters in resting [SOD, CAT, AU e TBARS ($p > 0.05$)]. However, during stress (CPT) the participants who presented a higher HRV index (indicating an increased parasympathetic tone during CPT) had a better antioxidant defense, with significant correlations between SOD vs. SDNN ($r = 0.389$; $p = 0.02$), RMSSD ($r = 0.362$; $p = 0.03$), and nn50 ($r = 0.416$; $p = 0.01$); between CAT vs. Mean R-R ($r = 0.346$; $p = 0.03$), SDNN ($r = 0.375$; $p = 0.02$), and RMSSD ($r = 0.348$; $p = 0.03$); as well as between AU vs. nn50 ($r = 0.383$; $p = 0.02$). Similar relationships were observed during post-stress recovery: SOD vs RMSSD ($r = 0.386$; $p = 0.02$) and nn50 ($r = 0.395$; $p = 0.02$); CAT vs. RMSSD ($r = 0.436$; $p = 0.008$) and nn54 ($r = 0.413$; $p = 0.01$); and AU vs. RMSSD ($r = 0.386$; $p = 0.02$) and nn50 ($r = 0.350$; $p = 0.03$). **CONCLUSION:** Besides having a better autonomic and redox balance in comparison to aged-matched controls, the responses of master athletes were similar to young group. Moreover, an improved autonomic balance during stress was associated to a better antioxidant status of the participants.

1245 Board #7 May 30 9:30 AM - 11:00 AM

Effect Of Wearing Compression Tights On Muscle Oxygenation And Exogenous Glucose Utilization During Prolonged Cycling

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PURPOSE: To determine effect of wearing compression tights on muscle oxygenation and exogenous glucose utilization during prolonged cycling in endurance athletes.

METHODS: Ten triathletes (19.9 ± 1.2 years, 172.2 ± 4.4 cm, 62.0 ± 3.8 kg, BMI; 20.9 ± 0.7 kg·m⁻²; VO₂max; 59.3 ± 4.4 ml·kg⁻¹·min⁻¹) completed 3 trials under respective conditions: 1) wearing a compression tight with approximately 15 mmHg [MED trial], 2) wearing a compression tight with approximately 30 mmHg [HIGH trial], and 3) wearing a tight with below 5 mmHg [CON trial]. The exercise consisted of 90 min of cycling at 65% of VO₂max. Changes in exogenous glucose utilization (¹³C excretion in expired gas after consuming ¹³C labeled glucose), muscle oxygenation (oxy-hemoglobin, deoxy-hemoglobin, total hemoglobin and tissue saturation index), blood parameters (blood glucose and lactate, and serum glycerol, insulin and total ketone body concentrations), blood gas parameters (pH, pO₂, pCO₂, HCO₃⁻, Na⁺ and K⁺), respiratory variables (VO₂, VCO₂, VE, RER), heart rate and rating of perceived exertion were evaluated throughout the exercise. Time to exhaustion test (at 85% of VO₂max) was performed after completing 90 min of cycling to evaluate endurance performance.

RESULTS: Exercise rapidly increased ¹³C excretion, but highest value of ¹³C excretion was significantly shown earlier in the MED trial (47.1 ± 9.9 min) compared with in the other trials (HIGH trial: 67.3 ± 23.7 min, CON trial: 54.0 ± 9.5 min, *P* = 0.033).

Although MED trial showed significant lower oxy-hemoglobin throughout the exercise (*P* = 0.003), the changes in deoxy-hemoglobin, total hemoglobin and tissue oxygenation index did not differ among the trials. No significant difference was observed for changes in other variables among the trials.

CONCLUSION: Wearing a compression tights exerting approximately 15 mmHg on thigh facilitated exogenous glucose utilization during 90 min of cycling.

1246 Board #8 May 30 9:30 AM - 11:00 AM

Seasonal Changes in Salivary Biomarkers and Psychomotor Function Among Elite Fencers

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PURPOSE: The present investigation sought to follow a group of elite fencers (n=10) through the competitive season monitoring salivary biomarkers and psychomotor function in order to develop a better understanding of the effects of training and peak competition in this sport.

METHODS: The methods for the present investigation are consistent with the declaration of Helsinki. Athletes provided saliva samples during the morning hours on 22 separate occasions during the main competitive phase of their annual training plan. Additionally, these same athletes completed a standard finger tapping psychomotor test on a tablet before and after training during this same phase of the annual plan. The saliva samples were analyzed via a point of care salivary analysis system for salivary IgA and Cortisol hormone. Finally, the primary coaches for the fencers provided a rank order for the athletes to determine highest and lowest performers. Data was analyzed for trends over time, by athlete rank and by pre-post training sessions using JMP 13.0 Pro software. Statistical significance was set a priori at *p* < 0.05.

RESULTS: A significant main effect for time was noted when analyzing pre to post practice change in finger tapping speed over the course of the season (*F* = 5.23, *p* = 0.024). Further analysis revealed that rank order of athletes (*F* = 2.08, *p* = 0.043) produced a significant main effect within the data for change in finger tapping speed pre to post practice. (Top half of athletes: 0.259 sec pre, 0.246 sec post; Bottom half of athletes: 0.282 sec pre, 0.251 sec post). Additionally, a significant main effect for time was noted for morning salivary cortisol (*F* = 2.35, *p* < 0.001). Average values for the group were less than 12 nm during the initial part of the training season, peaked during the middle of the monitoring period at 20.6 nm then fell towards the conclusion of the

season during the main competitions back below 12 nm. A main effect for time was not noted for salivary IgA (*F* = 0.969, *p* = 0.504). Average values for the season for salivary IgA were 402.5 ± 203 ug/ml.

CONCLUSIONS: Based upon the results of this observational study it appears that stress hormones in elite fencers peak mid-season then decline during the taper at the end of the season. Additionally, it appears that the best of the elite athletes have better baseline psychomotor function.

1247 Board #9 May 30 9:30 AM - 11:00 AM

Perceived Energy and Well Being in Collegiate Football Players with and without Sick Cell Trait

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(No relevant relationships reported)

Sickle cell Trait (SCT) has measurable physiological effects. Whether SCT has marked psychological effects in elite collegiate football players (ie perceived their energy levels, mood state, and overall well-being) compared to position-matched controls is unknown. **Purpose:** To examine self-perceptions of sleep quality, mood state, and general well-being in Division 1 football players with and without SCT.

Methods: Participants with SCT were identified by a team physician and confirmed by electrophoresis and paired with position-matched controls (n=12). Assessments included the Pittsburgh Sleep Quality Inventory (PSQI), Daily Analysis of Life Demands for Athletes Questionnaire (DALDA), Activation-Deactivation Adjective Check List (AD-ACL), and General Well-Being Questionnaire (GWB). Data was collected at three time points; before pre-season camp, after pre-season camp, post-season. **Results:** SCT reported higher levels of energy on the AD-ACL assessment than the control group at baseline (13.65 ± 0.68 vs. 11.56 ± 0.66, *p* < 0.05). No group*time interaction existed (*p* = 0.20). On the GWB, no differences between groups were found; however, a significant decrease in perceived well-being between pre-camp and post-camp (38.86 ± 1.80 vs. 32.08 ± 1.72, *p* < 0.05) and pre-camp and post-season (38.86 ± 1.80 vs. 32.69 ± 1.86, *p* < 0.05) was noted across all participants. Perceived sleep quality was similar across all participants at all time points. **Conclusion:** Participants with SCT reported a greater energy level coming into training camp and had similar perceived energy at the beginning and end of the competitive season compared to position-matched controls. GWB did not differ between groups but decreased in all athletes throughout the season. Interestingly, the post-season survey may be skewed by the win or loss from the final game. The decrease at the start of the season could be due to increased stress due to academic responsibilities or the expectation to perform well and win competitions. Future research will correlate these psychological findings to biological markers of stress and fatigue.

1248 Board #10 May 30 9:30 AM - 11:00 AM

Effect of Gas Exchange Measurements on Critical Power and Determination of Peak Oxygen Uptake during 3 min Critical Power Tests

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No data have been reported regarding the effect of performing gas exchange measurements during 3 min "all-out" tests of cycling Critical Power (CP) on the CP value itself. Conflicting data exists regarding the validity of determining peak oxygen uptake (VO_{2peak}) during 3 min CP tests. **PURPOSE:** To determine if differences exist between CP measurements performed with metabolic gas exchange data (WMD) and without (Control) during 3 min leg cycling tests. A second aim of this study was to determine if VO_{2peak} can be determined using data from the 3 min CP test. **METHODS:** Nineteen physically active (VO_{2peak} = 34.7 ± 7.7 ml/kg/min) subjects completed a ramp test to determine VO_{2peak} and two 3 min CP tests (WMD and control). VO_{2peak} was determined from an average of the last 30 sec of the ramp test and compared to VO₂ measured during the final 30 sec of the WMD CP test. Critical power (watts) was the mean power attained during the last 30 sec of the CP tests. The curvature constant (W') was computed as the power-time integral above CP. **RESULTS:** No differences (*p* = 0.11) were observed for CP in the WMD trial compared to the control condition (172 ± 46 W, 169 ± 49 W, respectively). Similarly, no differences occurred for W' (11.3 ± 5.4 kJ WMD, 11.7 ± 4.4 kJ control, *p* = 0.61) and peak watts (673 ± 326 W WMD, 636 ± 335 W control, *p* = 0.84). In regard to VO_{2peak} measured during the CP test (2517 ± 576 ml/min) and that of the ramp test (2564 ± 550 ml/min), there were no differences (*p* = 0.23). **CONCLUSIONS:** These data indicate that CP, peak W, and W' values do not differ between a 3 min all-out test performed with or without gas exchange measurements. Thus, one can be confident

that performing metabolic gas measures during the 3 min CP test does not bias the CP and W' data. As no significant differences were found for VO_{2peak} between the ramp and CP test, the data supports the contention that it is possible to obtain VO_{2peak} in a 3 min all-out CP test.

1249 Board #11 May 30 9:30 AM - 11:00 AM
Potential Benefit of Repeated Resting Metabolic Rate Measurements

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Obtaining valid and reliable measurements for resting metabolic rate (RMR) via indirect calorimetry is critical for clinical and research purposes. **PURPOSE:** The primary aim of the study was to determine the reliability of RMR measurements under standard (best practice conditions). The secondary aim was to determine if normal fluctuations in skin temperature, core temperature, heart rate, or environmental factors affect repeated RMR measurements. **METHODS:** Twenty college-aged men entered the lab following an overnight fast. Following twenty minutes of sitting quietly, continuous measurements of environmental temperature, relative humidity, skin temperature, core temperature, and heart rate were recorded along with RMR. Following the initial RMR measurement, participants sat quietly for an additional forty minutes. A second RMR measurement was then completed following the same protocol. Differences between the initial measurement and second measurement for RMR, inter-beat interval, core temperature, skin temperature, and environment were determined using a paired samples t-test for normally distributed data. A Wilcoxon signed-rank test was used for non-normally distributed data. Multiple linear regression was used to determine the relationship between inter-beat interval, core temperature, skin temperature, and environment on RMR measurements. All data are presented as mean \pm SEM. **RESULTS:** The higher of the two RMR measurements was 2067.58 ± 66.03 kcal/day while the lower of the two RMR measurements was 1975.31 ± 64.85 kcal/day ($t = 4.32$, $p < 0.01$). Similarly, the higher of the two core temperature measurements was $37.05 \pm 0.09^\circ\text{C}$ while the lower of the two core temperature measurements was $36.74 \pm 0.09^\circ\text{C}$ ($t = 7.17$, $p < 0.01$). The change in R-R interval for heart rate was significantly correlated with the higher and lower RMR measurements ($r = 0.47$, $p = 0.04$ and $r = 0.53$, $p = 0.02$, respectively). No other factors were significantly related to changes in RMR. **CONCLUSION:** Even when best practice guidelines are followed, significant variability in RMR measurements separated by forty minutes suggest that two measurements of RMR may be necessary to obtain accurate data.

1250 Board #12 May 30 9:30 AM - 11:00 AM
Effects Of Eccentric Versus Concentric Exercise Of The Trunk Extensor On Muscle Function, Blood Lipid Profile And Glycemic Response

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The variability in the insulin-stimulated glucose uptake of different skeletal muscles may be partly attributable to the differences in the muscle fiber type composition and the level of expression of the insulin-responsive glucose transporter known as Glucose transporter type 4. **PURPOSE:** To compare and evaluate the functional and metabolic changes from EIMD of the trunk extensor as compared with those induced by concentric contractions. **METHODS:** In a double-blinded, randomized, crossover trial, and ten men performed a single bout of 50 maximal voluntary concentric (CON) and eccentric (ECC) contractions of the trunk extensor at 2 weeks interval. The indirect markers of muscle damage (muscle soreness; SOR, creatine kinase; CK), the muscle function (muscle strength and muscle endurance), the lipid profile (triaclylglycerols; TGs, total cholesterol; TC, high-density lipoprotein cholesterol; HDLC, low-density lipoprotein cholesterol; LDLC) and the glycemic response (glucose, insulin, homeostasis model assessment; HOMA), and glycosylated hemoglobin) were measured before, immediately after, and 24, 48, 72, and 96 hours after each bout of exercise. Moreover, the muscle activity of paraspinal muscles were also recorded during CON and ECC.

RESULTS: The SOR at 24, 48, 72, and 96 hours after ECC had significant increased as compared with that after CON ($p < 0.05$). The TG, TC, LDLC, and TC/HDLC levels were significant lower at 48, 72, and 96 hours after ECC, as compared with those after CON ($p < 0.05$, respectively). The levels of glucose and HOMA were significantly higher at 48 and 72 hours after ECC as compared with those after CON ($p < 0.05$, respectively). However, no significant changes in the muscle strength and endurance,

HDLC, insulin, and glycosylated hemoglobin were observed between the two groups. Meanwhile, the LM and ILL activities were significantly higher during ECC than during CON ($p < 0.05$, respectively).

CONCLUSIONS: Thus, the study confirmed that EIMD of the trunk extensor had positive effects on the blood lipid profile and the glycemic response, and the LM and ILL showed a high level of muscle activity during ECC.

1251 Board #13 May 30 9:30 AM - 11:00 AM
Lactate Threshold Velocity At 4 mMol/l Does Not Maintain Blood Lactate Levels During Steady State Intensity

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Evidence shows that lactate threshold (LT) is a valid tool to evaluate endurance capacity and is used to prescribe training intensities. However, there are discrepancies between LT test methodologies and the way to use LT to prescribe training velocities, maintaining metabolic stress in steady-state intensity bouts. Few studies have investigated the relationship of LT Velocity at 4 mMol/l (V4) with intensity prescription on Interval Training (IT) workouts. **PURPOSE:** To determine if V4, obtained via an incremental test, can maintain Blood Lactate (BL) predicted, during a steady-state IT workout in swimmers. **METHODS:** Ten well trained swimmers (19.42 ± 6.77 yrs) performed two freestyle tests: an incremental 6x200-m test with 1-min passive rest, measuring Heart Rate (HR) and BL after each repetition to determine V4; and, 4 days after, a steady-state IT 10x200-m test with 1-min passive rest at V4, measuring BL and HR after reps. 2-4-6-8-10. Paired t-tests were used to compare V4 vs. IT speeds and times and BL@V4 vs. BL after reps. 2-4-6-8-10. In addition, repeated measures ANOVA was used to compare BL after reps. 2-4-6-8-10. Finally, Pearson's correlations (r) were obtained between BL vs HR in both incremental and steady state tests. **RESULTS:** Same speeds and times for V4 and IT were observed (1.38 ± 0.07 m/s and 145.4 ± 7.6 s vs 1.38 ± 0.07 m/s and 145.5 ± 7.5 s, respectively, $p > 0.05$). BL levels were maintained at BL@V4 levels only during reps 2 and 4 (4.10 ± 0.52 ; 3.72 ± 0.63 mMol/l, respectively, $p > 0.05$ vs. BL@V4); however, BL levels decreased over time during reps 6, 8, and 10 (3.59 ± 0.29 ; 3.40 ± 0.33 ; 3.13 ± 0.30 mMol/l, respectively, $p < 0.01$ vs. BL@V4 and vs. reps 2 and 4). Additionally, there was a moderate correlation ($r = 0.69$) between BL and HR during the incremental test. However, a low correlation ($r = 0.26$) between BL and HR during the steady state IT test was observed. **CONCLUSION:** V4 from an incremental test underestimates BL level showing, a progressive decrease during the steady-state IT test. These results suggest that IT at V4 might not be enough to maintain metabolic stress during an IT bout, especially during the second half of it. Additionally, the moderate and low correlations observed between BL vs. HR suggest that HR might not be a good marker of exercise intensity in swimmers.

1252 Board #14 May 30 9:30 AM - 11:00 AM
Validation Of Gas Analysis Over Incremental Work Intensities - A Comparison Of Two Metabolic Measurement Systems

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 (No relevant relationships reported)

Indirect calorimetry is a practical and accurate method of measuring metabolic gas exchange rate, specifically volume of oxygen and carbon dioxide ($\dot{V}O_2$ and $\dot{V}CO_2$). Commercial stationary and mobile systems typically include automated metabolic gas analyses. Metabolic cart systems are considered the standard; however, they pose limitations due to cost and portability. **PURPOSE:** To compare the accuracy of a commercially available mobile system (CareFusion Oxycon Mobile®, OXYCON) to a criterion stationary cart system (ParvoMedics TrueOne 2400®, PARVO). **METHODS:** Fifteen volunteers (13 Male, 2 Female; 24 ± 6 y (mean \pm SD), 77 ± 13 kg BW, VO_{2peak} 3.9 ± 0.7 L \cdot min⁻¹) completed four trials over two non-consecutive study days. Trials consisted of a rest period, followed by three incremental treadmill work rates: walk ($23\text{--}36\%$ VO_{2peak}), jog ($49\text{--}67\%$ VO_{2peak}), and run ($60\text{--}76\%$ VO_{2peak}) in controlled laboratory conditions ($20 \pm 0.5^\circ\text{C}$; $45 \pm 22\%$ RH). Metabolic system order was randomized and data collected was averaged over 3-4 minute steady-state periods from each work intensity. Correlation coefficients and systematic bias were used to evaluate the agreement between the systems. **RESULTS:** Measurements of $\dot{V}O_2$ from

the OXYCON and PARVO were highly correlated ($R^2=0.99$). The OXYCON showed some positive bias ($0.18 \pm 0.16 \text{ L}\cdot\text{min}^{-1}$) that increased with work intensity: rest ($\dot{V}\text{O}_2$ $0.05 \pm 0.06 \text{ L}\cdot\text{min}^{-1}$), walk ($\dot{V}\text{O}_2$ $0.15 \pm 0.09 \text{ L}\cdot\text{min}^{-1}$), jog ($\dot{V}\text{O}_2$ $0.26 \pm 0.16 \text{ L}\cdot\text{min}^{-1}$), and run ($\dot{V}\text{O}_2$ $0.31 \pm 0.16 \text{ L}\cdot\text{min}^{-1}$).

CONCLUSION: The mobile OXYCON is an acceptable alternative to stationary metabolic cart systems for measuring metabolic gas exchange rate during rest and low intensity exercise. Clinicians may consider alternative devices for assessments at higher work intensities.

1253 Board #15 May 30 9:30 AM - 11:00 AM
Tissue Oxygen Index Response During Maximal On-ice And Cycling Performances With Short Track Speed Skaters

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(No relevant relationships reported)

Cycling tests are usually performed to assess short track speed skater's performances. However, the cycling movement patterns and body position are quite different from the skating movement patterns and the low position that skaters adopt during speed skating on the short track. Thus, a comparison of muscle oxygenation between cycling and skating was conducted, as the low skating position may restrict blood flow to the lower limbs.

PURPOSE: The aim of this project was to create an on-ice test to compare skaters' $\dot{V}\text{O}_2$ max and tissue oxygen index (TOI%), while performing maximal progressive tests during on-ice skating and on a cycle ergometer.

METHODS: Twenty-four Canadian short track speed skaters of the provincial level or higher participated in the study. Skaters took part in two separate progressive maximal tests on ice and on a cycle ergometer. Oxygen consumption ($\dot{V}\text{O}_2$) was continuously monitored during both tests with a portable metabolic analyzer. Tissue oxygen index (TOI%) was also continuously measured on the vastus lateralis of both legs during both tests and during the post exercise recovery phase. A modified Borg scale was used to assess the rate of perceived cardiovascular effort (RPE), as well as leg pain.

RESULTS: $\dot{V}\text{O}_2$ max reached on-ice was significantly lower than $\dot{V}\text{O}_2$ max reached on a cycle ergometer (3.56 ± 0.65 vs $4.28 \pm 0.79 \text{ L}\cdot\text{min}^{-1}$, $p=0.001$, respectively). When expressed as a function of $\dot{V}\text{O}_2$, the TOI% was significantly lower during skating vs cycling for any tested $\dot{V}\text{O}_2$. The TOI% of the right leg (RL) was significantly lower than the left leg (LL) at any $\dot{V}\text{O}_2$ for both skating and cycling. At maximal capacity ($\dot{V}\text{O}_2$ max), TOI% was similar for both skating and cycling ($\sim 10\%$). During the recovery phase, TOI% peaked at 80% after 180s of recovery after skating, while it took 120s after cycling. The RPE of cardiovascular effort was significantly lower at the end of the on-ice test vs ergometer cycling test (15.9 ± 2.1 vs 17.0 ± 2.1 , $p=0.005$). However, no differences were detected for leg pain (18.5 ± 1.1 vs 18.4 ± 1.5 , $p=0.671$, respectively).

CONCLUSIONS: The low position adopted by speed skaters appears to restrict blood flow to the lower limbs and thereby negatively impacts muscle oxygenation. These findings reveal the importance of testing short track speed skaters directly on the ice.

1254 Board #16 May 30 9:30 AM - 11:00 AM
Minimal Effects of Hypoxia on Energy System Contribution during Supramaximal Upper-Body Exercise in Women

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(No relevant relationships reported)

High-intensity exercise performed under hypoxic conditions may yield beneficial physiological adaptations due to altered reliance on the anaerobic energy system. This type of intervention is commonly evaluated during lower body cycling; however, considerable differences exist in the upper body musculature, particularly in women.

PURPOSE: To determine the effects of normobaric hypoxia on energy system contribution in females during high-intensity upper-body time to exhaustion trials.

METHODS: Thirteen recreationally active women (age: 22.7 ± 2.6 y; height: 167 ± 8.6 cm; weight: 66.4 ± 9.7 kg; body fat: $27.6 \pm 5\%$ body fat) completed a graded exercise test in both normobaric hypoxia ($\text{H}; \text{F}\text{I}\text{O}_2 \sim 14\%$) and normoxia ($\text{N}; \text{F}\text{I}\text{O}_2 \sim 20\%$) to exhaustion on an arm ergometer to determine the relationship between O_2 uptake and peak power output (PPO). Each participant completed two constant work-rate arm-cranking tests at 110 and 120% PPO in both N and H. Utilizing oxygen consumed during the constant work-rate tests, energy system contribution was determined using the accumulated oxygen deficit method. Two-way (condition \times intensity) repeated measures ANOVA was used to compare absolute AOD ($\text{L}\cdot\text{min}^{-1}$) and AOD relative to lean arm mass ($\text{L}\cdot\text{min}^{-1}\cdot\text{kg}^{-1}$). Three-way (condition \times intensity \times energy system) repeated measures ANOVA was used to compare the percent contributions of the aerobic and anaerobic energy systems. Results are reported as

95% confidence intervals (CI). **RESULTS:** No significant condition \times intensity interactions were noted for relative or absolute AOD ($p>0.05$). A main effect was observed for energy system ($p<0.05$) with aerobic values (95% confidence interval: 59.8% to 71.3%) being greater than anaerobic values (95% CI: 28.7% to 40.2%), while an intensity \times energy system interaction was shown ($p<0.05$) with greater anaerobic contribution at 120% PPO (95% CI: 32.6% to 44.3%) compared to 110% PPO (95% CI: 22.9% to 27.9%). **CONCLUSIONS:** Moderate normobaric hypoxia had little effect, if any, on energy system contribution during high-intensity, constant work-rate arm-cranking in women. These findings suggest that limitations may exist for women when considering hypoxia as a means of altering metabolic stress during supramaximal upper body exercise.

1255 Board #17 May 30 9:30 AM - 11:00 AM
Dual Stress Warm-Up Protocol Does Not Significantly Alter Blood Glucose Concentration

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(No relevant relationships reported)

Dual stress challenges (e.g. paired physical and psychological challenges) have been shown to increase catecholamine and cortisol responses above that of exercise alone; however, the underlying mechanisms to explain this effect are not well defined. The increased hormonal response is thought to be the result of a greater glucose demand due to the challenges imposed on both the brain and skeletal muscle. **PURPOSE:** To determine whether a dual stress warm-up protocol significantly alters circulating glucose concentrations before and after a Wingate Anaerobic Test (WAnT).

METHODS: Thirteen college-aged subjects (Mean \pm SD; age = 21 ± 3 yr; Height = 177 ± 9 cm; Weight = 81.8 ± 11.8 kg) volunteered to participate and completed a familiarization WAnT on a Monark cycle ergometer using a resistance of 7.5% bodyweight prior to testing. On two separate visits, separated by at least 3 d but no more than 1 wk, subjects randomly completed a WAnT preceded by either a 5 min warm-up at a resistance of 1.5% BW at a pedal rate of 70-80 rpm (CTRL) or the same warm-up while also completing the Paced Auditory Serial Test, which is a mental arithmetic challenge (EXPT). Blood glucose was measured at 5 time points (pre, post warm up, post WAnT, and at 5 min and 10 min post WAnT) using a Contour NEXT Blood Glucose Monitor. Subjects abstained from caffeine, alcohol, and exercise for the 24 hr prior to testing. Diet was standardized across subjects for the 12 hr prior to each visit. Data were analyzed using a 2x5 repeated measures ANOVA ($\alpha < 0.05$).

RESULTS: There were no significant interactions between the two conditions. However, there was a main effect for time ($p = .001$) with glucose concentrations significantly increased at 5 min post WAnT. **CONCLUSION:** These findings suggest that incorporating a psychological challenge during a warm-up session had no effect on glucose concentrations following a WAnT when compared to warm-up session alone. The lack of a significant finding may be due to the relatively small sample size or by the lack of difficulty of the mental challenge. Future studies are warranted using higher-stress cognitive tests to gain a better understanding of the effect of dual stress challenges on glucose concentrations prior to and following exercise.

1256 Board #18 May 30 9:30 AM - 11:00 AM
Exercise Intensity, Energy Expenditure And Enjoyment During Variable High Intensity Exercise In Healthy Adults.

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(No relevant relationships reported)

Variable high-intensity exercise bouts may generate similar energy expenditures and possibly be favored over moderate-intensity exercise as an alternative to obtain optimal health benefits. **PURPOSE:** To examine exercise intensity, energy expenditure and perceptual responses to work-matched moderate-intensity steady-state exercise (MIE) and variable-intensity exercise (VIE) conditions in healthy adults ($n = 6$, age = 24.3 ± 5.4 yrs). **METHODS:** A graded exercise test on the cycle ergometer to maximal exertion was utilized to determine maximal oxygen uptake ($\dot{V}\text{O}_2$), maximal heart rate (HR) and work rate max (WRmax) for subsequent conditions. The two experimental conditions (MIE and VIE) were randomized and performed on separate days. MIE consisted of continuous moderate-intensity exercise at 40% of WRmax. VIE consisted of sixteen 10-sec supramaximal sprints (120% WRmax), sixteen 20-sec high intensity bouts (60% WRmax) and low-intensity recovery (20% WRmax) interspersed throughout the exercise. Total duration and total work were matched between conditions. $\dot{V}\text{O}_2$, heart rate (HR) were averaged over the entire bout for both conditions. OMNI ratings of perceived exertion (RPE) and affect, via Feelings Scale, were measured during exercise and enjoyment was measured post-exercise using the physical activity enjoyment scale. Responses between conditions were analyzed

using paired t-tests. Significance was established if $p < 0.05$. **RESULTS:** During VIE and MIE, HR (156 ± 10 bpm vs. 141 ± 12 bpm) and percent of maximal HR ($81.6 \pm 3.2\%$ vs. $73.3 \pm 4.1\%$) were significantly different. Absolute $\dot{V}O_2$ during VIE and MIE were 1.42 ± 0.22 L·min⁻¹ and 1.27 ± 0.24 L·min⁻¹ ($p = 0.13$). The intensities relative to $\dot{V}O_{2max}$ were similar between bouts (VIE = $50.9 \pm 10.3\%$; MIE = $44.9 \pm 8.0\%$). Total energy expenditure of VIE and MIE were 212.5 ± 32.3 kJ and 189.4 ± 36.3 kJ, respectively ($p = 0.12$). While perceived exertion (VIE = 4.6 ± 0.9 ; MIE = 3.6 ± 1.3) was similar between trials, in-exercise affect and post-exercise enjoyment were greater in VIE (2.0 ± 0.9 and 92.2 ± 3.3) compared to MIE (1.7 ± 1.0 and 77.2 ± 5.8). **CONCLUSION:** In healthy adults, VIE was perceived as more positive and enjoyable, while eliciting a greater HR response and similar energy expenditure compared to MIE. VIE may be an alternative exercise to MIE to obtain health benefits.

1257 Board #19 May 30 9:30 AM - 11:00 AM
Muscle Energy and Salivary Cytokine Response During a 100 Mile Trail Run: A Case Study
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 (Sponsor: allen parcell, FACSM)
 (No relevant relationships reported)

Purpose: The purpose of this study was to determine the impact of competing in a 100-mile ultramarathon on muscle fuel stores and cytokine production. **Methods:** One experienced male runner (40 yrs, 76.3 kg, 177.8 cm) completed the 100.5-mile distance in 32.9 hrs. Measurements were collected pre-race, at each support crew accessible aid station (28.5, 41, 52, 66, and 80 miles), and post-race. Measures included saliva cytokine markers (IL-6 and TNF- α), muscle energy status, and body mass. Saliva was collected using a passive drool technique and samples were stored on dry ice until they could be sent out for analysis. Muscle energy status (MES) was determined by scanning the right rectus femoris with a portable ultrasound transducer. Scanned muscle images were uploaded to a cloud-based application where they were analyzed for MES, which is an arbitrary number assigned to the muscle based on predicted glycogen concentration. Caloric expenditure was predicted based off average pace and terrain. Caloric intake was monitored by a combination of self-reporting, product wrapper collection, and unconsumed fluid measurement. **Results:** Caloric expenditure was estimated at 13,184 kcal (401 kcal/hr), while caloric intake was recorded at 5888.3 kcal (180 kcal/hr). Body mass declined 2.4% from pre to post-race, although it fluctuated throughout the race (76.3, 74.7, 74.1, 75.1, 75.9, 75.4, 74.5 kg; respectively). MES was reduced 57% from pre to post-race, but also fluctuated throughout the race (88.0, 34.4, 71.9, 25.1, 69.1, 70.9, 38.2). IL-6 levels correlated with MES values ($R^2 = 0.6987$). TNF- α values followed a similar pattern to IL-6; however, no correlation was found between TNF- α and MES. **Conclusion:** These data provide some interesting insights into potential MES plasticity and cytokine regulation during prolonged exercise. More specifically, fluctuating MES values observed during the current activity suggest that glycogenolysis and glycogenesis may occur throughout an ultra-event depending on terrain and intensity, even with a discrepancy between caloric intake and expenditure. Additionally, salivary IL-6 activity may be related to MES, suggesting that periods of low glycogen may increase physiological stress.

1258 Board #20 May 30 9:30 AM - 11:00 AM
Tissue Oxygen Recovery Time in Back and Front Squats
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Near infrared spectroscopy (NIRS) can be used to measure skeletal muscle tissue oxygen (SmO_2) levels, which may be a useful indicator of recovery and fatigue during resistance training.

Purpose: The purpose of this study was to determine the SmO_2 recovery rate in both the Vastus Lateralis (VL) and Biceps Femoris (BF) muscles in traditional back squats and front squats.

Methods: Eleven recreationally resistance trained participants completed the study. The 1-repetition maximum (1-RM) was determined for the front and back squats on two different occasions. In subsequent visits a wireless NIRS device was applied over the VL and BF on each leg. Participants completed 3 sets of 15 repetitions with 2-3 minutes of recovery using 70% of their 1-RM weight. During recovery, participants sat on a bench next to the squat rack. To complete the study, participants would repeat the above procedures for the other squat form (front or back) with at least 48 hours in-between visits. Repeated measures ANOVA was used to determine differences in the recovery rate.

Results: The recovery rate of SmO_2 ($\% \text{SmO}_2 / 0.5$ sec) was calculated as the slope of SmO_2 over time between 10-50 seconds of during each recovery period. The mean recovery rate during the third set recovery for VL in back squats was 0.885 ± 0.194 $\% \text{SmO}_2 / 0.5$ sec and 0.785 ± 0.129 $\% \text{SmO}_2 / 0.5$ sec in front squats. Mean recovery rate for third set recovery for BF in back squats was 0.449 ± 0.083 $\% \text{SmO}_2 / 0.5$ sec

and 0.290 ± 0.059 $\% \text{SmO}_2 / 0.5$ sec in front squats. There were significant differences in the SmO_2 recovery rates between the BF and VL in both legs ($p < 0.05$). There were no significant differences between the recovery rates in back vs front squats. Similar differences were found in the first and second set recovery periods.

Conclusion: During front and back squats the initial rate of recovery of SmO_2 is more rapid in the VL than in the BF. Additionally, there are no differences in SmO_2 recovery rate between front and back squats.

C-30 Free Communication/Poster - Cardiac

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1259 Board #21 May 30 9:30 AM - 11:00 AM
Myocardial Strain Imaging in Asian Competitive Athletes - A Single Centre
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 (No relevant relationships reported)

ABSTRACT INTRODUCTION

To date there has been limited literature pertaining to Athlete's Heart Syndrome in Asian athletes, especially for those in South East Asia.

METHODS

We performed a single center cross-sectional case-control study of elite athletes and controls, using current speckle-tracking echocardiography (STE) and tissue Doppler imaging (TDI)-based techniques. We reanalyzed previous data to further characterize the biomechanical changes in exercise induced cardiac remodeling elite athletes and controls at a tertiary hospital in Singapore.

RESULTS

The Left Ventricular (LV) strain of the athletes' group was significantly lower as compared to the control group (-19.0 ± 2.0 vs -20.3 ± 1.8 , $p = 0.011$). Furthermore, both LV torsion (14.3 ± 17.8 °/s vs 14.4 ± 6.7 °/s, $p = 0.031$) and Lateral S' (7.21 ± 1.4 vs 8.7 ± 1.6 , $p = 0.001$) showed small but statistically significant decreases in the athletes' group versus the controls. The athletes group demonstrated a significantly lower Basal Right Ventricular (RV) free wall strain as compared to the controls (-19.8 ± 5.5 vs -26.5 ± 6.4 P < 0.001). The mid RV strain was marginally higher in the athletes' group versus the controls (-25.0 ± 4.3 vs -24.7 ± 15.3 P = 0.023).

CONCLUSIONS

Our findings of impaired LV strain and torsion as well as basal RV free walls strain in the South East Asian athletes group mirror studies done in Western cohorts. The higher mid RV free wall strain could represent compensatory response to the impaired basal RV function in athletes.

1260 Board #22 May 30 9:30 AM - 11:00 AM
Factors Affecting Aortic Root Diameter in a Population of Former Professional Football Players
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 (No relevant relationships reported)

Purpose: Examine potential factors affecting aortic root size and dilation prevalence in former professional football players. Additionally, two methods of aortic root dilation (ARD) assessment were compared. **Methods:** For this cross-sectional study, former professional football players ($n = 1325$) were sampled for demographics, anthropometry, blood pressure, and 2D echocardiographic measurement of aortic root diameter (AoD) at the Sinus of Valsalva. Body surface area (BSA) was used to obtain indexed aortic root diameter (IAR). ARD was assessed by two methods: using previously described nomograms for IAR prediction (pIAR) and by $\text{IAR} > 1.9$ cm/m² (ASi), according to normal IAR range. Subjects were stratified by age and position groups for comparison. Statistical analysis included ANOVA, T-test, and Chi-square where appropriate. **Results:** The prevalence of ARD was $15.2\% \pm 2.4$ and $2.4\% \pm 1.0$ according to pIAR and ASi methods, respectively ($p < 0.0001$). Both age and position group (PG) had a significant effect on AoD ($p < 0.0001$ and $p = 0.0018$, respectively) and IAR ($p < 0.0001$ and $p = 0.0005$, respectively). However, when age was considered a covariate for PG, only IAR tended to remain significant ($p = 0.0560$). Both AoD and IAR increased with age; While ARD prevalence increased with each 20-year increase in age according to both prediction methods (pIAR: $p < 0.0001$; ASi: $p = 0.0025$), there was no effect of PG (pIAR: $p = 0.2879$; ASi: $p = 0.4856$). While IAR was greater in hypertensive versus normotensive subjects ($p = 0.0076$), AoD did not differ between the two ($p = 0.6616$), and ARD prevalence was higher in hypertensive subjects only via the ASi method ($p = 0.0202$). Finally, the presence of left ventricle

hypertrophy (LVH) contributed to ARD prevalence when pIAR was used ($p < 0.0001$), but not when the ASi method was considered ($p = 0.1047$), with larger AoD in subjects with LVH versus those with normal geometry ($p = 0.0090$), while IAR did not differ between the two ($p = 0.1106$). **Conclusions:** Body size, age, playing position, and LVH were all found to impact both aortic root size and ARD. Thus, methods of ARD assessment in these men should ideally account for both body size and age. Therefore, pIAR may be best for assessment of ARD in this population. Study funded and supported by the NFL's Player Care Foundation.

1261 Board #23 May 30 9:30 AM - 11:00 AM
Effects of Aerobic and Resistance Training on Diabetic Heart Function: Roles of Titin and Collagen
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PURPOSE: To examine the effects of aerobic and resistance exercise training on cardiac function, and investigate the roles of cardiomyocyte passive tension regulators (titin and collagen) in the mechanism of exercise-induced changes in cardiac function in diabetic rats.

METHODS: Sixty male SD rats were randomly divided into six groups: control (C), aerobic exercise (A), resistance exercise (R), diabetic (D), diabetic plus aerobic exercise (DA), and diabetic plus resistance exercise (DR). Type II diabetes was induced by high-fat diet feeding and low-dose streptozocin injection. Rats in the A and DA groups ran on a treadmill at 21m/min for 60 min, and rats in R and DR groups climbed a ladder bearing incremental loads daily, 5 days per week for 8 weeks. Fasting blood glucose (FBG) and insulin (FINS) concentrations were determined by a standard procedure. Cardiac function (such as the specific indicators of cardiac diastolic dysfunction-- Min dp/dt, Tau) was measured using a catheter insertion through the right carotid artery and a Labchart data acquisition and analysis system. Expression levels of collagen I, collagen III and TGFβ1 were determined using Western blot, and titin expression levels were analyzed using Immunofluorescence. Two-way ANOVA and post-hoc tests were used to assess differences between groups.

RESULTS: Compared to non-diabetic groups, diabetic groups had higher FBG ($P < 0.01$), lower Min dp/dt ($P < 0.05$), and longer Tau ($P < 0.05$); in addition, the diabetic groups had significantly lower expression levels of titin ($P < 0.05$), and higher expression levels of collagen I and TGFβ1 ($P < 0.05$). Compared to non-exercise diabetic rats, diabetic plus exercise groups had lower FBG ($P < 0.01$, -54.3% in DA and -66.0% in DR) and HOMA-IR ($P < 0.01$, -46.6% in DA and -53.8% in DR); the DA rats had higher expression levels of titin ($P < 0.05$) and Min dp/dt ($P < 0.05$), lower expression levels of collagen I ($P < 0.05$) and TGFβ1 ($P < 0.05$), and shorter Tau ($P < 0.05$), but the DR rats had higher expression levels of collagen I ($P < 0.05$) and TGFβ1 ($P < 0.01$).

CONCLUSION: Greater improvements in diabetic cardiac function occurred with aerobic exercise training, possibly through decreasing titin-dependent myocardial stiffness and collagen-dependent interstitial fibrosis.

1262 Board #24 May 30 9:30 AM - 11:00 AM
Cardiovascular Drift Response Over Two Different Constant-load Exercises In Healthy Non-athletes. Case Study.
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 (No relevant relationships reported)

Cardiovascular drift (CV-d) is a steady increase in heart rate (HR) over time while performing constant load moderate intensity exercise (CME) > 20 min. CV-d presents problems for the prescription of exercise intensity by means of HR, because the work rate (WR) during exercise must be adjusted to maintain target HR, thus disturbing the intended effect of the exercise intervention. It has been shown that the increase in HR during CME is due to changes in WR and not to CV-d.

Purpose

We aimed to investigate whether, indeed, the CV-d in healthy young people exercising at the WR corresponding to the lactate individual anaerobic threshold (IAT) determined in two different cardiorespiratory exercise test (CPT), was related to the WR difference.

Methods

Seven participants (30 ± 3 years old, 1.75 ± 0.1 m., 74.6 ± 12.8 Kg.) performed on different days two CPT with a WR increase of 20 Watts (W) every one or three minutes until exhaustion. The WR corresponding to the IAT was determined during these tests. The participants then performed two CME with a WR corresponding to the IAT. HR and blood lactate (La) were continuously measured during all tests. A comparison between CPTs and CMEs were made using a paired *t*-test. A one-way ANOVA repeated measurements was used to compare La values during the CME.

Results

$\dot{V}O_{2max}$ (36.9 ± 5.9 vs. 35.6 ± 5.7 ml·Kg⁻¹·min⁻¹; $p > 0.05$), maximal HR (181 ± 9 vs. 178 ± 11 bpm; $p = 0.3$), and peak La (8.7 ± 1.6 vs. 7.8 ± 1.6 ; $p = 0.1$) did not differ between CPTs. Maximal power output (271 ± 80 vs. 223 ± 75 W; $p < 0.001$) and WR at the IAT (164 ± 63 vs. 137 ± 45 W; $p > 0.01$) were different between CPTs. La between CMEs and minutes 10 and 30 were not different (3 ± 0.4 vs. 3.3 ± 0.5 ; $p = 0.1$). One-CME mean HR was 157 ± 12 bpm with an increase of 8 ± 4 bpm between minutes 10-30. Three-MCE HR was 147 ± 14 bpm and the HR increased by 9 ± 7 bpm between minute 10-30. Only a difference in HR between the two CME was found ($p = 0.009$) whereas there was no difference in the HR change between minute 10-30 ($p = 0.7$).

Conclusion

In this case study, the CV-d was not significantly different between the two CMEs (One-IAT and Three-IAT) despite a significant difference in the amount of WR between CMEs (26 ± 19). Other factors aside from the WR like an increase in peripheral blood flow, hyperthermia, plasma volume reduction, catecholamine levels, and training status play a role in the CV-d phenomenon.

1263 Board #25 May 30 9:30 AM - 11:00 AM
Evaluations Of Nonstationary And Stationary Autonomic Nervous Function Using Heart Rate Variability For Syncope Patients with Non-cardiogenic Causes
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 (No relevant relationships reported)

Background: One of the main causes of syncope is neuroregulatory syncope. Thus, it is very important to assess autonomic nervous function for syncope patients. Heart rate variability (HRV) was widely used for indirect evaluation of cardiac autonomic function. HRV was usually assessed with RR intervals changes of resting condition. Recently, however, HRV analysis using 24 hours Holter electrocardiogram became available to evaluate cardiac autonomic function during activity. **Purpose:** The aim of this study was to evaluate cardiac autonomic function of non-cardiogenic syncope patients using HRV analysis. **Method:** Seventy-six patients with non-cardiogenic causes of syncope were enrolled. They were divided into initial group ($n=31$, 68 ± 15 years old, 19 males, 12 females) and recurrence group ($n=45$, 57 ± 24 years old, 24 males, 21 females). RR intervals were measured with electrocardiogram at rest (stationary) and with 24 hours Holter electrocardiogram during activity (nonstationary). The three HRV frequency-domains (low frequency power: LF, high frequency power: HF, LF/HF ratio) were calculated. **Results:** At the nonstationary state, HF was significantly higher in the recurrence group than in the initial group. (HF: 160 ± 19 ms² vs. 410 ± 69 ms², $P=0.01$, ANCOVA; age and sex). There were no significant differences in LF and LF/HF ratio between the two groups at the nonstationary state. At the stationary state, there were no differences in LF, HF and LF/HF ratio between the two groups. There were significant relationships in LF and HF between the stationary and nonstationary states (LF: $r=0.78$, HF: $r=0.83$, $P<0.01$), while LF/HF ratio did not show significant relationship. **Conclusion:** Our results indicated that the recurrent non-cardiogenic syncope patients had increased parasympathetic nerve activity at the nonstationary state. The evaluation of HRV at the nonstationary state may be more important for syncope patients than that at the stationary state, although HRV showed significant relationships between the stationary and nonstationary states.

1264 Board #26 May 30 9:30 AM - 11:00 AM
The Effects of Low Intensity Resistance Exercise Training on Cardiac Autonomic Function in Obese Postmenopausal Women
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Menopause and obesity are associated with a deterioration of cardiac autonomic dysfunction (CAF) and are independent risk factors for cardiovascular disease (CVD). Heart rate variability (HRV) is a non-invasive tool for the evaluation of CAF. HRV is adversely influenced by menopause and obesity in women. Resistance exercise has emerged as an important strategy for the prevention and treatment of CVD. Low intensity resistance exercise training (LIRET) appears to be a useful modality for promoting improvements in muscular mass and strength, while being relatively safe for populations with increased cardiovascular risk. However, the possibility of improving CAF in obese postmenopausal women is currently unknown. **PURPOSE:** The purpose of this study was to examine the effects of LIRET on HRV and strength

in obese postmenopausal women. **METHODS:** Twenty obese postmenopausal women [age (54 ± 1 years) and body mass index (34.4 ± 0.8 kg/m²)] were randomized to either (n= 10) or no-exercise control group (n= 10) for 12 weeks. LIRET consisted on 4 different exercises for the leg musculature per session 3 x week. Participants performed 2-3 sets involving 18-22 repetitions for each exercise per session. Total power (TP), low-frequency power (LF), high-frequency power (HF) (vagal tone), the LF to HF ratio (LF/HF) (sympathovagal balance), heart rate (HR) and leg strength were measured before and after 12 weeks. LF and HF were normalized to TP resulting in nLF (sympathetic activity) and nHF. Logarithmic transformation (Ln) was performed to normalize the HRV variables in absolute units. **RESULTS:** There were significant group-by-time interactions ($P < 0.05$) for nLF, nHF, LnLF/LnHF, and ($P < 0.01$) for leg strength. There were significant decreases ($P < 0.01$) in nLF ($-6 \pm 1\%$) and LnLF/LnHF (-0.7 ± 0.1) as well as significant increases ($P < 0.01$) in nHF ($5 \pm 1\%$) and leg strength (27 ± 2 kg) following LIRET compared with no changes after control. No significant changes were observed in LnTP or HR after 8 weeks for both groups. **CONCLUSIONS:** Our findings indicate that LIRET improves CAF by improving sympathovagal balance in obese postmenopausal women.

1265 Board #27 May 30 9:30 AM - 11:00 AM
Atg7 Involves In Cardioprotection Induced By Exercise Preconditioning Against Exhaustive Exercise-induced Myocardial Injury

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(No relevant relationships reported)

The cardioprotective effects induced by exercise preconditioning (EP) in early phase has been proved, while the mechanism involved in cardioprotection is a multifactorial process. Several studies have identified that autophagy is one of the mechanisms of cardioprotection induced by EP. As a rate-limiting enzyme, Atg7 plays a pivotal role in autophagy.

Purpose: The aim of this research was to investigate the alteration of Atg7 during the early cardioprotective effects of EP against exhaustive exercise-induced myocardial injury.

Methods: Male 8-week-old Sprague-Dawley rats were divided into four experimental groups randomly: Group C (control), Group EE(exhaustive exercise), Group EEP (early exercise preconditioning) was subjected to an intervallic exercise of four periods of 10 min running at 30 m/min with 10 min intervallic rest, Group EEP+EE (early exercise preconditioning plus exhaustive exercise) was used to explore cardioprotection of EEP against exhaustive exercise-induced myocardial injury. Atg7 was detected by immunofluorescence and western-blot.

Results: In group C, Atg7 positive expression stained red and scattered in myocardial cytoplasm, and the nucleus was bright blue. Compared with group C, the positive reaction of Atg7 increased strongly in group EE and group LEP. The high Atg7 levels observed after exhaustive exercise were significantly (0.46 ± 0.14 vs. 0.73 ± 0.40 , $p < 0.05$). The levels of Atg7 were increased significantly after early phase of EP (0.46 ± 0.14 vs. 0.74 ± 0.30 , $p < 0.05$). Although there were no significant differences of Atg7 levels between group EE and group EEP+EE ($p > 0.05$), they had a downward trend in group EEP+EE.

CONCLUSION: The increased levels of Atg7 induced by autophagy might involve in the early cardioprotection of EP against exhaustive exercise-induced myocardial injury. Supported by the National Natural Science Foundation of China (Grant No. 31471136)

1266 Board #28 May 30 9:30 AM - 11:00 AM
Reliability Of A Vagal Modulation Index In Different Conditions

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Previous studies conducted with athletes have suggested a minimum of 3 days are required for identifying training induced adaptations in supine, morning, resting heart rate variability (HRV). However, there are no studies evaluating the minimum days required for appropriate reliability of HRV measures in non-athletes, and during different conditions of evaluation. **PURPOSE:** 1) To evaluate the reliability of a prominent HRV measure, the root mean square of the successive differences of R-R intervals (RMSSD), during different conditions in non-athletes; 2) to identify the minimum number of days required for weekly (5-day) evaluations of RMSSD. **METHODS:** Thirty-four young, physically active individuals (22.2 ± 3.6 years) completed daily 4-min R-R recordings during supine, seated, standing and walking (5 km/h) conditions over 5 days. Relative (intraclass correlation coefficients, ICC) and absolute (technical error of measurement, TEM; coefficient of variation, %CV)

reliability, and bias were calculated for 1, 2, 3, and 4 days, and compared with weekly (5 days) assessments. **RESULTS:** Excellent reliability was identified for all conditions over 4 days ($ICC \geq 0.986$, $CV \leq 2.8\%$) that was diminished when examined over 3 ($ICC \geq 0.970$, $CV \leq 3.4\%$), 2 ($ICC \geq 0.932$, $CV \leq 5.7\%$) and 1 ($ICC \geq 0.804$, $CV \leq 10.2\%$) day. When compared with weekly recordings, 2 day recordings demonstrated excellent and similar reliability values for all conditions examined, with better values observed for supine vs. seated vs. standing vs. walking conditions. **CONCLUSIONS:** From the current results, daily assessment of RMSSD is highly reliable with a minimum of 2 days of recordings recommended for determination of weekly HRV in non-athletes, regardless of the condition.

1267 Board #29 May 30 9:30 AM - 11:00 AM
Effects of Wheel Running on Health-Related Outcomes in Growth Restricted Mice.

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(No relevant relationships reported)

Growth restriction caused by early life undernutrition leads to an increased risk of cardiovascular disease, hypertension, type II diabetes and sarcopenia. However, limited information exists on the beneficial effects of physical activity engagement in growth restricted individuals. **PURPOSE:** To determine the effects of wheel running access on health-related outcomes in growth restricted mice. **METHODS:** Mice were undernourished in gestation (GUN, N=15) or lactation (PUN, N=17) by feeding FVB mothers a low protein diet (8% protein). The control group (CON, N=14) was fed a normal protein diet (20% protein) throughout gestation and lactation. At postnatal day 21 (PN21), all pups were weaned and refed with the control diet. At PN45, mice were singly housed and either given access to a free moving running wheel (VOL-wheel access) or used as a non-active control (SED-sedentary). At PN70 a maximal treadmill test was performed to determine exercise capacity, and at PN72 echocardiography was performed to evaluate cardiovascular function. **RESULTS:** Final body weight showed SED PUN (M: 21.22 ± 2.07 g, F: 17.42 ± 1.7 g) weighed significantly ($P=0.0002$) less than SED CON (M: 26.83 ± 2.2 g, F: 20.65 ± 1.65 g) and SED GUN (M: 26.9 ± 1.5 g, F: 19.98 ± 1.6 g) mice, while the VOL CON mice (M: 24.9 ± 1.62 g, F: 23.0 ± 1.42 g) were significantly larger ($P=0.0441$) than VOL PUN mice (M: 22.6 ± 2.7 g, F: 20.0 ± 2.26 g). Wheel access improved treadmill running time to exhaustion in CON ($P=0.045$, VOL: $1078 \pm 47s$, SED: $936 \pm 40s$), and GUN mice ($P=0.042$; VOL $1021 \pm 39s$ SED $890 \pm 44s$), but not PUN mice ($P=0.59$; VOL $933 \pm 31s$ and SED $908 \pm 32s$). Echoes showed heart rate was significantly lowered ($P=0.002$) in GUN mice (VOL: 366 ± 11 bpm; SED: 421 ± 10 bpm) with running wheel access. Stroke volume was also significantly higher ($P=0.02$) in GUN mice (VOL: 27 ± 1.2 uL; SED: 23 ± 1.1 uL). VOL CON ($1.64 \pm 0.08mm$) mice had a significantly greater ($P=0.05$) left ventricular anterior wall thickness at systole than SED CON ($1.38 \pm 0.08mm$). **CONCLUSION:** Voluntary wheel access does not attenuate growth-restriction in PUN mice nor does it improve maximal treadmill tests. This is due to a lack of improvements in cardiac function for PUN mice, despite access to voluntary wheel running, while GUN mice did improve.

1268 Board #30 May 30 9:30 AM - 11:00 AM
Carnosine Essential For Cardiac Function. A Study With Knockout Rats For The Carnosine Synthase Gene

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(No relevant relationships reported)

Carnosine is present in high concentrations in heart, where it appears to increase the sensitivity of the contractile apparatus to Ca²⁺. However, it is currently unknown whether this role is relevant to the cardiac physiology. **Purpose:** To evaluate the impact of the lack of carnosine on myocardial contractile function in rats knockout (KO) for the CARNIS1 gene (carnosine synthase1). **Methods:** We developed the first KO animal model for the CARNIS1 gene through CRISPR-Cas9 technology. Male wild-type (WT) and KO rats (4 months-old) were used. *In vivo* cardiac function was assessed by echocardiography (ECO) and cardiac electrical activity by electrocardiography (ELECTRO). Cardiomyocyte contractile function was assessed in isolated cardiomyocytes by measuring cardiomyocyte and sarcomere contractility analysis, along with the determination of Ca²⁺ transient. Unpaired t-tests were used to compare variables between WT and KO. The study was approved by the Ethics Committee on the Use of Animals of USP. **Results:** ECO (WT:n=4; KO:n=6) showed that KO rats presented a higher systolic diameter (WT: 0.008 ± 0.001 mm/g; KO: 0.011 ± 0.001 mm/g; $p=0.002$), lower Fraction of Left Ventricular Ejection (WT: $80.26 \pm 6.86\%$; KO: $69.86 \pm 4.67\%$; $p=0.01$) and lower Fraction of Left Ventricular Shortening (WT: $51.12 \pm 7.39\%$; KO: $40.88 \pm 3.92\%$; $p=0.01$), characterizing systolic dysfunction. ELECTRO (WT: n=8; KO:n=8) showed higher T wave amplitude in the KO group (WT: 0.06 ± 0.02 mV; KO: 0.13 ± 0.03 mV; $p=0.005$), indicating a disturbance

in the Ca^{2+} channels. *In vitro* contractility data (WT: $n=3$; KO: $n=3$) showed that sarcomere shortening is reduced in the KO (WT: $11.75 \pm 4.20\%$; KO: $9.28 \pm 3.71\%$) (WT: $6.81 \pm 3.15s$; KO: $4.33 \pm 1.87s$; $p < 0.0001$), and the time to reach 50% of maximal shortening is longer in the KO (WT: $0.04 \pm 0.01s$; KO: $0.05 \pm 0.01s$; $p < 0.0001$). Ca^{2+} transient analysis showed lower amplitude of Ca^{2+} in the KO group (WT: 0.20 ± 0.10 ; KO: 0.16 ± 0.06 F340/380 ratio; $p = 0.001$) and longer time for to reach 50% of the Ca^{2+} decay rate (WT: $0.21 \pm 0.04s$; KO: $0.24 \pm 0.03s$; $p = 0.001$). **Conclusion:** Absence of carnosine resulted in systolic dysfunction associated with Ca^{2+} transient changes in cardiac muscle. This is the first evidence to demonstrate *in vivo*, *ex vivo* and *in vitro* that carnosine is essential for normal cardiac function.

Supported by FAPESP 2014/11948-8 and CAPES

1269 Board #31 May 30 9:30 AM - 11:00 AM
Left Ventricular Morphology and Function of Recurrent Syncope Patients

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(No relevant relationships reported)

[Purpose]

It has been known that number of syncope episodes during life is the strongest predictor for future syncope recurrence. It has been reported that impaired left ventricular diastolic function (LVDF) and low cardiac output due to left ventricular (LV) atrophy are related with orthostatic intolerance. The aim of this study was to clarify whether the number of syncope episodes would be related to LV morphology and function.

[Methods]

We enrolled clinically non-cardiogenic syncope patients who presented at the emergency department of Kyorin University Hospital between 2015 and 2018. We divided them into 2 groups: F (1 episodes of syncope during life) and R (2 or more). Early diastolic filling velocity (E), atrial filling velocity (A), deceleration time (DT), peak early diastolic velocity of the mitral annulus (e'), E/A, and E/ e' were assessed by echocardiography. LV mass (LVM) was calculated by Devereux Formula, which was normalized by BSA (LVM index, LVMI). Stroke volume (SV) and ejection fraction (EF) were estimated by modified Simpson's method. ANCOVA statistics, adjusting for sex and age, was used to compare those parameters between the 2 groups.

[Results]

Of 80 patients enrolled, F group were 35 (68 \pm 17 years old, 19 men) and R group were 45 (56 \pm 23 years old, 23 men). E/ e' was significantly lower in the F group than that in the R group (E/ e' : 8.72 ± 0.44 vs. 10.00 ± 0.39 , $p = 0.037$). There were no significant difference between the two groups in E (67 \pm 3 vs 70 \pm 2 m/s, $p = 0.45$), A (73 \pm 3 vs 74 \pm 2 m/s, $p = 0.85$), E/A (1.05 ± 0.05 vs 1.11 ± 0.05 , $p = 0.44$), DT (222 \pm 11 vs 227 \pm 9 ms, $p = 0.72$), e' septal (7.3 ± 0.2 vs 6.8 ± 0.2 m/s, $p = 0.18$), e' lateral (9.0 ± 0.4 vs 9.1 ± 0.3 m/s, $p = 0.87$), SV (48 \pm 2 vs. 46 \pm 2 ml, $p = 0.36$), EF (65 \pm 1 vs. 63 \pm 1 %, $p = 0.66$), LVM (138 \pm 7 vs. 148 \pm 6 g, $p = 0.28$) and LVMI (86 \pm 4 vs. 91 \pm 3 g/m², $p = 0.36$).

[Conclusions]

These results suggest that impaired LVDF is one possible pathophysiology for repeated non-cardiogenic causes of syncope, but LV morphology and systolic function are not.

1270 Board #32 May 30 9:30 AM - 11:00 AM
The Impact Of Acute Hyperglycemia On Heart Rate Variability In Men And Women.

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(No relevant relationships reported)

BACKGROUND: Heart rate variability (HRV) is used to non-invasively assess autonomic nervous system (ANS) regulation of the heart. Chronic hyperglycemia has been known to reduce HRV; however, no research has examined the impact of acute hyperglycemia on HRV, considering the potential for sex- and menstrual cycle phase-based differences. **PURPOSE:** To examine the impact of acute hyperglycemia on HRV, in men and women during the early and late follicular phases of the menstrual cycle. **METHODS:** 41 healthy men and naturally menstruating women (17F, age: 21 \pm 1 years) were recruited. Women were assessed during the early and late follicular phases of the menstrual cycle. 'Ultra short-term' assessments of HRV (1-minute recordings) were completed using an electrocardiogram before, and 60- and 90-min after consuming a 75g oral glucose challenge. Analysis of HRV time-domain variables was performed. **RESULTS:** Acute hyperglycemia resulted in elevated HR (shorter R-R intervals) at 60- and 90-min post-glucose ingestion (Pre: 61 ± 1 , Post60: 65 ± 1 , Post90: 66 ± 1 bpm; $p = 0.005$, $p < 0.001$ respectively), with no differences between men and women, or across phases of the menstrual cycle. The root mean square of successive differences between R-R intervals (RMSSD) and standard deviation in normal R-R intervals (SDNN) were significantly lower Post90 vs Pre ($p = 0.022$, $p = 0.048$ respectively), with no sex differences. Additionally, women, regardless of phase, had higher average HR compared to men ($p < 0.001$). **CONCLUSION:** Acute

hyperglycemia appears to decrease HRV, indicative of an acute change in ANS regulation. Furthermore, this study confirmed previously observed sex differences in HR, but not in HRV. Research supported by: NSERC Discovery Grant & Canadian Graduate Scholarship - Master's

1271 Board #33 May 30 9:30 AM - 11:00 AM
Post exercise Heart Rate And Vagal Reactivation Correlates With Vagal Withdrawn After Orthostatic Maneuver In Men

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(No relevant relationships reported)

PURPOSE: The relationship between post-exercise parasympathetic reactivation, chronotropic reserve recovery (CRR) and the cardiac autonomic modulation responsiveness to active postural change at rest is still an open field to be explored. Therefore, our objective was correlate parasympathetic reactivation, CRR with cardiac autonomic status after an orthostatic maneuver (active stand from supine position) at rest.

METHODS: Cardiac Parasympathetic reactivation (rMSSD) at 1st min and CRR from the 1st, to 5th min following sub-maximal graded exercise were correlated with absolute and relative change of time-domain index (rMSSD) after active postural change from supine to standing position using heart rate variability (HRV) in 20 physically active, non-athlete men. Statistical analysis employed non-parametric tests with two-tailed p-value set at 5%.

RESULTS: Parasympathetic reactivation in the 1st min of post-exercise recovery correlated positively with absolute and relative vagal withdrawal (rMSSD) after orthostatic maneuver ($r_s = 0.41$ $p = 0.02$ and $r_s = 0.58$ $p = 0.01$). CRR at 1st min post-exercise time did not correlated with absolute or relative cardiac autonomic modulation responsiveness after active postural change at rest. However, CRR from the 2nd to the 5th min positively correlated with absolute and relative vagal withdrawal (rMSSD) after orthostatic maneuver (Absolute: $r_s = 0.64$ $p = 0.01$ < 0.01) and (Relative: $r_s = 0.37$ $p = 0.04$ < 0.01).

CONCLUSIONS: Parasympathetic reactivation and CRR during the initial 1st to 5th minutes of the recovery period after sub-maximal graded exercise is exercise is positively correlated with the parasympathetic decrease (reserve) after active postural change at rest in physically active, non-athlete men. In others words, we observed that highest parasympathetic decrease after postural change at rest, highest was CRR during post-exercise recovery.

1272 Board #34 May 30 9:30 AM - 11:00 AM
Sympathetic Activity and Cardiovascular Risk Markers in Non-diabetic and Diabetic Mexican Older Adults

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(No relevant relationships reported)

Age-related metabolic dysfunctions occur in a wide variety of clinical manifestations, including hyperglycemia, dyslipidemia and increased body fat. These conditions increase the risk of cardiovascular diseases (CVD), which can develop low heart rate variability (HRV) and higher resting heart rate (HR). The pathological metabolic conditions in older adults are associated with a hyperactive sympathetic nervous system (SNS). **PURPOSE:** To compare the SNS activity and metabolic markers associated to CVD in type 2 diabetic (T2D) and non-diabetic (ND) Mexican older adults. **METHODS:** Volunteers were 11 T2D (Age = 60.8 \pm 5.2 yr., body mass index [BMI] = 29.9 \pm 4.6 kg/m²) and 17 ND (Age = 64 \pm 4.8 yr., BMI = 28.4 \pm 4.1 kg/m²) older adults residing in Baja California, Mexico. Morning blood serum samples were collected after 8-h fasting following body composition analysis (InBody 770, Cerritos, CA). A 5-min resting ECG recording (BioRadio, Cleveland, OH) was used to analyze HRV. Time and frequency domain analysis were assessed with Kubios HRV 3.1 software (Kubios Oy, Finland). **RESULTS:** Between-group differences were found on blood glucose (T2D = 171.9 \pm 91.6 vs. ND = 80.17 \pm 12.0mg/dL, $p < 0.001$), and triglycerides (T2D = 266.9 \pm 126.17 vs. ND = 60.54 \pm 47.8mg/dL, $p < 0.02$). Non-significant between-group differences were found on cholesterol (T2D = 183.0 \pm 45.1 vs. ND = 180.9 \pm 29.7mg/dL, $p = 0.88$), HDLc (T2D = 60.54 \pm 55.8 vs. ND = 47.88 \pm 20.73mg/dL, $p = 0.92$) and LDLc levels (T2D = 84.4 \pm 44.6 vs. ND = 107.84 \pm 26.74mg/dL, $p = 0.22$). The HR (T2D = 72.6 \pm 11.5 vs. ND = 71.7 \pm 7.8bpm, $p = 1.0$), beat-to-beat intervals (RR) (T2D = 845.7 \pm 128.7 vs. ND = 843.7 \pm 93ms, $p =$

0.94), Root Mean Square of the Successive Differences (RMSSD) ($T2D = 68.7 \pm 58.0$ vs. $ND = 45.6 \pm 31.2$ ms, $p = 0.45$) and relative successive beats with > 50 ms of difference (pNN50) ($T2D = 23.4 \pm 25.5$ vs. $ND = 9.7 \pm 13.7\%$, $p = 0.32$) were similar in both groups. High- ($T2D = 48.14 \pm 24.64$ vs. $ND = 45.5 \pm 22.9$ n.u., $p = 0.67$) and Low-frequency ($T2D = 51.7 \pm 24.5$ vs. $ND = 54.0 \pm 23.3$ n.u., $p = 0.70$) time domains and LF/HF ratio ($T2D = 2.0 \pm 2.4$ vs. $ND = 2.4 \pm 3.0$, $p = 0.68$) were similar in both groups. **CONCLUSIONS:** Diabetic conditions did not affect substantially SNS activity compared with non-diabetic condition in a sample of Mexican older adults.

1273 Board #35 May 30 9:30 AM - 11:00 AM
Effects of Maturational Development on Central Hemodynamics in Pre and Post Adolescent Children
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 (No relevant relationships reported)

There has been a clear trend of increased cardiovascular disease risk development in adulthood as children have begun to develop large artery stiffness at an earlier age due to possible increased adiposity and poor diet. In recent years, there has been a pressing need to observe the implications of maturation on central hemodynamic parameters among children before and after pubertal development. **PURPOSE:** This study sought to observe the differences in central hemodynamic parameters between children pre and post-adolescence. **METHODS:** Children pre and post-adolescence (ages 7-12 and 13-17 years, $N = 33$, $N = 20$, respectively) were included in this study. Central hemodynamics including ejection duration percentage (ED%), forward pulse height (PH_f), reflected pulse height (PH_r), reflection magnitude (RM%), augmentation index (AIx75), heart rate period (HRP), and time to reflected wave (T2) were assessed through brachial blood pressure measurement using the Sphygmocor XCEL device. Pulse wave velocity (PWV) was obtained through carotid applanation tonometry. **RESULTS:** From pre-adolescence to post-adolescence, values indicate a significant decrease in ED% ($42.2 \pm 5.7\%$ to $37.4 \pm 4.3\%$, $p = 0.002$), AIx75 ($13.6 \pm 13.6\%$ to $3.2 \pm 9.7\%$, $p = 0.004$), and RM% ($49.2 \pm 6.1\%$ to $44.0 \pm 5.9\%$, $p = 0.003$). However, significant increases were observed in PWV (4.3 ± 0.7 m/s to 5.1 ± 0.8 m/s, $p = 0.0003$), HRP (791.2 ± 133.5 ms to 929.8 ± 134.3 ms, $p = 0.001$), and PH_f (25.5 ± 4.0 mmHg to 29.5 ± 4.5 mmHg, $p = 0.002$). **CONCLUSION:** Major findings indicate that increases in PWV may be due to pubertal development and ED%, and HRP may be associated with an increase in heart mass. decreases in AIx75 and RM% and an increased PH_f may be associated with increased height or vessel length. Future studies are necessary to determine possible factors responsible for seen changes.

1274 Board #36 May 30 9:30 AM - 11:00 AM
The Influence of Cardiovascular and Metabolic Variables on Autonomic Nervous System Activity
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 (No relevant relationships reported)

Multiple factors influence the balance of parasympathetic (PS) and sympathetic (SY) drive in the autonomic nervous system (ANS). Root mean square of successive differences of R-R intervals (RMSSD), is a linear metric obtained during the assessment of heart rate variability (HRV) and represents PS input to the heart. Systolic time intervals (STI) assessed via pre-ejection period (PEP, the time from the start of the QRS complex to the opening of the aortic valve), are a non-invasive measure that reflects SY activity at rest. **PURPOSE:** To investigate the effects of biological variables typically associated with metabolic syndrome on ANS activity as measured by RMSSD and PEP. **METHODS:** Utilizing the Atherosclerosis Risk in Communities (ARIC) dataset, 1,216 subjects (62.8% female, 74 ± 4.8 yrs) free from known cardiovascular disease, hypertension, myocardial infarction, and diabetes, not currently taking beta-blockers, and non-smokers were evaluated for fasting glucose (FBG) and insulin (FI) concentrations, waist circumference (WC), blood pressure (BP), RMSSD and PEP. Simultaneous 5-minute recordings of resting ECG, carotid arterial pulse, and phonocardiogram were used to assess PEP and RMSSD. FBG, FI, and WC inferred a latent variable termed glucose management (GM), where pulse and diastolic BP inferred a latent variable termed cardiac control (CC). Path analysis assessed the relationship between latent variables and RMSSD and PEP, after controlling for age, race, and sex. **RESULTS:** The model fit was acceptable (root mean square error of approximation = 0.108 [90% CI = $.098, .118$], comparative fit index = $.649$, and standardized root mean square residual = $.07$), with CC positively associated with PEP ($\beta = .27$, $p < .01$), but negatively associated with RMSSD ($\beta = -.41$, $p < .01$). Contrary to CC, GM was negatively associated with PEP ($\beta = -.18$, $p < .01$), but positively associated with RMSSD ($\beta = .20$, $p < .01$). **CONCLUSIONS:** Latent variables (CC and GM) in this model show opposing associations with RMSSD and PEP, suggesting that the metabolic syndrome risk factors included influence HRV and STI. This

Abstract was prepared using ARIC Research Materials obtained from the NHLBI Biologic Specimen and Data Repository Information Coordinating Center and does not necessarily reflect the opinions or views of the ARIC or the NHLBI.

1275 Board #37 May 30 9:30 AM - 11:00 AM
Early Ovarian Hormone Deprivation Increases Cardiac Contractility In Old Female Rats - Role Of Physical Training
 HUGO C.D. SOUZA, Ana Carolina S. Felix, Sabrina G.V. Dutra, Stella V. Philbois, Tábara P. Faccioli. *UNIVERSITY OF SAO PAULO, Ribeirão Preto, Brazil.*
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 (No relevant relationships reported)

Physiological menopause occurs around 51 years of age. However, in some cases, menopause can happen early, that is, before the age of 40. Of the main consequences of early ovarian hormones deprivation or early menopause, one of the most alarming is the increased risk of cardiovascular diseases, contributing to an increase in the morbidity and mortality rate in these women. Our hypothesis is that early deprivation of ovarian hormones, when associated with the aging process, promotes more adverse cardiac remodeling and greater damage to cardiac function related to physiological ovarian failure. Thus, aerobic physical training is fundamental to attenuate these deleterious effects. **PURPOSE:** The objective of the present study was to investigate the effects of early deprivation of ovarian hormones on cardiac morphological and functional parameters in 82 week-old female rats subjected to ovariectomy at 10 weeks of age, as well as to evaluate the application of aerobic training as a non-pharmacological therapeutic tool. **METHODS:** Female Wistar rats ($N = 48$) were divided into two groups, at 10 weeks of life: early ovarian hormones deprivation by ovariectomy (OVX; $N = 24$) and sham (SHAM; $N = 24$). Between weeks 62 and 82, 12 animals of each group underwent aerobic training (OVX-T and SHAM-T, $N = 12$). At the end of week 82, all were evaluated by echocardiography, cardiac function (Langendorff technique) and cardiac β -adrenergic receptor expression quantification. **RESULTS:** Echocardiography showed slight changes in morphology between OVX and SHAM. OVX ($\Delta = 101 \pm 4.7$ mmHg) showed higher values for maximal left intraventricular pressure in response to dobutamine, when compared to SHAM ($\Delta = 55 \pm 11.8$ mmHg). Both OVX-T ($\Delta = 70 \pm 4.0$ mmHg) and SHAM-T ($\Delta = 22 \pm 6.6$ mmHg) showed a reduction in this response. While, β -adrenergic receptor expression was not different between the sedentary groups, SHAM-T (0.23 ± 0.02 AU) and OVX-T (0.29 ± 0.01 AU) showed decreased expression of these receptors when compared to their respectively sedentary groups. **CONCLUSIONS:** Early ovarian hormones deprivation associated with aging, promotes discrete changes in cardiac morphology, increasing cardiac contractility. Aerobic training decreases β -adrenergic receptors expression, influencing the cardiac contractility. Supported by FAPESP Grant 01937-9

1276 Board #38 May 30 9:30 AM - 11:00 AM
Strength Training Attenuates Hypertension And Preserves The Diastolic Function Of Spontaneously Hypertensive Rats: Role Of Linear Periodization
 Danilo S. Bocalini¹, Roberta L. Rica², Ariana A. Silva², Adriano F. Maia¹, Mauro S. Perillhã³. ¹Federal University of Espírito Santo, Vitoria, Brazil. ²São Judas Tadeu University, São Paulo, Brazil. ³Federal University of São Paulo, São Paulo, Brazil.
 (No relevant relationships reported)

PURPOSE: Among non-pharmacological strategies to hypertension control, aerobic physical training as well as strength training has been indicated as an important time point to general treatment. However, little is known when the training program is periodized in a linear progression. In this way the aim of this study was evaluated the effects of a linear strength training program on parameters of cardiac remodeling in spontaneously hypertensive rats. **METHODS:** Thirty rats were distributed in three groups: untrained normotensive (N, $n = 10$), untrained hypertensive (H, $n = 10$) and trained hypertensive (TH, $n = 10$). The training protocol (12 climbs with 90 second intervals) was organized in three mesocycles of four weeks, with an increase in the training load organized in a linear progression (60%, 65%, 70% and 75%) for each block, considering the weight established in the maximum load test. The following parameters were evaluated: ventricular function evaluated by echocardiogram, systemic blood pressure, ventricular hemodynamics, cardiac morphometric and myocardium contractility. **RESULTS:** No significant changes ($p > 0.05$) were found in FEAT between groups, however, animals from group H had a longer isovolumetric relaxation time compared to other groups, which did not differ between them. There was a significant reduction of caudal BP in the TH group after eight training weeks, additionally, negative correlations were found between systolic blood pressure and increased muscle strength as well as total work, indicating the influence of these parameters on SBP control. The HR, PSVE, and PDFVE values of the H and TH groups did not differ, but both were higher than N group. The values of $+dP/dt$ of H group were lower than the N and HT groups, which did not differ from each other. The RV, LV and cardiac mass values did not differ ($p > 0.05$) between the H and HT

groups, however, they were superior to the N group. The nuclear volume was not different between groups; however, the total collagen content of H group was higher than N and HT group. **CONCLUSIONS:** Briefly, the findings in this study suggest that the training program performed promoted pressure attenuation and preserved the ventricular function of spontaneously hypertensive rats with no change in heart mass.

C-31 Free Communication/Poster - Imaging and Assessment in Skeletal Muscle, Bone and Connective Tissue

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1277 Board #39 May 30 9:30 AM - 11:00 AM Dynamic Ultrasonography of Anterior Femoral Translation: Comparison to Ballet Turnout and Hip Symptoms in Dancers

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(No relevant relationships reported)

Purpose:

To determine if there is a relationship between turnout, self-reported hip symptoms, and femoral head anterior translational motion under dynamic ultrasound in a population of adolescent ballet dancers.

Methods:

Cross-sectional cohort study. Population: 25 ballet academy students, 17 females and 8 males, ages 14-18 yrs. Dynamic ultrasound of the bilateral hips was performed on each study participant in supine position. With the low frequency linear ultrasound probe in sagittal oblique plane, the distance between the femoral head and acetabular rim was measured in 3 positions: both hips in neutral position, ipsilateral hip in neutral and contralateral hip hyperflexed, and with the ipsilateral hip in extension and external rotation and the contralateral hip hyperflexed. Compensated turnout was defined as difference between functional turnout angle in first position and total bilateral hip passive external rotation in prone. Each participant completed the Hip Osteoarthritis and Outcome Score (HOOS) questionnaire.

Results:

Spearman's rho correlation coefficient (r) was used to test strength of association between variables, defined as <0.3 = poor, 0.3-0.5 = fair/moderate, 0.5-0.7 = good, >0.7 = strong. P=0.05 was used as threshold for statistical significance. IBM SPSS software (version 23, SPSS, Chi, IL) was used for all analyses. Mean maximal femoral translation distance for the right hip: 0.66mm (+/- 1.74mm), and the left hip: 1.56mm (+/- 1.93mm). Mean compensated turnout: 62.8° (+/- 14.8°). There was no significant correlation between femoral translation and HOOS scores, nor between femoral translation and compensated turnout (right: p=.56, r=0.123, left: p=.203, r=-0.64). There was a significant correlation between greater compensated turnout and higher mean bilateral HOOS scores, with strongest association in the domains: symptoms (p=.02, r=.463), quality of life (p=.003, r=.561) and activities of daily living (p=.034, r=.426).

Conclusions:

In this population of adolescent ballet dancers, there was no significant correlation between femoral head translational motion on ultrasound and compensated turnout or self-reported symptoms. There was significant correlation between degree of compensated turnout and more favorable self-reports on hip symptoms and function.

1278 Board #40 May 30 9:30 AM - 11:00 AM Effects Of Downhill Running On Muscle MRI T2 In Young mdx Mice

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(No relevant relationships reported)

Previous studies have demonstrated that downhill treadmill running causes skeletal muscle damage that can be detected with magnetic resonance transverse relaxation time (T₂) in adult dystrophic mice (mdx). However, young mdx mice (under 12 weeks of age) are characterized by a peak inflammatory phase with greater heterogeneity among muscles, potentially making it more difficult to detect T₂ changes. **PURPOSE:** To determine whether muscle damage following downhill running can be detected in young mdx mice using proton magnetic resonance imaging (MRI) and spectroscopy (MRS). **METHODS:** C57BL/10ScSn-DMDmdx (mdx, n=5) and wild-type C57BL/10ScSn (controls, n=5) male mice of 6-9 weeks of age performed downhill

running on a treadmill (14% grade at 8-12m/min for 45-60 min). MRI/MRS was conducted prior to and 24 hours following running in the mice hindlimbs. T₂-weighted, multiple-slice, single spin-echo MR axial images were acquired (TR 2s, TE 14/40 ms, 12 slices) from the hindlimbs. MRI T₂ values were calculated on a pixel-by-pixel basis for the anterior compartment (AC), posterior compartment (PC), and the deep medial region between the tibia and fibula (MC). In addition, single voxel ¹H-MRS data were acquired from the soleus and gastrocnemius using stimulated echo acquisition mode (STEAM; TR 9 s, 32 TE's exponentially spaced: 5-288 ms, 4 phase cycles) with a 4.7 T Varian/Agilent MR system. **RESULTS:** At baseline, T₂ was elevated (p<0.05) in mdx mice (26.8±1.2ms) compared to controls (24.8±0.9 ms). Following downhill running, the mdx mice had elevated (p<0.05) T₂ values compared to baseline when a composite of the compartments were compared (Pre: 26.8±1.2ms; Post: 28.8±1.4 ms). The MC was typically (80%) the most affected hindlimb region in the mdx mice. Similarly, ¹H-MRS derived T₂ values were increased (p=0.05) in a composite measure of the soleus and gastrocnemius after downhill running (29.8±4.2ms) in mdx compared to before downhill running (26.4±2.8ms). There were no significant changes in T₂ in control mice after performing the downhill running protocol. **CONCLUSIONS:** Overall, our findings support the use of downhill running combined with MR T₂ measures as a valuable approach for testing potential therapeutic interventions in young dystrophic mice. **Funding Source:** NIH (NIAMS) R01 AR070101.

1279 Board #41 May 30 9:30 AM - 11:00 AM Interactions Among Age, Sex, and Scanning Location in the Assessment of Rectus Femoris Echo Intensity

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(No relevant relationships reported)

Echo intensity is an ultrasound-derived measurement of skeletal muscle quality believed to reflect both fibrous tissue content and adipocyte infiltration. Moderate correlations between echo intensity and measures of muscle function have been reported in older adults. But, it is less clear if the aging process results in comparable declines in muscle quality in men and women. Also, it has yet to be determined if age and sex discrepancies are uniform throughout a muscle. **PURPOSE:** The purpose of this investigation was to examine differences in echo intensity among younger and older men and women along the length of the rectus femoris. **METHODS:** Fifteen younger men (mean ± SD age = 23 ± 3 years), fifteen younger women (21 ± 2 years), eight older men (75 ± 6 years), and sixteen older women (70 ± 5 years) participated in this study. Participants were untrained, healthy, and had a body mass index ≤ 30 kg/m². B-mode ultrasonography was used to acquire panoramic images of the dominant rectus femoris in the transverse plane at the one-third, one-half, and two-thirds distances along the length of the rectus femoris. ImageJ software was used to analyze the images. Echo intensity was corrected for subcutaneous tissue thickness using sex-specific equations. Analyses of variance and effect size statistics were used to analyze the data. **RESULTS:** When collapsed across scanning location, differences between men and women (marginal mean difference = 28.1 AU, p < .001) were greater in magnitude than those for younger versus older adults (marginal mean difference = 7.0 AU, p = .237). However, age had a strong influence on differences among scanning locations, with proximal echo intensity (107.8 ± 14.5 AU) being significantly lower than the middle (127.6 ± 13.7 AU) and distal (130 ± 19.6 AU) values for older men (F = 7.4, p = .018, partial η² = .514), with a similar trend for older women (F = 2.9, p = .073, partial η² = .164). Within each sex, younger adults had very similar echo intensity values at the proximal, middle, and distal sites (greatest mean difference < 5.0 AU). **CONCLUSION:** The difference in corrected echo intensity is greater for men versus women compared to younger versus older adults. Furthermore, aging results in nonuniform changes in muscle quality throughout the belly of the rectus femoris, with greater deterioration at the middle and distal portions.

1280 Board #42 May 30 9:30 AM - 11:00 AM Can Changes In Echo-intensity Be Used To Detect The Presence Of Muscle Swelling?

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(No relevant relationships reported)

When examining skeletal muscle, it has been suggested that changes in echo-intensity (EI) measured with B-mode ultrasound can detect the presence of edema-induced muscle swelling. Specifically, if an increase in muscle size is accompanied by an increase in EI it is thought that true growth has not occurred. Interestingly, our research group has shown that small upward and downward tilting of the ultrasound probe can have a large influence on EI, while having minimal impact on muscle thickness (MT). This suggests that proposed changes in EI following resistance exercise may be artifact from probe tilt as opposed to swelling. **PURPOSE:** To examine the acute changes in biceps MT and EI, while accounting for probe tilt, following 4 sets of biceps curls.

METHODS: 49 resistance-trained men and women were recruited. Individuals in the experimental group (n = 23) visited the laboratory twice. During the first visit, paperwork and one repetition maximum (1RM) strength were measured. During the second visit, individuals performed 4 sets of biceps curls to volitional failure using 70% of their 1RM. B-mode ultrasound images of the biceps were taken to examine changes in both MT and EI. The ultrasound probe was equipped with a standard spirit level to ensure that probe tilt would play a minimal role in all EI measurements. Ultrasound measurements were taken immediately before and following exercise. Individuals in the control group (n = 26) visited the lab on one occasion and served as a time-matched control for changes in both MT and EI. Results are presented as means (95% CI). **RESULTS:** For MT there was a group by time interaction ($p < 0.001$). MT increased in the experimental group [mean change = 0.44 (0.33-0.54) cm], but not in the control group [mean change = -0.015 (-0.03-0.01) cm]. For EI, there was no group x time interaction ($p = 0.074$). In addition, there were no main effects for group ($p = 0.254$) or time ($p = 0.314$). The mean difference in the change in EI between groups was -2.99 (-6.25-3.03) arbitrary units. **CONCLUSIONS:** Our results suggest that EI does not appreciably change in response to acute swelling when accounting for probe tilt. In addition, changes in EI were not different compared to a time matched non-exercise control. It seems unlikely that EI can provide meaningful information regarding the presence of muscle swelling following exercise.

1281 Board #43 May 30 9:30 AM - 11:00 AM
The Validity And Reproducibility Of A 5-minute
Endurance Test Of The Diaphragm Muscle

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Diaphragmatic function could be important in treating respiratory failure. Electrical stimulation and accelerometer-based mechanomyography have been used to identify the endurance index of various muscles, but not of the diaphragm.

PURPOSE: Measure the validity and reproducibility of an endurance test of the diaphragm muscle using electrical stimulation of the phrenic nerve.

METHODS: Ten healthy subjects (21.3 ± 1.1 yrs) were tested in the supine position on two separate occasions within one week. Custom-made stimulation electrodes were placed on the left (n=12) or right (n=2) phrenic nerve, which lies underneath the sternocleidomastoid muscle. The stimulation intensity to induce a vigorous contraction was determined. An accelerometer was placed on the abdomen. The endurance test consisted of 5 minutes of electrical stimulation on 5 Hz, with a sampling rate of 400 Hz. The average acceleration per minute was recorded. The endurance index, which equals the ending value/peak value*100, was then calculated. A series of practice tests were performed before data collection.

RESULTS: The test was successfully completed 27/30 times. The time to find the phrenic nerve was 43.9 ± 50.4 s for trial 1 and 25.9 ± 26.3 s for trial 2. The average endurance index for trial 1 and 2 were $70.5 \pm 11.2\%$ and $70.4 \pm 12.4\%$, respectively (between days, $p=0.54$, $CV=7.71\%$).

CONCLUSIONS: The time to find the phrenic nerve decreased with practice. The endurance test was reproducible and did not have an order effect. With additional training and testing, the diaphragm endurance test may be practical in clinical populations.

1282 Board #44 May 30 9:30 AM - 11:00 AM
Effects Of Downhill Running On Skeletal Muscle Of
Dystrophic Mice Evaluated By 31 P Phosphorus magnetic
resonance spectroscopy

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 (No relevant relationships reported)

In this study we examined the effects of downhill treadmill running on dystrophin-deficient skeletal muscle of *mdx* mice, an animal model of Duchenne muscular dystrophy (DMD). **Purpose:** We hypothesized that *mdx* mice would be susceptible to muscle damage following downhill running and this would be associated with altered muscle energetic status and magnesium (Mg^{2+}). **Methods:** Mice (wild-type 5, *mdx* 5) underwent downhill running (14° decline) on a motorized treadmill at a speed of 8-10 m/min, for 45-60 min. Unlocalized 31 P phosphorus magnetic resonance spectroscopy (31 P-MRS) data was collected using an 11.1T MR system from the posterior hindlimb compartment to measure adenosine triphosphate (ATP), phosphocreatine (PCr), inorganic phosphates (Pi), intracellular pH, and magnesium (Mg^{2+}) before and 24 hours after exercise. In addition, we acquired MRI- T_2 weighted images to identify regions of muscle damage in the hindlimbs and performed localized 31 P-MRS measures to co-register with damaged regions. **Results:** Downhill running resulted in a significant ($p < 0.01$) decrease in relative intracellular Mg^{2+} concentration in *mdx* compared to pre-exercise (Pre: 0.398 ± 0.072 mM; Post: 0.241 ± 0.050 mM), but no differences

were observed in controls. Also, there was a trend ($p=0.18$) towards an elevated Pi/PCr in the gastrocnemius and soleus muscles in *mdx* after exercise compared to before exercise (Pre: 0.046 ± 0.028 ; post: 0.061 ± 0.018). The energetic alterations in *mdx* were enhanced in the regions of muscle damage identified with T_2 -weighted MRI. **Conclusions:** Downhill running resulted in intracellular changes in *mdx* mice evident with 31 P-MRS, including lower intracellular Mg^{2+} concentrations, likely due to compromised sarcolemma integrity. Overall, 31 P-MRS measures are sensitive to acute muscle damage induced by downhill running and may be a valuable technique for testing potential therapeutic interventions in dystrophic muscle. **Funding Source:** NIH (NIAMS) R01 AR070101.

1283 Board #45 May 30 9:30 AM - 11:00 AM
Evaluation of Resistane Exercise-Induced Muscle
Swelling Using Bioelectrical Impedance Analysis
 Maki Atsuta, Yuri Misonoo, Shun Kondo, Hiroaki Ito, Yuto Yamada, Natsuko Okamoto, Atsushi Iwashita, Yusuke Mizutani, Haruna Nagatsuka, Kurumi Watanabe, Mikihiro Wata, Seishiro Kayanuma, Ayame Iwata, Kazushige Goto. *Ritsumeikan University, Kusatsu, Japan.* (Sponsor: Robert Kraemer, FACSM)
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PURPOSE: The purpose of the present study was to examine time course changes of muscle swelling evaluated by bioelectrical impedance analysis (BIA) following resistance exercise.

METHODS: Nine subjects (20.8 ± 0.4 yrs, 174.4 ± 6.8 cm, 67.4 ± 8.1 kg) conducted exercise condition (EX) and rest condition (REST) on different days (a week between conditions). In the EX, subjects conducted unilateral arm curl exercise (12 repetitions \times 5 sets, 90 s rest period between sets) for biceps brachii muscle at 60% of maximal voluntary contraction. In the REST, the subjects maintained rest for identical period from exercise duration in the EX. Time course changes in BIA (locally evaluated BIA for biceps brachii muscle), muscle thickness (evaluated by ultrasound) for biceps brachii muscle, circumference of upper arm and blood lactate concentrations were determined before exercise (or rest), immediately after, 30 min and 60 min after exercise (or rest).

RESULTS: The EX caused significant increases in muscle thickness and circumference during post-exercise ($p < 0.05$). Moreover, blood lactate concentration was significantly increased in the EX after exercise ($p < 0.05$). In contrast, no significant change was observed for these variables in the REST. The EX showed rapid reduction of BIA immediately after exercise (from 28.7 ± 10.4 k Ω to 18.5 ± 4.6 k Ω , $p < 0.05$). Furthermore, BIA revealed significantly lower values in the EX than those in the REST immediately after exercise (EX: 18.5 ± 4.6 k Ω vs. REST: 27.7 ± 6.7 k Ω , $p < 0.05$) and 15 min after exercise (EX: 22.0 ± 7.0 k Ω vs. REST: 29.5 ± 9.5 k Ω , $p < 0.05$).

CONCLUSION: Resistance exercise reduced local BIA during post-exercise, with concomitant increases in muscle thickness and circumference. Therefore, acute reduction of BIA following resistance exercise may reflect exercise-induced muscle swelling and increased water volume in the muscle.

1284 Board #46 May 30 9:30 AM - 11:00 AM
The Assessment Of Muscular Characteristics Using
Tensiomyography In Hemiplegic Stroke Patients
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 (No relevant relationships reported)

PURPOSE:

Tensiomyography (TMG) has been used to assess muscular characteristics of the lower extremity. However, in stroke patients, the TMG characteristics have not been reported to date. The aim of this study was to investigate the functional behavior and stiffness of muscles in hemiplegic stroke patients

METHODS: Fifteen patients with hemiplegic stroke (mean age: 64 ± 12.51 years; 13 males, 2 females) were recruited. In hemiplegic side, the presence of hypertonus was proved by the H/M ratio and we excluded the subjects with abnormal muscle tone in sound side. The evaluation included: muscular function by TMG with a digital transducer De-Dc Trans-Tek® and muscle stiffness by sonoelastography. Functional elements of the lower extremity muscle groups (Rectus femoris, RF, Biceps femoris, BF, Gastrocnemius, GCM and Tibialis anterior, TA) were evaluated and the following parameters were assessed from muscular point of view: contraction time (Tc), sustain time (Ts), delay time (Td), relax time (Tr) and displacement maximal amplitude (Dm) after electrical stimulation. We performed comparative analysis of between the sonoelastographic data of sound side and affected side. Then, we checked the correlation between TMG parameters and the sonoelastographic parameters.

RESULTS: 1) There were no significant differences in the vast majority of the TMG parameters between affected and sound side of lower extremities. The RF-Tr ($p=0.008$), the RF-Dm ($p=0.041$) and the TA-Tr ($p=0.05$) were decreased, compared to the sound side. 2) At the affected side of BF, GCM and TA, the quantitative analysis of

the color histogram revealed a significantly greater intensity of red ($p=0.030$, $p=0.001$, $p=0.004$) and a lower intensity of blue ($p=0.004$, $p=0.001$, $p=0.026$) than sound side. 3) In affected side, the red intensity of TA is correlated with the RF-Tc ($r=-0.566$, $p=0.044$) and TA-Ts ($r=0.618$, $p=0.043$). The red intensity of GCM is correlated with the GCM-Tc ($r=0.714$, $p=0.047$) and the GCM-Tr ($r=-0.786$, $p=0.021$). The red intensity of BF is correlated with GCM-Tr ($r=-0.857$, $p=0.014$).

CONCLUSIONS:

The results of our study help understanding muscle physiologic change associated with CNS lesion. These are useful to detect muscle dysfunction and assess the effect of neuromuscular rehabilitation in stroke patients

1285 Board #47 May 30 9:30 AM - 11:00 AM Exercise-induced Changes In Muscle Thickness As Measured By Both A-mode And B-mode Ultrasound

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(No relevant relationships reported)

Acute changes in muscle thickness (MT) following resistance exercise are often examined to determine the anabolic potential of an exercise stimulus. This acute change is often attributed to swelling and has been postulated to act as a proliferative signal resulting in a shift towards muscle growth. B-mode ultrasound is commonly used to track acute changes in MT. However, A-mode ultrasound presents a more affordable alternative to measure these same changes. Although A-mode ultrasound may be used to image skeletal muscle, this method does not allow live imaging across a large area of tissue like B-mode ultrasound. In addition, interface detection may be more difficult due to the quality of the image. **PURPOSE:** To compare MT values between A-mode and B-mode ultrasound before and following four sets of biceps curls. **METHODS:** Participants visited the laboratory twice. During the first visit, paperwork and one repetition maximum (1RM) strength assessment were completed. During the second visit, participants performed 4 sets of biceps curls to volitional failure using an exercise load equal to 70% of 1RM. MT measurements were taken before and immediately following exercise. MT measures were taken with both A-mode and B-mode ultrasound. Results are displayed as means (95% CI). **RESULTS:** A total of 23 resistance trained men ($n=12$) and women ($n=11$) completed the study. For MT, there was no interaction, the mean difference in the exercise-induced change in ultrasound-measured MT between A-mode and B-mode was 0.02 (-0.11 - 0.05) ($p = .51$) cm. There were, however, main effects for time ($p < 0.001$) and measurement type ($p = 0.001$). MT increased from pre [3.62 (3.25-3.99) cm] to post [4.07 (3.66-4.47) cm] exercise. In addition, MT values as measured by A-mode ultrasound were smaller than those measured by B-mode ultrasound [mean difference 0.174 (0.08- 0.26) cm]. **CONCLUSIONS:** Our results suggest MT measurements taken using A-mode ultrasound are smaller than those using B-mode ultrasound. Despite this difference, it appears A-mode can detect similar acute changes in MT following resistance exercise when compared to B-mode. These results suggest that A-mode ultrasound can serve as a useful tool to examine acute changes in MT, which may also help to better understand the effectiveness of a resistance exercise stimulus.

1286 Board #48 May 30 9:30 AM - 11:00 AM Age-related Change In Cross Sectional Area Of The Psoas Major Muscle In Japanese

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(No relevant relationships reported)

Although skeletal muscle mass decreases in sarcopenia, it is not clear whether it occurs systemically or partially. It is important to clarify the age-related change of each skeletal muscle as a basic component of sarcopenia research. **PURPOSE:** The purpose of this study was to investigate characteristics of age related changes in the cross sectional area of psoas major muscle as part of elucidation of sarcopenia. **MRTHODS:** Subjects consisted of 2014 persons (938 males and 1076 females) aged 10 to 91 (classified every 5years) examined at our clinic. Using MRI, muscle cross-sectional area was measured on psoas major muscle at height of the iliac crest (L4 - L5). Data was divided into gender and age, and analysis of variance and multiple comparisons were performed. We also examined the relationship with BMI for 614 subjects who were able to confirm their height and weight. **RESULTS:** The cross-sectional area of psoas major muscle peaked the ages of 15 to 19, and declined with age. The decline was noticeable after the aging 50s in both sexes. A remarkable decrease was also observed in the late 30s and 70s in men. Interaction between sex and age was observed, and differences in patterns were observed between men and women. As a result of analysis of variance, no correlation was found between BMI and age, but a correlation was found between gender and BMI and between sex and age. In all age

groups, it was confirmed that the group having a larger BMI exhibited a larger muscle cross sectional area. **CONCLUSIONS:** These results showed the characteristics of age-related change of cross sectional area of the psoas major muscle. Further investigation is needed for sarcopenia research.

1287 Board #49 May 30 9:30 AM - 11:00 AM Skeletal Muscle VO₂ Kinetics By Nirs "Repeated Occlusions Method" During Recovery From Cycle Ergometer Exercise

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(Sponsor: Bruno Grassi, FACSM)

(No relevant relationships reported)

Near-infrared spectroscopy (NIRS) has been utilized as a non-invasive method to evaluate skeletal muscle mitochondrial function in humans, by calculating muscle VO₂ (VO_{2m}) recovery kinetics (repeated occlusions method) following brief (~15 s) light-intensity (unknown work rate) plantar flexion exercise. **Purpose:** The aim was to determine VO_{2m} recovery kinetics, by the same approach, following standard cycle ergometer exercise of different intensities, and to compare them with pulmonary VO₂ (VO_{2p}) recovery kinetics. **Methods:** Fifteen young physically active healthy males performed on a cycle ergometer an incremental exercise (INCR) up to exhaustion (to determine peak VO_{2p} and the gas exchange threshold [GET]) and two repetitions of constant work-rate (CWR) exercises at 80% of GET (MOD) and at 40% of the difference between GET and peak VO_{2p} (HEAVY). VO_{2p} and vastus lateralis muscle fractional O₂ extraction by NIRS ($\Delta[\text{deoxy}(\text{Hb}+\text{Mb})]$) were recorded continuously. Transient arterial occlusions (5-10 s each; rapid cuff inflation at ~300 mmHg) were carried out at rest and during the recovery for VO_{2m} calculation by standard methods. The time constants (τ) of the monoexponential VO_{2m} and VO_{2p} kinetics during the first 7-6 minutes of recovery were determined. **Results:** Peak VO_{2p} was 47.5±6.7 ml·kg⁻¹·min⁻¹. VO_{2m} values at the onset of recovery were ~27, ~38 and ~35 times higher (in MOD, HEAVY and INCR, respectively) than at rest. τ of VO_{2m} recovery (coefficient of determination, r^2 , ranging from 0.93 to 0.99) was lower (faster kinetics) following MOD (29.1±6.8 s) vs. HEAVY ($P<0.001$) or INCR ($P<0.001$) (40.8±10.9 and 42.9±10.9, respectively). Also τ of VO_{2p} recovery was lower following MOD (37.5±6.2 s) vs. HEAVY ($P<0.01$) or INCR ($P<0.001$) (41.9±5.9 and 44.7±5.1, respectively). A significant difference between τ of VO_{2m} and VO_{2p} kinetics was observed only in MOD ($P<0.0001$). τ of VO_{2p} recovery kinetics were significantly ($P=0.0002$, $r=0.53$) correlated with τ of VO_{2m}. **Conclusion:** Both VO_{2m} and VO_{2p} kinetics were faster in the recovery from moderate- vs. heavy- or maximal-intensity cycle ergometer exercise. VO_{2m} recovery kinetics, determined non-invasively by the NIRS "repeated occlusions" technique can be utilized as a functional evaluation tool also following conventional cycle ergometer exercise.

1288 Board #50 May 30 9:30 AM - 11:00 AM Pelvic Limbs Length And Knee Alterations In Health Sciences College Students.

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PURPOSE: To assess muscle-skeletal conditions (MEC) of pelvic limbs and knees in the University of Guanajuato Health Sciences Division freshmen.

METHODS: Transversal, descriptive study designed to clinically evaluate musculoskeletal alterations of the pelvic limbs and knees in first-year students enrolled in health sciences college programs of a Central Mexico University. The evaluation was performed by a team integrated by a certified orthopedist and traumatologist, two physiologists, a medical sciences doctor, and a graduate student. Methods were based on Viladot (2004).

RESULTS: 293 students mean age 18.9 ± 1.7 (± s.d.) were evaluated. 208 of them women and 85 men; 291 singles and two married; 39 employed, 247 do not have a different occupation than being students; 7 did not respond the question. Four participants were classified as obese, 15 as robust, 205 as having medium complexion and 68 as being slim. The sample showed various limbs and knees musculoskeletal alterations: four participants had a center of gravity anteriorized; eighty had shortening in the right pelvic member, and five in the left side. 52 persons shown *genu valgus* and five, *genu varus*. One participant presented tibial *varus*.

CONCLUSIONS: Prevalence of limb and knee musculoskeletal alterations in freshman health sciences students is similar to the one for other sectors of the Mexican population. Considering that health providers are prone to develop bone, muscle and joints alterations derived from their professional activities, it is important to know predisposing conditions, to support exercise preventing programs.

- 1289** Board #51 May 30 9:30 AM - 11:00 AM
Effect Of Limb Position On Vastus Lateralis Muscle Morphology Measured By B Mode Ultrasonography
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 (No relevant relationships reported)

PURPOSE: A narrative review of studies which measured vastus lateralis (VL) muscle thickness (MT) using Ultrasonography (US) revealed inconsistencies in the procedures and techniques used for measurement. One consideration for measurement is the position of the limb and participant. Knee extension was the most commonly reported position, however some studies used knee flexion. The extent to which this alters muscle morphology is unknown and therefore, there is uncertainty as to whether data from studies using different positions can be compared. The aim of this study was to analyse whether limb position, knee extension or knee flexion, had a significant effect on VL-MT, pennation angle and fascicle length.

METHODS: In order to have a homogenous sample, thirty two full time male professional soccer players took part in the study [age = 18.3 ± 0.5 years (mean \pm SD), height = 179 ± 1.7 cm, mass = 77.3 ± 3.5 kg]. In vivo MT and architecture was measured using B mode US (LOGIQ e, GE Healthcare). Two images were taken of the VL in the dominant leg while the participant was supine with their knee extended or flexed at 90 degrees (leg off the bed). Images were downloaded to an imaging software (Image J, v1.51k; NIH; Bethesda; USA). Analysis of the data was conducted in SPSS v24. Descriptive statistics were calculated for each of the dependant variables (MT, pennation angle and fascicle length). A Paired T test was performed for each of the data sets. $P < 0.05$ was classed as significant. **RESULTS:** MT was significantly greater in the supine/knee extended position compared to the supine/knee flexed position (2.43 ± 0.18 cm vs. 2.36 ± 0.17 cm; $t(31) = 2.76$, $p < 0.010$). Pennation angle was also significantly larger in knee extension compared to knee flexion ($18.47 \pm 1.18^\circ$ vs. $16.87 \pm 1.14^\circ$; $t(31) = 7.59$, $p < 0.000$). Whereas fascicle length was significantly greater in knee flexion compared to knee extension (9.87 ± 0.53 cm vs. 9.04 ± 0.92 cm; $t(31) = -7.652$, $p < 0.000$). **CONCLUSIONS:** This study is the first to demonstrate differences in muscle morphology, dependent on limb position, as measured by US. The differences in MT were less than the smallest real difference calculated for US in our laboratory. A standard operating procedure for the measurement of MT using US is required. This study only addresses one aspect of a standard operating procedure.

- 1290** Board #52 May 30 9:30 AM - 11:00 AM
Profiles of Quadriceps Muscles after Downhill Running using Ultrasonography
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 (No relevant relationships reported)

PURPOSE: The aim of study was to examine the changes of muscle properties after downhill running at different intensities, and further to investigate the optimal biomarkers for muscle damage. **METHODS:** Eleven sedentary men were randomly assigned to repeated measured running sessions set up either at High (HS, 70% HR_{max}) or Low (LS, 50% HR_{max}) with -9° (-16% gradient). Each session consisted of 30 min downhill running on separate occasions 2-wk apart. Range of motion (ROM) was calculated from voluntary maximal extension and flexion. Muscle soreness was recorded on visual analog scale (VAS) with algometry on rectus femoris (RF), vastus lateralis (VL), and vastus medialis (VM). Echo intensity (EI) was scanned with B-mode ultrasonography and analyzed with gray scale analysis. In addition, serum creatine kinase (CK) activity had evaluated as a blood biomarker. All parameters were taken at PRE, POST, 24, 48, and 72hr, respectively. **RESULTS:** Significant differences were found in EI and CK activity ($p < 0.05$, respectively) between sessions including baseline. Interestingly, significant increases of EI were found on RF (at POST, 24hr, & 48hr) and VL (at POST & 24hr) after HS ($p < 0.05$, respectively). Also, significant interactions were found on RF and VL after HS ($p < 0.05$, respectively) whilst no significant differences and interactions were indicated on VM at both sessions. In particular, significantly greater EI was found after HS than LS ($p < 0.05$). In addition, CK activity was significantly different at both sessions (at 24 & 48hr), but HS had significantly greater CK activity at 24hr, compared to LS ($p < 0.05$). Moreover, significantly greater VAS on RF ($p < 0.05$ at 24 & 48hr, respectively) and VL ($p < 0.05$ at 24hr) after HS yet there were no significant differences after LS. Furthermore, ROM had significant differences at both sessions, compared to baseline ($p < 0.05$, respectively) while significantly greater changes was found after HS ($p < 0.05$ at 48hr). **CONCLUSIONS:** Downhill running at different intensities does have effect on serum protein and muscle quality. In particular, echo intensity reflected the muscle damage differences depending on exercise intensities, similar to CK changes. Thus, this study has suggested the non-invasive ultrasonography is an effective method for muscle damage evaluation. Supported by NRF-2017R1C1B1006196

- 1291** Board #53 May 30 9:30 AM - 11:00 AM
Feasibility of Using Shear Wave Elastography to Quantify Achilles Tendinopathy Stiffness Before and After Rehabilitation
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 (No relevant relationships reported)

BACKGROUND: Chronic Achilles tendinopathy is characterized by a softening of the elastic property of the tendon which can be quantified with Shear Wave Elastography (SWE). Blood flow restriction training (BFR) may increase tenocyte proliferation and repair when combined with a loading protocol, thereby restoring stiffness to softened tendons. **PURPOSE:** The primary purpose of this study was to evaluate the feasibility of using SWE to measure changes in Achilles tendon elasticity before and after rehabilitation. A secondary purpose was to evaluate feasibility and effectiveness of incorporating BFR or sham BFR in addition to an eccentric exercise protocol. **METHODS:** Participants presenting with unilateral Achilles tendinopathy to outpatient physical therapy clinics performed eccentric exercises as a home exercise program (HEP) 2x/day. Participants came into the clinic 2x/week for 12 weeks and were randomized to perform either BFR (limb occlusion pressure = 80%, $n = 6$) or sham BFR (limb occlusion pressure $< 10\%$, $n = 5$). Tendon stiffness was quantified with SWE as Young's modulus in symptomatic (SYM) and asymptomatic (ASY) tendons at baseline and after 12 weeks. **RESULTS:** At baseline participants' ($n = 11$, age = 33.9 ± 10 , weight = 80.6 ± 16.3 kg, male = 63.6%, weeks of symptoms = 34.1 ± 24.1) Young's modulus was lower in SYM tendons than in ASY tendons (mean \pm SD = 432.2 ± 124.8 kPa vs 496.6 ± 66.5 kPa). At the end of 12 weeks the SYM tendon had normalized to the ASY side (530.0 ± 93.1 kPa vs 527.0 ± 75.4 kPa). The change in Young's modulus in the BFR group was approximately twice that of the sham BFR group (123.2 ± 71.4 kPa vs 67.4 ± 185.8 kPa) in the SYM tendons. Both groups compliance with the HEP was $> 80\%$ (BFR 83.3% vs sham BFR 91.6%), and there was no difference between in-clinic compliance (BFR 74.4% vs sham BFR 74.7%). Blinding in the sham BFR group resulted in 80% of subjects unable to determine correct group assignment. **CONCLUSIONS:** It is feasible to use SWE to measure changes in Achilles tendon stiffness. The addition of BFR to eccentric exercises may result in larger improvements in tendon stiffness. High compliance in both groups support the feasibility of BFR training in addition to a HEP of eccentric exercise, and sham BFR can be used as a control. This work was funded by the AMEDD Advanced Technology Initiative #6042, TATRC, US Army MRMC.

- 1292** Board #54 May 30 9:30 AM - 11:00 AM
Examination of Tendon and Muscle Architecture and Their Influence on Postural Stability
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 (No relevant relationships reported)

Total length of the Achilles tendon (AT_{Length}) and strength characteristics of the triceps surae have been utilized to investigate musculotendinous stiffness and tendon compliance. However, very few studies have examined the relationship between tendon characteristics and fascicle-specific muscle architecture (pennation angle; PA), or their influence on subsequent functional performance. **PURPOSE:** Evaluate the relationship between AT_{Length} and medial gastrocnemius (MG) PA, as well as their influence on balance performance (overall stability index; OSI). **METHODS:** Eighteen female (mean \pm SD: age = 19 ± 1 years) participants laid in a prone position on a cushioned table, with their hip and knee in extension, and ankle maintained in a neutral position (90°). Ultrasonography (US) PA images were scanned in a longitudinal position at the medial 1/3 of the low leg with a linear-array probe at the level of the tibial tuberosity, and were identified as the angle formed between the muscle fascicles and the deep fascia of the MG muscle. AT_{Length} was captured in the extended-field of view setting starting at the calcaneal insertion of the AT and ending at the MG musculotendinous junction (MTJ). AT_{Length} was identified as the distance (cm) between the calcaneal notch and MG MTJ. All US image measurements were analyzed using a third-party image analysis software. Balance assessments were performed on a commercially designed balance unit with an adjustable dynamic platform and involved three, 20-s single leg balance trials. Pearson product-moment correlation coefficients (r) were used to examine the relationships between AT_{Length} , MG PA, and OSI. **RESULTS:** A significant negative correlation ($r = -0.499$; $R^2 = 0.247$; $p = 0.035$) was observed between MG PA and AT_{Length} . No significant correlations were observed between OSI and MG PA ($r = -0.109$, $R^2 = 0.012$; $p = 0.666$) or OSI ($r = 0.071$; $R^2 = 0.005$; $p = 0.778$) and AT_{Length} . **CONCLUSION:** The present investigation revealed a longer Achilles tendon length was associated with a diminished pennation angle of the

medial gastrocnemius in young females. Additionally, balance assessments may not be a sensitive measure for determining the influence of musculotendinous architecture on functional performance.

1293 Board #55 May 30 9:30 AM - 11:00 AM

Assessing Agreement of Lateral Leg Composition Using Dual X-ray Absorptiometry

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(No relevant relationships reported)

PURPOSE: Recently, we reported the accuracy of a novel lateral segmentation dual X-ray absorptiometry (DXA) scanning method for measuring lower extremity total, lean, and fat masses in the lateral view on the GE Lunar iDXA compared to the standard whole-body frontal DXA scanning view. Therefore, the current study was undertaken to examine the agreement of this lateral segmentation DXA scanning method using a Hologic Horizon A DXA scanner. **METHODS:** Thirty healthy college-age participants (16 female; $\bar{X}_{age} = 21.5 \pm 1.7$ yrs.) received three DXA scans (1 whole-body and 2 lateral leg scans) to quantify and compare leg composition in the frontal and lateral plane. To mark regions of interest (ROIs) that would be visible on the DXA scan, metallic markers were placed at 60% of the length above and below each leg's lateral epicondyle. Using lateral subject positioning, leg composition was measured with participants lying on their right and left sides, with the scanned leg elevated using two foam pads at the ankle and the widest portion of the upper-leg. Paired t-tests examined the lateral DXA scanning method's agreement when quantifying total, lean, and fat masses, and bone mineral content (BMC) compared to measurements of equal area obtained in the standard whole-body frontal DXA scanning view. **RESULTS:** Comparisons of frontal and lateral view DXA scan measurements for right leg total mass (7.12 ± 0.91 kg vs. 6.40 ± 0.85 kg), lean mass (5.14 ± 1.05 kg vs. 4.78 ± 0.93 kg), fat mass (1.70 ± 0.44 kg vs. 1.36 ± 0.33 kg), and BMC (0.28 ± 0.06 kg vs. 0.23 ± 0.05 kg), respectively, were significantly different (all $p < 0.001$). Similarly, comparisons of frontal and lateral left leg total mass (7.12 ± 0.97 kg vs. 6.44 ± 0.93 kg), lean mass (5.15 ± 1.12 kg vs. 4.82 ± 1.01 kg), fat mass (1.70 ± 0.44 kg vs. 1.35 ± 0.41 kg), and BMC (0.28 ± 0.06 kg vs. 0.23 ± 0.06 kg), respectively, were all significantly different (all $p < 0.001$). **CONCLUSIONS:** Unlike our previous study in which we reported agreement of lateral leg composition measurements in comparison to frontal composition measurements of equal area utilizing the GE iDXA scanner, we did not observe agreement between the two views using the Hologic Horizon A DXA scanner. Therefore, caution should be used when examining leg composition in the lateral view using a Hologic Horizon A DXA scanner.

C-32 Free Communication/Poster - Motor Control

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1294 Board #56 May 30 10:30 AM - 12:00 PM

Neuromuscular Responses in Lower Limb Bilateral Deficit: A Pilot Study

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Neuromuscular Responses in Lower Limb Bilateral Deficit: A Pilot Study

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The bilateral deficit is the phenomenon in which the sum of the forces produced unilaterally is greater than the force produced bilaterally during maximal contractions of the limbs. **PURPOSE:** This study examined the neuromuscular responses during the measurement of lower limb bilateral and unilateral muscular strength. **METHODS:** Twelve (male: $n = 6$; female: $n = 6$) subjects (mean \pm SD age: 24.5 ± 4.8 yrs, body mass: 74.2 ± 14.6 kg) completed randomized, isometric, seated leg extension bilateral and unilateral maximum voluntary isometric contractions (MVIC). On a separate day, the subjects completed a randomized, bilateral and unilateral dynamic, seated leg extension for the determination of the 1 repetition maximum (1RM) strength. The electromyographic (EMG) and mechanomyographic (MMG) amplitude (AMP) and mean power frequency (MPF) were measured from the vastus lateralis of the right and left lower limbs during the MVIC and 1RM trials, and were normalized to the corresponding signal from the MVIC trials. Statistical analyses included paired samples t-test ($p \leq 0.05$). **RESULTS:** Six of the 12 subjects demonstrated a 1RM bilateral deficit (BLD; $-9\% \pm 2.9\%$). Within the BLD subjects, the EMG MPF was significantly greater ($p = 0.03$) during the unilateral 1RM than the bilateral 1RM, but

EMG AMP, MMG AMP, and MMG MPF were not different (Figure 1). There were no differences between unilateral and bilateral neuromuscular responses for the non-BLD ($n = 6$) subjects. **CONCLUSION:** These findings indicated the BLD could be due to different motor control strategies, such as changes in muscle fiber conduction velocity, in a bilateral versus a unilateral movement of the lower limbs.

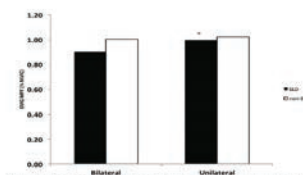


Figure 1. Mean \pm SD of the bilateral and unilateral (normalized) electromyographic mean power frequency (EMG MPF) normalized values during the dynamic, seated leg extension (1RM) for the subjects ($n = 12$) with a 1RM bilateral deficit (BLD) and the subjects ($n = 6$) with no bilateral deficit (non-BLD). *Significantly ($p < 0.05$) greater than the bilateral dynamic, seated leg extension 1RM.

1295 Board #57 May 30 10:30 AM - 12:00 PM

Recommendations For The Evaluation Of The Foot Tapping Test (ftt) In A Healthy Population

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(No relevant relationships reported)

The foot tapping test (FTT) is a neurological exam used to assess upper-motor neuron (UMN) function in clinical populations. However, little research has been done to determine the best method of conducting the FTT. Furthermore, it is unknown how participant characteristics such as lower limb lean mass may impact the FTT.

PURPOSE: This study sought to evaluate the reliability of the FTT in a healthy population when using different counting methods and testing conditions, as well as to assess the impact of lower limb muscle mass on tapping rates. This information could be used to establish testing recommendations for the FTT in clinical populations.

METHODS: Thirty-eight healthy individuals (age 18-63) completed a series of FTT trials over 4 visits. Participants had their foot positioned so that the ball of the foot was over a small force plate and the heel off. They were then instructed to tap as many times as possible over a 10 second period. A total of 32 trials under different conditions (shoes ON, shoes OFF, dom. foot, and non-dom. foot) were performed. A DXA scan was used to measure lower limb mass. Means were compared between trial #, visit #, shoe condition (ON or OFF), dom. vs. non-dom. foot (footedness), and counting method. Correlations between subject characteristics (such as age, activity level, shoe size, weight, height, and lower limb lean mass) and tapping rates were also calculated. **RESULTS:** Significant differences were found between footedness, shoes ON/OFF and in foot taps counted using each counting method ($p < 0.001$). In addition, significant interactions were found between force plate count and shoes ON/OFF ($p = 0.011$), as well as live count and shoes ON/OFF ($p < 0.001$). Live and video counts showed no significant differences; however, force plate counts were significantly lower ($p < 0.001$). Foot tapping rate was not correlated with any of the participant characteristics ($p > 0.05$, $R < 0.282$ for all). **CONCLUSION:** These results suggest that the FTT should be performed whilst wearing shoes, and measured using the force plate counting method. These conditions were found to be the most accurate for this population, and thus should be used if a force plate is available. Future research should attempt to determine normative FTT rates in clinical and aging populations in order to evaluate the extent that UMN function is affected.

1296 Board #58 May 30 10:30 AM - 12:00 PM

Sleep Restriction Negatively Influences Visually and Memory-Guided Force Control

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(No relevant relationships reported)

Cognitive performance is negatively influenced by sleep restriction, and athletic performance is improved through sleep extension. However, little work has quantified motor output under rigorous and controlled conditions of sleep restriction. **PURPOSE:** This study examined the effects of sleep restriction on visually and memory-guided grip force control. **METHODS:** Participants ($N=9$) were inpatients in a sleep restriction study, during which behavioral, physiological, and neuroimaging experiments occurred. Here, we report the results of a grip force task conducted on three days: (D1) after two nights of adequate sleep, (D2) after four consecutive nights of sleep restriction, and (D3) after one night of recovery sleep. Participants completed four

20-s trials of isometric force with their index finger and thumb, to 25% of their maximal voluntary contraction. In the full-vision (FV) condition, visual feedback was provided for the duration of the trial. In the no-vision (NV) condition, visual feedback was provided for the first 8 s of the trial, and then visual feedback was removed. Participants were to maintain force output for the remaining 12 s. **RESULTS:** In FV, participants produced less mean force on D2 (24.0%) relative to D1 (24.9%) and D3 (25.0%). Mean force did not differ as a function of day in NV. The coefficient of variation was higher on D2 relative to D1 and D3, in both FV (D1: 1.7%, D2: 5.6%, D3: 1.5%) and NV (D1: 5.2%, D2: 5.6%, D3: 5.0%). **CONCLUSIONS:** These findings are the first demonstrations that restricted sleep negatively impacts force control.

1297 Board #59 May 30 10:30 AM - 12:00 PM

The Effect of Muscle Contraction Type on Neuromuscular Complexity in Trained Individuals

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(No relevant relationships reported)

Physiological systems exhibit high levels of complexity characterized by non-linearity and persistent fractal correlations (low levels corresponding to states such as disease, injury, and fatigue) and has become recognized as a defining feature of healthy physiological functioning. Neuromuscular complexity is affected by fatigue and intensity of contractions, although no study has investigated the effect of contraction type on complexity.

Purpose: The purpose of this study was to investigate the effect of contraction type on neuromuscular complexity.

Methods: Twelve collegiate-aged resistance-trained females (21 ± 1 years, 63.3 ± 7.4 kg) were recruited to visit the laboratory on two occasions, the first for familiarization purposes. In session two, participants performed three maximal knee extensor contractions on an isokinetic dynamometer for each contraction type [concentric (CON), eccentric (ECC), and isometric (ISO)] in random order. Relative knee angle was standardized to 120° during ISO contractions. Angular speed was standardized to $30^\circ \cdot s^{-1}$ and range of motion to 90° ($90^\circ - 180^\circ$ at full extension) during CON and ECC contractions. Each contraction lasted three seconds with three seconds rest between contractions. Electromyographic (EMG) signals were recorded from the vastus lateralis using a bipolar electrode configuration. Sample entropy (SE), a unitless measure of statistical irregularity was used as an index of physiological complexity. A one-way repeated measures ANOVA was performed to investigate differences in EMG SE among contraction types. Alpha level was set to 0.05.

Results: Contraction type was observed to have a significant effect on EMG SE ($F(2,22) = 7.212, p = 0.004$). Specifically, CON contractions (1.671 ± 0.193) displayed significantly greater EMG SE than ECC ($1.497 \pm 0.321, p = 0.017$) and ISO ($1.569 \pm 0.223, p = 0.028$) contractions.

Conclusion: These findings indicated that neuromuscular complexity is contraction-type dependent, being significantly higher during CON than ECC and ISO contractions. In addition, there exists no generally accepted framework to explain the underlying factors regulating complexity and thus, further investigation may provide valuable insight into these potential mechanisms.

1298 Board #60 May 30 10:30 AM - 12:00 PM
Reliability of Motor Unit Behavior during a Maximal Voluntary Isometric Contraction of the Knee Extensors

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(No relevant relationships reported)

PURPOSE: To establish the intra- and inter-day reliability of the mean firing rate (MFR) versus recruitment threshold (RT) of the vastus lateralis (VL) during a maximal voluntary isometric contraction (MVIC) of the knee extensor muscle.

METHODS: Thirty-two young, healthy males (Mean \pm SD; Age: 23 ± 3 years; Height: 176.4 ± 5.9 cm; Weight: 87.3 ± 13.4 kg) reported to the laboratory on three separate occasions, each separated by 6 ± 1 days. Each visit occurred at the same time of day (± 1 hour) and consisted of MVIC testing and ramp contractions, during which MU behavior was recorded. Specifically, subjects completed 2 MVIC attempts each separated by approximately 2 min., in the subject's maximal force (F_{MAX}) was obtained. Following an additional 2 minutes of rest, subjects completed 2 maximal ramp contraction, each separated by 2 minutes of rest, during which MU behavior was recorded through surface electromyography (sEMG). The ramp contraction trajectory consisted of a 3 second quiescent period, followed by a 10 second linear increase to F_{MAX} , a 6 second hold at F_{MAX} , a 5 second linear decrease back to baseline and another 3 second quiescent period. Both relative intra- and inter-day reliability of the MFR versus RT relationship were examined using the intra-class correlation coefficients ($ICC_{2,1}$). The standard error of measurement (SEM) was calculated as the square root of the mean square error term from the ANOVA table and expressed in

the units of measurement. The coefficient of variation (CV) was also calculated by expressing the SEM relative to the grand mean (%). **RESULTS:** For intra- and inter-day analyses, 16 and 20 subjects met the inclusion criteria and were included in final analyses, respectively. Both intra- and inter-day reliability statistics are presented in Table 1. **CONCLUSIONS:** The MFR versus RT relationship of the VL demonstrates strong intra- and inter-day reliability during a maximal voluntary contraction in young, healthy men.

	Intra-Day (n = 16)		Inter-Day (n = 20)	
	Slope	Y-Intercept	Slope	Y-Intercept
Mean 1 (SD)	-0.32 (0.12)	30.0 (8.1)	-0.31 (0.10)	30.2 (7.6)
Mean 2 (SD)	-0.31 (0.09)	30.6 (7.3)	-0.30 (0.09)	30.2 (7.9)
Sig.	0.793	0.638	0.677	0.984
ICC	0.802	0.783	0.813	0.800
95% CI	0.518-0.926	0.482-0.918	0.525-0.926	0.486-0.921
SEM	-0.04	3.65	-0.05	4.55
CV	14.2%	12.1%	18.1%	15.1%

1299 Board #61 May 30 10:30 AM - 12:00 PM

A Comparison of Motor Unit Control Strategies Between Two Different Isometric Muscle Actions

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(No relevant relationships reported)

The isometric muscle action is primarily responsible for performing two different tasks: attempting to shorten the muscle against an immovable object, and maintaining a fixed posture/joint position while resisting the lengthening inertial imposed by an external load. **PURPOSE:** To compare the motor unit control strategies between the two different tasks with similar mechanical requirements. **METHOD:** Twelve healthy men (Age: 23.7 ± 3.9 years; Weight: 84.8 ± 12.1 kg; Height: 172.8 ± 5.7 cm) and seven women (Age: 21.1 ± 1.6 years; Weight: 73.4 ± 15.6 kg; Height: 164.3 ± 3.9 cm) participated in this study. After the first visit as the familiarization, Visits 2 and 3 were randomly sequenced for force task and position task experimental testing. During both visits, maximal voluntary isometric contraction (MVIC) was measured, followed by the designated submaximal isometric trapezoid contraction task. Specifically, the force task required the participants to gradually increase the force from 0 to 40% MVIC in 4 seconds, held it for 10 seconds, and then gradually decreased the force to 0% in 4 seconds. For the position task, the participants were required to maintain a constant position, and to resist against the pulling force, created by the investigator with the same rate and intensity as those during the force task. Surface EMG signals from the biceps brachii muscle were collected and decomposed into constituent motor unit action potential trains. The relationship between the motor unit recruitment threshold and average firing rate, and between the recruitment and derecruitment thresholds were examined using linear regression analyses. **RESULTS:** Paired samples t-tests showed no significant differences between two tasks for the mean slope coefficient (-0.51 ± 0.34 vs. $-0.58 \pm 0.29, p = 0.515$) and y-intercept (24.80 ± 12.37 vs. $26.59 \pm 9.43, p = 0.589$) for the recruitment threshold vs. average firing rate relationship. In addition, the mean slope coefficient (1.23 ± 0.76 vs. $1.62 \pm 0.78, p = 0.125$) and y-intercept (-12.98 ± 23.54 vs. $-18.98 \pm 13.45, p = 0.391$) were also not different between two tasks for the relationship between recruitment and derecruitment thresholds. **CONCLUSION:** The motor unit control strategies did not seem to differ between the two submaximal isometric muscle actions.

1300 Board #62 May 30 10:30 AM - 12:00 PM

Badminton Players Show A Lower Coactivation And Higher Beta Band Emg-emg Coupling Between Antagonist Muscles

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(No relevant relationships reported)

PURPOSE: Previous studies have suggested that skilled athletes may show a specific muscle activation pattern with a lower antagonist coactivation level. Based on the point, we hypothesize that the coupling of antagonistic muscles may be different between elite badminton players and non-skilled individuals during exercises. The current work was designed to verify the hypothesis.

METHODS: Ten male college students and eight male badminton players performed three maximal voluntary isometric contractions (MVC) and a set of three maximal concentric ankle dorsiflexion and plantar flexion at angular velocity of $30^\circ, 60^\circ, 120^\circ$

and 180°/s. Surface EMG were recorded from the tibialis anterior (TA) and lateral gastrocnemius (LG) muscles during the test. Normalized average amplitude of the integrated EMG and phase synchronization index (PSI) between the EMG of TA and LG were calculated.

RESULTS: Antagonist muscle coactivation were significantly lower ($22.1\% \pm 9.4\%$, $24.7\% \pm 12.8\%$, $22.4\% \pm 9.4\%$, $22.4\% \pm 9.7\%$ for non-players and $10.7\% \pm 3.7\%$, $10.1\% \pm 4.9\%$, $11.2\% \pm 2.5\%$, $10.6\% \pm 2.5\%$ for badminton players in four angular velocity speed, $P < 0.05$ for four group comparison) and PSI in beta frequency band were significantly higher (0.42 ± 0.06 , 0.36 ± 0.13 , 0.36 ± 0.10 , 0.35 ± 0.12 for non-players and 0.47 ± 0.15 , 0.47 ± 0.15 , 0.48 ± 0.11 , 0.49 ± 0.14 for badminton players in four angular velocity speed, $P < 0.05$ for four group comparison) in badminton players group compared to non-players group during isokinetic ankle dorsiflexion contraction, while no significant difference was found in antagonist muscle coactivation and PSI between two group subjects during ankle plantar flexion.

CONCLUSIONS: The decrease of antagonist coactivation may indicate an optimal motor control style to increase the contraction efficiency, while the increase coupling of antagonistic muscles may be related to the compensation of joint stability as a result of the decrease of antagonist coactivation.

1301 Board #63 May 30 10:30 AM - 12:00 PM Does Strict Validation Criteria for Individual Motor Units Alter Extrapolation Analyses of the Motor Unit Pool?

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(No relevant relationships reported)

Recent technology allows for motor units (MU) action potentials (AP) to be acquired from multi-electrode surface EMG decomposition. Due to the high yield of MUs, this technology can be used to extrapolate findings for the entire MU pool (e.g. the relationship between mean firing rate (MFR) and recruitment threshold (RT)). However, it is unknown if characteristics of individual MUs affect extrapolation to the pool. **PURPOSE:** To have decomposed MU trains undergo strict validation based on interspike interval (ISI) variability, and to determine if analyses are affected if limited to only the validated MUs. **METHODS:** Five subjects performed 1 maximal ramp contraction of 15 sec. MU APs were obtained using a 5-pin array placed over the vastus lateralis. Two samples of MUs were used for analyses: an original (ORG) and a validated yield (VAL). ORG consisted of MUs that demonstrated >90% accuracy using the Decompose-Synthesize-Decompose-Compare test. VAL consisted of MUs from ORG that met further, strict criteria of ISI variability and histogram shape. All VAL MUs had a coefficient of variation (COV) < 30%, with an ISI histogram demonstrating a unimodal, kurtotic shape, absent of excess (> 2) counts in regions that represent missed or additional firings. Slope and intercept values were calculated for the MFR/RT relationship from ORG and VAL for each subject. Pedhazur's test for comparing regression equations was used to determine if the regression coefficients changed for each subject. **RESULTS:** 54% of the ORG MUs passed the validation. The COVs of the validated MUs ($M \pm SD$; $22.5 \pm 2.3\%$) were significantly ($p < .001$) lower than the discarded MUs ($26.2 \pm 3.4\%$). There were no significant differences in the regression coefficients between the two outputs for any of the subjects (Table 1). **CONCLUSION:** When using the outputs from a high-yield of MUs to extrapolate to the entire MU pool, strict validation criteria of individual MU firings does not alter the outcome of the analyses.

Table 1. Simple regression coefficients of original (O) vs. validated (V) motor units						
Recruitment Threshold vs. Mean Firing Rate						
	Slopes			Intercepts		
	O	V	p	O	V	p
S01	-0.54	-0.73	0.36	40.93	51.22	0.38
S02	-0.21	-0.24	0.33	22.11	23.21	0.91
S03	-0.74	-0.82	0.68	53.35	57.38	0.67
S04	-0.75	-0.67	0.47	53.01	49.64	0.24
S05	-0.25	-0.24	0.92	24.01	24.06	0.70

1302 Board #64 May 30 10:30 AM - 12:00 PM Differences In Biomechanical And Electromyographic Strategies Between Young And Old Persons During The Timed Up-and-go

Lawrence Villanueva, Keri Strand, Jeonghoon Oh, Moataz Eltoukhy, Jordan Strnad, Kevin Posner, Nathaniel Strand, Lauren Catena, Joseph F. Signorile. *University of Miami, Miami, FL.* (Sponsor: Dr. Kevin Jacobs, FACSMT)

(No relevant relationships reported)

PURPOSE: The timed-up-and-go (TUG) is one of the most common tests used to assess functional mobility. Although researchers have examined strategies used by specific groups in completing the turning component of the test, none have analysed electromyographical (EMG) activity. This study compared ground reaction force (GRF) vectors and EMG of the medial (MGas) and lateral (LGas) heads of the gastrocnemius, the vastus medialis (VM) and vastus lateralis (VL) during the turning component of the TUG. **METHODS:** Eight old (OG: 69.8 ± 7.3 y) and 10 young (YG: 21.5 ± 2.6 y) subjects performed three trials of the TUG. Force plates were positioned behind the cone to allow GRF collection, while EMG was simultaneously collected on the MGas, LGas, VM and VL using telemetry. EMG values during the turn were normalized using values during the approach. Subjects were instructed to perform the task as rapidly as possible. **RESULTS:** An ANCOVA covarying for subjects' weight revealed a significant difference in medio-lateral force vectors in the direction of the cone by age for the left ($p = .033$; $\eta^2 = .348$) and right ($p = .001$; $\eta^2 = .348$) leg stance phase. Pairwise comparisons showed the values were higher for the YG versus OG (right: $Mdiff = 250.2 \pm 106.5$ N; left: $Mdiff = 97.5 \pm 23.2$ N). These differences were also reflected in the analysis of vertical force to mediolateral force ratios on each side (right: $p = .023$, $\eta^2 = .298$; left: $p = .005$, $\eta^2 = .419$) and pairwise comparisons (right: $Mdiff = 1.62 \pm .64$; left: $Mdiff = 2.07 \pm .63$). Multivariate analysis of the nEMG data for the right and left LGas, MGas, VL, and VM showed a single significant difference with YG having lower utilization than their OG counterparts ($Mdiff = .397 \pm .149$, $p = .018$). **CONCLUSION:** Although the YG showed larger lateral GRF vectors toward the cone than OG, the lack of difference between groups for all but one muscle during the turn indicates that factors other than greater muscle activation appear to have allowed this strategy.

1303 Board #65 May 30 10:30 AM - 12:00 PM Knee Proprioception Measurement Reliability and its Relationship to Single Leg Reach Distance

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(No relevant relationships reported)

Improving knee proprioception is often recommended in rehabilitation after knee injuries. The best technique or tool for measuring knee proprioception is not yet identified. Additionally, evidence suggesting the role of proprioception in mechanics and injury risk is mixed, requiring further investigation. **PURPOSE:** To evaluate the validity and reliability of an inertial measurement unit (IMU) based clinical tool to assess knee proprioception, and to determine the association between proprioception and dynamic function. **METHODS:** Active joint position sense (JPS) was measured using an IMU-based tool (CoreX Therapy Pro, CX) and Biodex System III in 29 healthy participants (18F, aged 22-27y) with no current knee pain or prior knee surgery. For JPS on the Biodex, seated participants extended their knee and then flexed to 30° and held for 5s to learn the position. They extended the knee, and then matched the position as best they could. One practice and 5 trials were recorded. A similar procedure was completed for CX but testing was completed standing on the non-test leg. The anterior component of the Y-balance test was performed with heel down and hands on hips while standing on the test leg. Five recorded trials after 1 practice were averaged and normalized to leg-length. Intra-class correlation coefficients were calculated to establish within-session reliability of each proprioception measurement and Pearson correlation coefficients were used to assess the associations between proprioception and reach distance. **RESULTS:** The middle 3 values of each JPS measurement were averaged. Intra-session reliability of CX ($ICC(2,k) = 0.800$) and Biodex ($ICC(2,k) = 0.813$) were both good. However, agreement between CX and Biodex measurements was poor ($ICC(2,1) = 0.083$). Neither the Biodex ($r = 0.174$) nor CX ($r = -0.198$) correlated with single-leg reach distance.

CONCLUSIONS: After analyzing the differences between CX and Biodex measurements, we conclude the tools are assessing different aspects of proprioception. Additionally, knee proprioception does not appear to be the primary limiting factor in single-leg reaching. More research should be done to determine test-retest reliability of CX and Biodex and better understand the relationships between knee proprioception and knee function.

- 1304** Board #66 May 30 10:30 AM - 12:00 PM
The Motor Unit Mean Firing Rate versus Recruitment Threshold Relationship is Unaffected by Short-Term Disuse
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 (No relevant relationships reported)

The loss of muscle strength during periods of disuse is rapid. Some investigators have postulated that these changes are due to neural, rather than muscular, adaptations. It is unclear, however, if short-term immobilization of the knee joint affects the voluntary control of motor units. **PURPOSE:** To determine whether the slope and y-intercept of the motor unit mean firing rate versus recruitment threshold relationship is altered by 72 hours of disuse. **METHODS:** Fifteen healthy females (mean \pm SD age = 21 ± 2 years, body mass index [BMI] = 23.1 ± 2.3 kg/m²) voluntarily underwent left knee joint unloading via ambulating on crutches and use of a brace. The brace was worn at all times except during sleep, and compliance was confirmed via accelerometers secured around both ankles. Following two extensive familiarization sessions at the laboratory, testing was performed immediately prior to immobilization (PRE) and 72 hours later (POST). During both testing sessions, participants performed trapezoidal isometric contractions at a torque level corresponding to 50% of their maximal voluntary contraction (MVC). Participants were instructed to increase torque from 0 to 50% in five seconds, maintain 50% MVC for 15 seconds, and decrease torque from 50% to 0 in five seconds. Bipolar surface electromyographic (EMG) signals were recorded from the vastus lateralis. A surface EMG signal decomposition algorithm was used to calculate the mean firing rate (pulses per second [pps]) and recruitment threshold (% MVC) of each detected motor unit. Motor units with decomposition accuracy levels < 90% were discarded. Linear regression was then used to quantify the slope (pps/% MVC) and y-intercept (pps) of each relationship. **RESULTS:** Immobilization had no influence on the linear slope coefficient for the mean firing rate versus recruitment threshold relationship (PRE = -0.362 ± 0.127 , POST = -0.399 ± 0.108 pps/%MVC; $p = 0.413$, $d = 0.218$). Similarly, no change in the y-intercept was observed (PRE = 23.2 ± 2.8 , POST = 23.3 ± 4.0 pps; $p = 0.972$, $d = 0.009$). **CONCLUSION:** Our findings demonstrated that 72 hours of knee joint immobilization in healthy females had little influence on vastus lateralis motor unit control during submaximal contractions.

Funding: The De Luca Foundation and the UCF Office of Research's Advancement of Early Career Researchers program

- 1305** Board #67 May 30 10:30 AM - 12:00 PM
Aging and Altered Brain Activation during Isometric Contractions with the Lower Limb
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Many daily tasks require maintenance of steady contractions of limb muscles which are more challenging for older adults possibly due to the age-related changes of the brain. **PURPOSE:** The purpose of this study was to determine intensity and patterns of brain activation in healthy old and young adults during isometric target-matching contractions of the ankle dorsiflexors using functional magnetic resonance imaging (fMRI). **METHODS:** Twenty-one young adults (11 males, 24.7 ± 7.9 years) and 24 older adults (12 males, 69.6 ± 6.4 years) performed three sets of 16-s isometric contractions at 10, 30, 50 and 70% of maximal voluntary contraction of the right ankle dorsiflexor muscles while lying supine in a 3.0 T MRI scanner. Each 16-s contraction was followed by 60 s of rest. Force steadiness was quantified as the coefficient of variation (CV=standard deviation/mean \times 100%) of force. Percent signal changes (PSCs, %) of the blood oxygenation level-dependent response for each contraction was extracted using region of interest analysis. Pearson product-moment correlations were used to determine the relationships between the force steadiness and the PSCs. **RESULTS:** Older adults were weaker ($p < 0.05$) and less steady ($p < 0.01$) than young adults. A total of 21 cortical and subcortical areas were identified as task-related regions. PSCs in some regions including paracentral lobule (primary motor area of dorsiflexors) and cerebellum increased linearly with contraction intensity and were greater for older adults ($p < 0.05$). PSCs in precentral gyrus and cerebellum were associated with the force steadiness in older adults ($r = -2.7$ and -0.39 respectively, $p < 0.05$). **CONCLUSION:** Older adults exhibited greater brain activation than young adults while maintaining the same intensity of contraction with the ankle dorsiflexor muscles. In addition, the age-related changes in brain activation were related to the impaired steadiness suggesting that aging alters brain activation when performing target matching submaximal contractions of the distal lower limb muscles.

- 1306** Board #68 May 30 10:30 AM - 12:00 PM
Acute Effects of Transcranial Direct Current Stimulation on Knee Extensor Torque-Producing Capabilities
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 (No relevant relationships reported)

Transcranial direct current stimulation (tDCS) is a method of neuromodulation aimed to increase cortical excitability. Recently, tDCS has been utilized as a modality treatment in various medical conditions (e.g. stroke rehabilitation); however, few investigations have examined its effect on motor function.

PURPOSE: To examine the acute effects of tDCS on torque producing capabilities of the knee extensors.

METHODS: Thirty-two recreationally active females (Age = 21.8 ± 2.6 ; Height = 165.3 ± 6.3 cm; Weight = 68.1 ± 11.6 kg) participated in this single-blind investigation. Participants were required to report to the laboratory on two separate occasions to receive two randomized conditions, tDCS or sham stimulation. During the initial visit, participants were familiarized with maximal voluntary isometric knee extension (MVIC; 120° knee extension) testing procedures via an isokinetic dynamometer, which was utilized to assess peak torque (PT) and peak rate of torque development (pRTD). Subsequently, participants underwent a 5-minute low-intensity warm-up via a cycle ergometer prior to data acquisition. Participants performed two MVICs with a 2-minute rest period between contractions. Following initial isometric testing procedures, participants were outfitted with a set of commercially available headphones designed to deliver tDCS to the primary motor cortex for a duration of 21 minutes, during which, they performed various low-intensity dynamic movements. Participants then completed an additional series of MVICs identical to pre-testing following "stimulation".

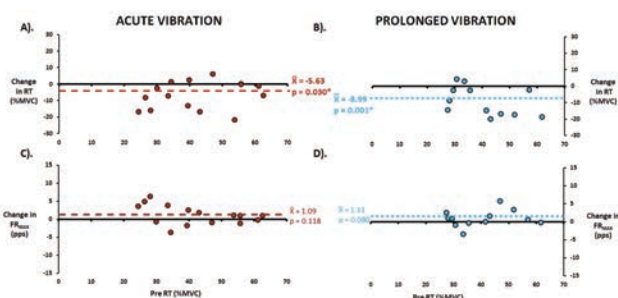
RESULTS: Two separate 2x2 (time x condition) repeated-measures ANOVAs were conducted to assess differences in pre- to post-stimulation PT and pRTD within conditions. No differences were observed in PT for either condition ($p > 0.05$). pRTD revealed no interaction effect ($p > 0.05$); however, a main effect of time was observed ($F_{1,31} = 9.97$, $p = .004$). Follow-up paired-samples t-tests revealed decreases in pRTD from pre- to post-stimulation within the tDCS condition ($t_{31} = 2.643$, $p = 0.013$).

CONCLUSIONS: Although tDCS does not appear to alter PT production, our findings suggest that tDCS may negatively affect an individual's ability to rapidly produce force.

- 1307** Board #69 May 30 10:30 AM - 12:00 PM
Effects of Brief and Prolonged Vibration on Longitudinally Tracked Motor Units
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 (No relevant relationships reported)

Vibration applied to the muscle has been shown to manipulate the sensitivity of muscle spindles by either facilitation (brief vibration less than 25 seconds) or depression (prolonged vibration 20 minutes). These effects have been reported on averaged motor unit (MU) behavior properties, which could result in incorrect interpretations.

PURPOSE: To analyze the effects of altered stretch reflex sensitivity on individual motor units that have been longitudinally tracked. **METHODS:** Twenty-four young participants (25 ± 6 years) performed 1 maximal knee extension under 3 conditions: control, brief vibration, and prolonged vibration. Multi-channel EMG was recorded from the vastus lateralis and decomposed in to MU action potential trains. Cross-correlation of action potential shapes were used to longitudinally track the same MUs across the 3 conditions. **RESULTS:** Surprisingly, a significant decrease in recruitment thresholds was seen after both acute (-5.63% ; $p = 0.03$) and prolonged (-8.99% ; $p = 0.001$) vibration. **CONCLUSION:** It is possible that altering muscle spindle activity results in an altered motor unit recruitment pattern.



1308 Board #70 May 30 10:30 AM - 12:00 PM
Vastus Lateralis Motor Unit Recruitment Thresholds in Younger Versus Older Men

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Aging results in a variety of muscular adaptations which may affect the recruitment of motor units. **Purpose:** We sought to determine if younger and older men recruit motor units at similar isometric force levels. **Methods:** Twelve younger (age = 25 ± 3 years, mass = 65.2 ± 8.9 kg, height = 1.72 ± 0.1 m) and twelve older (mean ± SD age = 75 ± 8 years, mass = 78.9 ± 10.2 kg, height = 1.74 ± 0.1 m) men performed trapezoidal isometric contractions of the dominant knee extensors at a force level corresponding to 50% maximal voluntary contraction (MVC). Bipolar surface electromyographic (EMG) signals were detected from the vastus lateralis during each contraction. A surface EMG signal decomposition algorithm was then used to quantify the recruitment threshold of each detected motor unit, which was defined as the isometric force level corresponding to the first firing. Recruitment thresholds were calculated in both relative (% MVC) and absolute (N) terms. Motor units with accuracy levels < 93.0% were not considered for analysis. **Results:** The mean ± SD number of motor units detected was 17 ± 5 for younger and 13 ± 4 for older men. MVC force was significantly greater in younger vs. older men (709.6 ± 197.8 vs. 520.8 ± 121.6 N [$p = 0.010$; Cohen's $d = 1.15$]). The relative median recruitment threshold values were significantly greater for younger (26.6 ± 9.1% MVC) compared to older (15.6 ± 7.9% MVC [$p = 0.005$; $d = 1.29$]) men. Younger men also demonstrated greater median recruitment threshold values when expressed in absolute terms (198.0 ± 99.2 vs. 81.2 ± 43.0 N [$p = 0.001$; $d = 1.53$]). Similarly, large differences in the mean recruitment thresholds were found when expressed in both relative (25.9 ± 7.7 vs. 16.2 ± 7.8% MVC [$p = 0.005$; $d = 1.27$]) and absolute (191.4 ± 87.5 vs. 85.1 ± 44.9 N [$p = 0.001$; $d = 1.53$]) terms. The relative recruitment threshold range was not significantly different between younger (22.6 ± 9.5% MVC) and older (18.5 ± 6.4% MVC [$p = 0.235$; $d = 0.50$]) men. However, the absolute range was considerably larger for younger (167.6 ± 92.4 N) compared to older (95.7 ± 36.5 N [$p = 0.020$; $d = 1.02$]) men. **Conclusion:** Older men tend to recruit motor units at lower force levels. We speculate that motor unit recruitment threshold compression may be a neural adaptation that serves to compensate for denervation and subsequent re-innervation in aged muscle.

1309 Board #71 May 30 10:30 AM - 12:00 PM
Time Course of Changes in Neuromuscular Parameters During Maximal Bilateral Dynamic Muscle Actions

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 (No relevant relationships reported)

Purpose: The purpose of the present study was to identify the time course of changes in neuromuscular parameters from the vastus lateralis (VL) muscles during fatiguing, bilateral, maximal isokinetic leg extensions. **Methods:** Fifteen men (22.3 ± 3.3 yr) performed consecutive, maximal, bilateral, concentric isokinetic leg extensions at 180° s⁻¹ until their peak torque was reduced by 50% (53 ± 17 repetitions). The amplitude (root mean square = RMS) and frequency (mean power frequency = MPF) contents of electromyographic (EMG) and mechanomyographic (MMG) signals from the

VL muscles of both legs were recorded simultaneously during each repetition of the fatiguing bout. The EMG RMS, EMG MPF, MMG RMS, and MMG MPF were normalized to their corresponding maximal isometric voluntary contraction values and torque values were normalized to maximal bilateral isokinetic concentric peak torque values at 180° s⁻¹. The repetitions were normalized to each 10% of the total number of repetitions completed. Four, 2 (right and left VL) x 10 (10-100% of the total repetitions) repeated measures ANOVAs were used to determine mean differences for each neuromuscular parameter. A 1 x 10 repeated measures ANOVA was used to examine torque production. Post-hoc Student Newman-Keuls was used to identify when the neuromuscular and torque values changed from the values at 10% of the total repetitions. **Results:** The results demonstrated no significant interactions involving the right and left VL muscles or main effects for repetitions for any of the neuromuscular parameters. The maximal bilateral peak torque (311.4 ± 51.2 N·m) decreased significantly ($p < 0.01$; $\eta^2 = 0.688$) at 90% of the total repetitions. **Conclusion:** The results of the present study demonstrated no differences between the right and left VL muscles for their patterns of neuromuscular responses during the fatiguing bilateral leg extensions. While peak torque decreased, no changes occurred for any of the neuromuscular parameters across the repetitions. Therefore, the current findings suggested that the decrease in torque production was due to peripheral mechanisms of fatigue and not a decrease in central neural drive to the muscles.

1310 Board #72 May 30 10:30 AM - 12:00 PM
Is the Mean Firing Rate versus Recruitment Threshold Relationship Linear?

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 (No relevant relationships reported)

Advances in surface electromyographic (EMG) signal decomposition now allow investigators to analyze firing rate data for 20-50 motor units per contraction. To simplify data interpretation, some investigators have relied on group mean analysis of the mean firing rate versus recruitment threshold relationship. It is unclear, however, whether this association is consistently linear.

Purpose: To determine whether the motor unit mean firing rate versus recruitment threshold relationship is strongest when analyzed via linear, quadratic, or cubic regression.

Methods: Twenty-one men (mean ± SD age = 24 ± 4 years) participated in this study. After determining maximal voluntary contraction (MVC) force of the dominant knee extensors, participants performed trapezoidal isometric contractions at 50% MVC by tracing a visual template displayed on a monitor directly in front of them. Participants were instructed to increase force from 0 to 50% in five seconds, maintain 50% MVC for 15 seconds, and decrease force from 50% to 0 in five seconds. Bipolar surface EMG signals were recorded from the vastus lateralis during each contraction. A surface EMG signal decomposition algorithm was used to calculate mean firing rate and recruitment threshold of each detected motor unit. Motor units with decomposition accuracy levels < 90% were discarded. Polynomial regression was used to determine if each mean firing rate versus recruitment threshold relationship was best fit with a linear, quadratic, or cubic model. Data were interpreted on an individual participant basis.

Results: Statistically significant ($p < .05$) moderate to strong ($r^2 = .599-.964$) linear relationships existed for all 21 participants. Fourteen of the 21 participants demonstrated relationships that were best fit with a linear model ($r^2 = .599-.964$). Of the remaining seven participants, five were best fit with a quadratic model ($r^2 = .864-.953$) and two were best fit with a cubic model ($r^2 = .977-.989$).

Conclusion: While moderate to strong linear relationships were found between the firing rate of motor units and their recruitment thresholds for all participants, in certain cases the strength of the association was enhanced when analyzed via a non-linear model. Our findings provide further support for the need to examine motor unit data on a participant-by-participant basis.

1311 Board #73 May 30 10:30 AM - 12:00 PM
Electromyographic Analysis of the Intensity Progression of Mat Pilates Exercises

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 (No relevant relationships reported)

Studies evaluating the electromyographic activation (EMG) of spine flexor muscles during Pilates exercises (PE) concluded that EMG is different among abdominal exercises, even when classified in the same intensity category. **Purpose:** To compare EMG of spine extensors, flexors and rectus femoris in seven mat PE among basic (B), intermediate (I) and advanced (A) variations. **Methods:** The EMG of upper rectus abdominis (URA), lower rectus abdominis (LRA), external oblique (EO), internal oblique (IO), rectus femoris (RF) and multifidus were assessed for the Roll Up (RU), Single Leg Stretch (SLS), Double Leg Stretch (DLS), Hundred (HD), and Rolling Like a Ball (RLB) exercises in B, I, and A. Also evaluated in I and A were Double

Straight Leg Stretch (DLS) and Single Straight Leg Stretch (SLS). EMG results were expressed as a percentage of maximum voluntary isometric contraction. One-way ANOVA with repeated-measures was used ($\alpha < 0.05$) to compare the three variations. **RESULTS:** In HD exercise, LRA and IO EMG was significantly less ($p < 0.01$) in B variation (48.5% and 41.1%, respectively) than I (68.7% and 68.5%, respectively) and A (75.1% and 80.7%, respectively), and EO EMG was significantly greater ($p < 0.01$) in A (63.4%) compared to B (39.8%), while I (54.2%) was equal to A and B. In RU exercise, URA EMG was significantly greater ($p = 0.04$) in A (43.8%) than B (34.9%). In DLS exercise, LRA EMG was significantly less ($p < 0.01$) in B variation (43.7%) than I (53.2%) and A (66.8%), EO EMG was significantly greater ($p < 0.01$) in A (57.7%) than B (36.1%), and IO EMG was significantly greater ($p < 0.01$) in A (73.5%) than B (39.7%) and I (55.5%). In SLS exercise, LRA, IO and OE EMG were significantly less ($p < 0.01$) in B (35.5%, 37.4% and 41.5%, respectively) than A (55%, 52.4% and 61.1%, respectively). In DLS exercise, EO and RF EMG were significantly greater ($p = 0.04$) in A (81.6% and 29.3%, respectively) than I (71.7% and 23.29%, respectively). In SLS and RLB exercises, no significant differences were found among B, I, and A. **CONCLUSION:** The higher URA EMG may be more related to upper limb positions while higher LRA, EO and IO EMG may be more related to lower limb positions and changes greater than 45° of raising or lowering lower or upper limbs seems to be necessary. Supported by Capes and CNPq.

1312 Board #74 May 30 10:30 AM - 12:00 PM
Neural And Contractile Determinants Of Rate Of Force Development: A Preliminary Analysis

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 (No relevant relationships reported)

Neural and contractile factors have been suggested as important determinants for different phases of the rate of force development (RFD). **PURPOSE:** To examine the influence of rate of muscle activation, motor nerve conduction velocity (CV) and motor unit number estimation (MUNE) of the vastus lateralis on early and late phase RFD. **METHODS:** Fifteen males (age = 23 ± 3 y) completed 2 maximal (MVIC) and rapid (rMVIC) voluntary isometric contractions. Participants were instructed to kick out as hard as possible, and as fast as possible for the MVICs and rMVICs, respectively. The RFD values were calculated during the first 50 ms (nRFD50) and 100 to 150 ms (nRFD100-150) and normalized to maximal force (%MVIC/s). The rate of electromyographic signal rise (RER) was calculated during the first 50 ms of muscle excitation (nRER50) and normalized to the peak-to-peak M-wave amplitude (%MPP/s). MUNE was calculated as a ratio of the ensemble average of the single motor unit potential area to the compound muscle action potential area, and was corrected for alternation. Motor CV (m/s) was assessed as the time (m/s) from maximal stimulation of the femoral nerve to onset of muscle activity. Pearson's correlation coefficients were used to analyze the relationships between the dependent variables. Additionally, stepwise multiple regression was used to examine the degree to which the predictor variables (nRER50, MUNE, Motor CV) explained a significant proportion of the total variance in each RFD phase (nRFD50 and nRFD100-150). **RESULTS:** nRER50 (41.47 ± 25.16 %MPP/s) was significantly related to nRFD50 (249.4 ± 94.4 N) ($r = .640$, $p = .01$). nRFD100-150 was not related to any of the predictor variables. nRER50 was the only significant predictor ($\beta = .640$, $p = .015$), explaining 41% of the variance in nRFD50. **CONCLUSION:** These preliminary data are in agreement with previous research suggesting that the early phase RFD is primarily determined by neural factors. Continued sampling will determine if additional variables significantly contribute to predicting early and late RFD performance. **ACKNOWLEDGEMENTS:** The funding for this study was provided, in part, by the Central States American College of Sports Medicine Student Research Grant.

1313 Board #75 May 30 10:30 AM - 12:00 PM
Examining Quadriceps Muscle Excitability Throughout A Progressive Exercise Test: A Pilot Study

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PURPOSE: A metabolic threshold occurs during progressive exercise with a non-linear increase in blood lactate. The power output at which this occurs closely corresponds to the ventilatory threshold, a non-linear increase in minute ventilation (\dot{V}_E). These factors may affect muscle excitability and thus force generating capacity. Muscle excitability has been shown to decrease after high-intensity whole-body exercise, however it has not been identified when this decrease occurs during progressive exercise. Therefore, the purpose of this study was to examine quadriceps muscle excitability throughout a progressive exercise test. **METHODS:** Five men (age 23 ± 3.5 years) performed a step-wise cycling test, beginning at 100W and increasing 25W/min until volitional exhaustion. Minute averages of oxygen consumption ($\dot{V}O_2$) and \dot{V}_E were collected, and heart rate (HR)

and rating of perceived exertion (RPE) were recorded at the end of every minute. M-waves were induced using a stimulating electrode positioned over the femoral nerve and given at a fixed crank angle of 90° while the subject was cycling. During the exercise test, supramaximal stimulations were given every 10 seconds and averaged over the minute. Using a mixed linear model to control for within-subject variance, both absolute and relative (percent decrease) M-wave amplitudes for each minute were compared to the first minute of exercise.

RESULTS: Subjects exercised for an average of $10 (\pm 0.7)$ minutes. \dot{V}_{O_2} , HR, and RPE increased significantly each minute in a linear fashion. Ventilatory threshold occurred at minute 7 (± 1 minute). Compared to the first minute of exercise, absolute M-wave amplitude decreased significantly at minute 7 (2.14 ± 2.45 mV versus 3.78 ± 2.58 mV), whereas relative M-wave amplitude decreased significantly at minute 6 ($-20.44\% \pm 28.53\%$). After this point, both remained reduced until exhaustion.

CONCLUSIONS: These data show that the M-wave may exhibit an excitability threshold corresponding to that of the ventilatory threshold. This could reflect the metabolic state of the muscle, indicating the division between sustainable and unsustainable exercise intensities. Further research should examine the neural response to progressive exercise in relation to peripheral losses of excitability.

C-33 Free Communication/Poster - Movement Disorders

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1314 Board #76 May 30 10:30 AM - 12:00 PM
Optimizing Dance Interventions To Improve Motor Function In People With Parkinson'S Disease And Older Adults

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Dance comprises a broad range of techniques and styles, which have been utilized in classes specifically designed for individuals with Parkinson's disease (PD) and healthy older adults. Previous studies have shown that a series of dance sessions can improve balance, posture, and mobility for people diagnosed with PD and healthy older adults. However, these studies have not analyzed the linkage between repetitive movement types and persistent changes in motor skills. In order to begin understanding the causative factors of repetitive movement types that result in improved motor skill performance, the functional relationship between movement features and observed performance improvements needs to be examined. **PURPOSE:** To identify dance movement patterns resulting in the greatest improvement in tests of gait, balance and upper extremity function using partnered and non-partnered dance to music in PD and healthy older adults. We hypothesize that scripted variation in movement will promote improvements in motor performance. **METHODS:** Participants in structured group dance classes were recruited for this study. Performance measures of upper and lower extremity were collected before and after each dance class. Motion capture, video and live observations were used to examine movement patterns. **RESULTS:** Individuals with PD had slower baseline performance in the 9 hole peg test (9HPT) than healthy older adults in both left ($p = 0.026$, 33.5 s vs 24.9 s) and right hand ($p = 0.008$, 31.2 s vs 26.5 s). There was also a significant improvement in the 9HPT for the left hand after the dance classes in the individuals with PD ($p = 0.035$, 3.44 s). Factors that led to observed improvements in mobility and movement execution included: repetition of foundational weight shifts in a separate preparatory exercise, engagement of the spine and arms in counterbalancing movement in the legs, incorporating flexion at the knee into the dance stride, and partnering with a moderately-skilled dancer. Increased amplitude and ease of stride and greater lift in the feet in locomotion were also documented. **CONCLUSIONS:** These preliminary results suggest that repetitive shifts in balance and movement during dance with music can lead to upper extremity motor performance and increased amplitude of movement in the lower extremity in individuals with PD.

1315 Board #77 May 30 10:30 AM - 12:00 PM
Effects Of A Cooling Vest On Dual-task Performance And Fatigability In Persons With Multiple Sclerosis

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(No relevant relationships reported)

Fatigue and heat sensitivity are commonly reported symptoms in persons with multiple sclerosis (PwMS). PwMS also often have difficulty performing concurrent cognitive and motor tasks that presents as a dual-task decrement. Heat sensitivity along with a dual-task decrement may hinder activities of daily living and quality of life for PwMS. Though using a cooling vest could help decrease heat sensitivity, it is currently unknown if it improves dual-tasking performance in PwMS. **PURPOSE:** To examine the effects of a cooling vest on cognitive-motor dual-task cost (DTC) and fatigability in PwMS. **METHODS:** 5 PwMS participated in two sessions that were at least 1 week apart. During one session participants wore a sham cooling vest and the other session an actual cooling vest. During each session participants completed a Timed 25-Foot Walk Test (T25FWT), 6 Minute Walk Test (6MWT), T25FWT while performing Serial 3's, and a 6MWT while narrating a story. The type of vest and order of tests was randomized for each participant. Total times for T25FWT and total distances for 6MWT were recorded. DTC, defined as the percent change between single- and dual-task performance, was calculated. Fatigability, defined as the difference between the averages of the first two and the last two lap times of the 6MWT, was calculated. Paired samples t-tests were used to compare DTC during cooling and non-cooling sessions and fatigability during single- and dual-task conditions within each session. **RESULTS:** The mean DTC during the 6MWT for cooling and non-cooling was -4.1% and -6.5%, respectively. The DTC during the T25FWT for cooling was 7.3% and 11.5% for non-cooling. The mean distance walked during 6MWT dual-task increased from 275.5m without cooling to 285.6m with cooling. There was a trend towards significant difference between single- and dual-task fatigability during 6MWT for non-cooling session (Single: 1.6 ± 7.6 m; Dual: 6.2 ± 5.3 m; $p=.051$), but not for cooling session (Single: 0.7 ± 3.8 m; Dual: 12 ± 16.4 m; $p=.082$). **CONCLUSION:** Preliminary results with lower DTC and no significant difference between single- and dual-task fatigability when using a cooling vest suggests that a cooling vest may have a benefit PwMS while dual-tasking during endurance activities. Further research with a larger sample size is needed to confirm these findings.

1316 Board #78 May 30 10:30 AM - 12:00 PM
Comparing Turn Performance In Parkinsonism

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(No relevant relationships reported)

Turning while walking is one of the main tasks of daily living known to elicit falls in healthy older adults and persons with movement disorders, such as Parkinson's disease. Essential tremor is the most common adult movement disorder; recent work has identified meaningful gait impairments in this population. However, turning performance has not been evaluated in this population. **PURPOSE:** To determine differences in gait patterns between patients with Parkinson's disease and those with Essential Tremor during a turning task and their relationship to reported falls. **METHODS:** 15 persons with Essential Tremor (ET) and 15 persons with Parkinson's disease (PD) age matched within 3 years, performed two 180 degree turns, as part of the Primary Gait Screen, on an instrumented pressure mat. Average time to complete the turn, amount of steps required to turn, and cadence (number of steps/time) of the turn were calculated. Reported falls in the last six months on a categorical scale, (0: No falls, 1: Rarely, 2: Monthly, 3: Weekly, 4: Daily), age at diagnosis, and age at first symptom were collected. Paired t-tests were used to compare measures between groups while a simultaneous multiple regression was performed to analyze potential predictors of falls. **RESULTS:** No significant differences were found between the ET and PD groups ($p>.05$) with the exception of cadence. Those with PD had a significantly higher cadence during the turn than those with ET ($2.17 \pm .301$ steps/sec vs. $1.91 \pm .369$ steps/sec, $p=.042$). Using regression to analyze possible predictors, the overall model failed to obtain significance in predicting falls ($F(6)=1.855$, $p=.134$, $R^2=.336$). Only age at evaluation ($p=.011$) and age at diagnosis ($p=.032$) were statistically significant predictors in this model, as age at evaluation increased ($B=.084 \pm .030$, $Beta=.813$) so did falls and as age at diagnosis decreased ($B=-.058$, $Beta=-.700$), falls increased. Average time, number of steps, age at first symptom, and diagnosis (ET or PD) were not significant predictors ($p>.05$). **CONCLUSION:** Surprisingly, turning performance was similar between those with ET and PD, suggesting that gait impairment in ET is more prevalent than clinically recognized. However, turning performance was not predictive of fall frequency.

1317 Board #79 May 30 10:30 AM - 12:00 PM
Neuromuscular Impairment of the Plantar Flexors In Adults With and Without Prader-Willi Syndrome

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(No relevant relationships reported)

Muscle weakness is common in individuals with Prader-Willi Syndrome (PWS), but the source of weakness is unclear. **PURPOSE:** The purpose of this study was to compare neuromuscular function, and muscle size and quality of the plantar flexor muscles between individuals with and without PWS. **METHODS:** Ten participants with PWS were matched on sex to 10 obese control and 10 lean control participants. Hoffman (H) reflex and muscle response (M-wave) were obtained from the soleus by stimulating the tibial nerve to determine the H:M ratio. Isometric plantar flexor strength was assessed using an isokinetic dynamometer to find peak torque (PT), early (RTD100) and late (RTD200) rate of torque development. Surface electromyography (EMG) was recorded from the soleus and gastrocnemii during strength assessments to determine early (RER100) and late (RER200) rise in EMG, and early (I100) and late (I200) integrated EMG. EMG data were normalized to peak EMG amplitude collected during the MVIC trial. Strength variables were normalized to lean mass. Ultrasound imaging was used to quantify gastrocnemii cross sectional area (CSA) and echointensity (EI). One-way ANOVA was used to compare dependent variables between groups. **RESULTS:** There were group differences in H:M ratio ($p=0.03$), RTD100 ($p<0.01$), RTD200 ($p=0.01$), RER100 ($p=0.02$), and CSA ($p<0.01$). Post hoc tests indicated that the PWS group had lower H:M ratio (0.29 ± 0.18 vs. 0.52 ± 0.13 , $p=0.03$), RTD100 (1.49 ± 0.64 vs. 5.19 ± 3.26 Nm/kg, $p<0.01$), and RTD200 (2.20 ± 1.05 vs. 4.95 ± 2.48 Nm/kg, $p<0.01$) compared to lean controls. The PWS group had lower RER100 (1.07 ± 1.14 vs. 2.84 ± 1.49 %MVIC/sec, $p=0.02$) in the soleus compared to obese controls. Obese controls had larger CSA compared to lean controls (2527.99 ± 579.02 vs. 1638.55 ± 354.52 mm², $p<0.01$) and compared to the PWS group (1797.29 ± 764.77 mm², $p=0.026$). There were no differences between groups in RER200, I100, I200, or EI. **CONCLUSIONS:** A lower H:M ratio in adults with PWS compared to controls may indicate lower α -motoneuron excitability. Similarly, lower RTD100 in adults with PWS compared to controls may indicate lower motor unit recruitment and firing rate, which is supported by lower RER100. Conversely, lower RTD200 may be attributed to smaller CSA. Muscle weakness in adults with PWS may originate from neural and morphologic factors.

1318 Board #80 May 30 10:30 AM - 12:00 PM
Impact Of Attention-deficit/hyperactivity Disorder On Gross Motor Skills Among A Group Of Girls Teens

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(No relevant relationships reported)

Scientific literature has shown motor impairment in adolescent boys with Attention-Deficit/Hyperactivity Disorder (ADHD), but little is known about girls with ADHD. **PURPOSE:** The purpose of this study was to evaluate the impact of ADHD on Gross Motor Skills (GMS) of adolescent girls. **METHODS:** GMS of 7 girls with ADHD (mean=15.3 \pm 1.8 years old) was compared to 7 control girls (mean=15.1 \pm 1.6 years old) using the «Myg & Gym» GMS test battery for Reaction Time, Limb Speed, Agility, Coordination, and Balance. Scores were compared between groups controlling for the following covariates: Age, BMI percentile and presence of Pharmacological Treatment. **RESULTS:** Girls with ADHD showed significantly slower arm and leg limb speed when compared to girls without ADHD (Arm: 63.43 ± 9.43 vs 88.43 ± 11.25 single touch, $p=0.001$; Leg: 21.14 ± 3.02 vs 25.71 ± 3.68 double touches, $p=0.03$). Girls with ADHD showed significantly less hand-eye coordination when compared to girls without ADHD (2.8 ± 1.5 vs 7.8 ± 1.2 throws, $p<0.001$). Correcting for Age, BMI and Pharmacological Treatment did not affect the differences in GMS outcomes. **CONCLUSION:** It appears that significant differences are present between girls with ADHD when compared to girls without ADHD for GMS functions. Future motor development research should include female participants with ADHD and include an assessment of executive functions. This would help better understand the possible causes of the motor impairment identified in individuals with ADHD.

- 1319** Board #81 May 30 10:30 AM - 12:00 PM
Aquatic-based Exercise For Individuals With Parkinson's Disease: A Systematic Review And Meta-analysis Of Randomized Controlled Trials
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 (No relevant relationships reported)

PURPOSE: What are the effects of aquatic-based exercise (AqEx) on motor and non-motor symptoms, functional performance and quality of life (QOL) in individuals with Parkinson's disease (IwPD)? **Does AqEx have greater effects on these outcomes than other forms of exercise in IwPD?** **METHODS:** A systematic review and meta-analysis of randomized controlled trials (RCTs), which enrolled IwPD in supervised AqEx programs > 2 weeks, was conducted. The primary outcomes were motor symptoms and functional performance; the secondary outcomes were non-motor symptoms and QOL outcomes. **RESULTS:** Of the 129 records identified, seven trials met the inclusion criteria and six entered the meta-analysis (159 subjects). One trial assessed the effect of AqEx compared to usual care and found a significant improvement at the Unified Parkinson's Disease Rating Scale Part-III (UPDRS-III, mean difference, MD -4.6, 95% CI -7.5 to -1.7) in favour of AqEx. Six studies compared AqEx with Land-based exercise (LEX) *Post-intervention* (after an average of 7.2 ± 2.2 weeks of training; 159 subjects). The effect of AqEx was superior to LEX on the Berg Balance Scale (MD 2.7, 95% CI 1.6 to 3.9), the Falls Efficacy Scale (MD -2.1, 95% CI -3.1 to -1.0) and the 39-item Parkinson's Disease Questionnaire (MD -6.0, 95% CI -11.3 to -0.6), with no significant between-groups differences in the other outcomes considered. The significant between-group difference for the Berg Balance Scale was maintained at the follow-up assessment (54 subjects, MD 6.3, 95% CI 2.1 to 10.5). **CONCLUSIONS:** AqEx significantly improves motor symptoms in IwPD. It also has slightly to moderately greater benefits than LEX on balance capacity, postural stability and perceived well-being in IwPD, especially in those presenting with specific functional and mobility impairments. On other outcomes, the benefits of AqEx were similar to those of LEX. **REVIEW REGISTRATION:** PROSPERO CRD42017077370

- 1320** Board #82 May 30 10:30 AM - 12:00 PM
Single-Arm Torque Perceptual Deficits in Individuals with Chronic Hemiparetic Stroke
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Background: To perform activities of daily living safely and efficiently, an individual with hemiparetic stroke needs to accurately perceive how much force is generated about their joints, i.e., torque perception. We know that individuals with moderate to severe motor impairments post hemiparetic stroke have between-arms torque perceptual impairments. However, a question that has yet to be addressed is whether these individuals have a torque perceptual impairment within their paretic arm and/or non-paretic arm.

Objective: To compare single-arm torque perception between individuals with chronic hemiparetic stroke and individuals without neurological impairments (i.e., controls).

Methods: Nine individuals with chronic hemiparetic stroke and five similarly-aged individuals without neurological impairments (i.e., controls) partook in the study. By following automated audiovisual cues, each participant generated 25% of their maximum voluntary elbow extension torque for three seconds, relaxed for two seconds, and then matched the remembered torque for one second without receiving feedback on their torque-matching ability. This torque-matching task was performed in each arm.

Results: The mean \pm standard deviation of the normalized absolute torque matching error was $26.5 \pm 18.3\%$ and $28.2 \pm 23.3\%$ for the participants with chronic hemiparetic stroke in their paretic and non-paretic arm, respectively, and $19.8 \pm 7.1\%$ and $20.1 \pm 11.3\%$ for the controls in their dominant and non-dominant arm, respectively. Absolute error was not found to significantly differ depending on the arm tested ($p=0.53$).

Conclusions: Our participants with chronic hemiparetic stroke and controls matched torques similarly in each arm. This result supports the notion that unilateral torque perceptual deficits may not occur in individuals with chronic hemiparetic stroke who exhibit motor impairments during unimanual activities.

- 1321** Board #83 May 30 10:30 AM - 12:00 PM
Functional Motor Control Deficits In Fragile X Mental Retardation 1 Gene Premutation Carriers
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 (No relevant relationships reported)

Individuals with the fragile X mental retardation 1 (FMR1) gene premutation are at increased risk for fragile X associated tremor/ataxia syndrome (FXTAS). However, it is unknown whether FMR1 gene premutation carriers, with or without FXTAS, exhibit functional motor control deficits compared with healthy individuals. **PURPOSE:** To determine whether FMR1 premutation carriers exhibit impaired ability to perform functional motor tasks. **METHODS:** Eight FMR1 gene premutation carriers (4 with FXTAS and 4 without FXTAS; 58.88 ± 9.25 yrs) and eight age- and sex-matched healthy individuals (60.13 ± 9.25 yrs) performed 1) a constant isometric force control task with the index finger at 20% MVC; 2) a dynamic stance task where a participant continuously swayed anteriorly-posteriorly; and 3) a single step initiation task. We recorded the force from the index finger during a constant contraction task, the center of pressure (COP) during a dynamic stance task, and the time and velocity during a single step initiation task. **RESULTS:** Compared with healthy controls, FMR1 gene premutation carriers exhibited 1) greater force variability (coefficient of variation of force) during a constant force task (1.48 ± 1.02 vs. $0.63 \pm 0.37\%$; $p < 0.04$); 2) less anterior-posterior trajectory distance (4.24 ± 0.71 vs. 5.30 ± 0.42 cm; $p < 0.01$) during a dynamic stance task; and 3) greater step duration (0.39 ± 0.14 vs. 0.27 ± 0.04 s; $p < 0.05$) and less step velocity (111.07 ± 24.62 vs. 136.42 ± 16.47 cm/s; $p < 0.05$) during a single step initiation task. **CONCLUSION:** Irrespective of existence of FMR1-related tremor/ataxia syndrome, FMR1 premutation carriers exhibit functional motor control deficits compared with healthy individuals.

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- 1322** Board #84 May 30 10:30 AM - 12:00 PM
The Relationship Between Y Balance Performance & Hip Strength & Recreationally Trained Women.
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 (No relevant relationships reported)

PURPOSE: This study aimed to identify the relationship between the Y Balance Test - Lower Quarter (YBT-LQ) and hip isometric strength and to compare outcomes between preferred and non-preferred limbs in recreationally resistance-trained women.

METHODS: Twenty young college females (22.3 ± 2.1 years) with background in regular strength or plyometric training volunteered to participate in this study. Maximal reach distance in each of the three YBT-LQ reach directions (anterior, posteromedial, and posterolateral) and a composite reach score (sum of the three directions) were recorded for the preferred and non-preferred leg and normalized to leg length. A handheld dynamometer was used to measure the maximum voluntary isometric strength of each participant for the hip extensors, flexors, adductors, abductors, and internal and external rotators (N).

RESULTS: Significantly lower normalized scores were noted for the preferred ($81.2 \pm 11.7\%$) compared to the non-preferred leg ($83.6 \pm 12.4\%$) for anterior distance. For the composite score of the YBT-LQ and hip strength measures, associations were weak for hip extension and external rotation; moderate for hip flexion, adduction, and abduction; and strong for hip external rotation ($r = 0.516$, $p = 0.059$).

CONCLUSIONS: The strong association between hip external rotator strength and composite score of the YBT-LQ suggest that strengthening this muscle group might be important for dynamic postural control and the reduction of injury risk factors in recreationally active females.

1323 Board #85 May 30 10:30 AM - 12:00 PM
Effect of Treadmill vs. Recumbent Cross Trainer on Gait and Leg Electromyography after Chronic Stroke

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(No relevant relationships reported)

A recumbent cross trainer (RCT) relies on similar neural networks as gait. Therefore, neurologically impaired individuals may improve walking ability after exercise on the RCT. **PURPOSE:** The purpose of this investigation was to compare the effects of the RCT and Treadmill (TM) on intra-exercise electromyography and post-exercise spatial-temporal gait parameters. **METHODS:** 34 participants were divided into two groups; stroke (CVA) (10 ± 5 years post-CVA) and age and sex-matched control. Participants completed two 5-minute exercise bouts on both the RCT and TM at an RPE based self-selected cadence. Intra-exercise Mean electromyography (mEMG) values were normalized to maximum voluntary contraction and were recorded bilaterally at the rectus femoris, vastus medialis oblique, semitendinosus, tibialis anterior, medial gastrocnemius, and soleus. Change in joint range of motion was calculated (maximum-minimum degree; Δ ROM) from wireless goniometer measures at the hip, knee, and ankle. Gait parameters were evaluated by the Wireless Gait Assessment Tool (WiGAT) immediately following each exercise bout (3 x 10m walk). HR and BP were monitored to ensure the return to pre-exercise levels. **RESULTS:** Stroke ($n = 15$) and healthy ($n = 19$) did not differ in age (Mdn : 66 years vs. 57 years, respectively) or BMI (Stroke: $M = 27.02$, $SD = 4.57$ vs. Healthy: $M = 26.46$, $SD = 4.63$), $p > .05$. Healthy participants were stronger at all joints, $p < .025$. Preferred TM speed was faster in the healthy condition despite no statistical difference in RPE, $p < .05$. RCT average steps per minute did not differ between the conditions, $p > .05$. RPE did not differ between groups or across exercise modes. The TM elicited a higher mEMG on a majority of the studied muscles in both populations, $p < .025$. TM demonstrated an increased Δ ROM in the R knee and both ankles in the healthy population, $p < .025$. There were no statistical differences between the TM and RCT in the CVA's Δ ROM. WiGAT determined the RCT decreased the stance percentage (%) and increased swing % on the non-affected leg, $p < .05$. Neither exercise mode modulated the affected-side stance %, affected-side swing %, double support time or bilateral (affected vs. non-affected) stride length, $p > .05$. **CONCLUSION:** Five minute RCT intervention improved non-affected side gait parameters in a chronic CVA population.

1324 Board #86 May 30 10:30 AM - 12:00 PM
Acute Effects of Yoked Prism Lenses on Gait in Individuals with Acquired Brain Injuries

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Acquired brain injuries (ABI) have been known to lead to a host of neurological impairments including visual imbalances that can greatly impact everyday life. Along with headaches, dizziness, and photophobia individuals with ABI report difficulty with postural alignment, balance, and gait. It has been suggested that common symptoms associated with ABIs are due in part to poor integration of the sensory motor system. Recent research has shown that yoked prisms can alter spatial perception and if used correctly draw the visual midline to its corrected position. **PURPOSE:** To examine the effects of yoked prism lenses on individuals with acquired brain injuries to determine if there is a change in gait. **METHODS:** 13 individuals with ABI (mean age: 43.1 ± 18.1 years) walked 2-4 times at their self-selected speed across a 14' GAITrite walkway under two conditions with current vision correcting prescription: without additional yoked prisms (WOP) and with a yoked prism lens (WP). Spatiotemporal gait parameters consisting of gait speed, stride length, stride width, and single support percent were extracted and averaged across the trials within each condition. Paired samples t-test was used to compare the gait parameters across both the conditions. **RESULTS:** Wearing yoked prism lenses resulted in increased gait speed (WOP: 92.3 ± 25.9 cm/s; WP: 99.1 ± 28.9 cm/s; $p = 0.007$) and stride length (WOP: 102.1 ± 17.7 cm; WP: 108.3 ± 20.0 cm; $p = 0.035$). Stride width (WOP: 10.8 ± 3.8 cm; WP: 10.8 ± 3.0 cm; $p = 0.855$) and single support percent (WOP: 37.0 ± 2.8 ; WP: 37.3 ± 2.9 ; $p = 0.335$) did not show significant changes. **CONCLUSION:** When participants with reported ABIs wore yoked prism lenses they may be experiencing better integration of their sensory motor systems including a corrective shift in visual midline which allows for an increase in gait speed and stride length, indicating an overall improvement in gait. Our findings suggest that yoked prism lenses have acute benefits to improve gait in individuals with ABIs. Long-term benefits need to be evaluated.

1325 Board #87 May 30 10:30 AM - 12:00 PM
Effects of Activity-Based Physical Rehabilitation on Locomotor Recovery in Rats after Severe Spinal Cord Injury

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(No relevant relationships reported)

Activity-based physical rehabilitation (e.g., bodyweight supported treadmill training (TM) or passive Cycle training) promotes recovery of voluntary locomotor function after moderate-severity spinal cord injury (SCI). However, little evidence supports efficacy of these treatments following severe SCI. **Purpose:** To determine the effects of TM and passive Cycle training on the recovery of voluntary locomotor function in rodents after severe SCI. **Methods:** 16-week old male Sprague-Dawley rats ($n=44$) received either a T9 laminectomy (SHAM) surgery or T9 laminectomy plus severe (250 kilodyne) contusion SCI using a computer-guided impactor. SCI animals were then stratified into groups that received 1) no training (SCI), 2) TM training (SCI+TM), or 3) Cycle training (SCI+Cycle). TM and Cycle training were initiated 1-week post-surgery and consisted of two 20 min bouts/day, performed 5 days/week for 3 weeks. Hindlimb locomotion was assessed weekly using the BBB Locomotor Rating Scale. **Results:** One-week post-surgery, all SCI animals exhibited locomotor deficits (BBB score < 3 on a 0-21 scale, $p < 0.01$ vs baseline), indicating near-complete hindlimb paralysis. Thereafter, the SCI group spontaneously regained some voluntary hindlimb function (BBB = 6.1 ± 0.993 at week 4, $p < 0.01$ vs week 1). However, SCI animals did not recover the ability to hindlimb weight support in stance or to perform stepping patterns. Similarly, BBB scores improved in the SCI+TM group from week 1 to week 4 ($p < 0.01$), although, hindlimb locomotor recovery was not greater than SCI alone. In contrast, BBB scores did not improve significantly from weeks 1-4 in the SCI+Cycle group. SCI+TM exhibited higher BBB scores than SCI+Cycle at weeks 3-4 (week 4 average: SCI+TM = 8.1 ± 1.025 ; SCI+Cycle = 4.4 ± 0.561 , $p < 0.05$). **Conclusion:** Our findings suggest that neither TM nor Cycle training promoted locomotor recovery after a 3-week time span in male rodents after severe SCI. Additionally, Cycle training may have limited locomotor recovery in our model, given that BBB scores did not improve in SCI+Cycle animals. Future research is needed to determine an alternative treatment that can be used in conjunction with locomotor training to improve ambulatory status after severe SCI.

C-34 Free Communication/Poster - Posture and Balance

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1326 Board #88 May 30 10:30 AM - 12:00 PM
Dry Needling Improves Static and Dynamic Balance in Individuals with Chronic Ankle Instability

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(No relevant relationships reported)

Individuals with chronic ankle instability (CAI) commonly exhibit balance deficits that are associated with dysfunction of the fibularis longus (FL) muscle. Dry needling (DN) is a treatment that targets muscular trigger points and is hypothesized to improve neurophysiological function of treated muscles. The ability of FL DN to improve dynamic and static balance in patients with CAI is unknown. **Purpose:** Examine the effect of FL DN on dynamic and static balance in individuals with CAI. **Methods:** Twenty-five adults with CAI (9 males, 16 females; 26 ± 9.42 years; 173.12 ± 9.85 cm; 79.27 ± 18 kg) volunteered to participate. Participants completed the Star Excursion Balance Test (SEBT) and postural control measures before and immediately after a single DN treatment to the FL. The anterior, posterolateral, and posteromedial directions of the SEBT were tested in a random order and reach distances were normalized to a percent of leg length. A composite SEBT score was calculated by dividing the normalized, average scores in each direction by three. Postural control was assessed in single-limb stance on a forceplate through time to boundary (TTB) measurements and calculated in the mediolateral and anteroposterior directions under eyes open and eyes closed conditions. A single DN treatment was performed on the FL using a "pistoning" technique. Descriptive statistics (mean change \pm SD), paired t-tests, and standardized response mean effect sizes were calculated to compare balance measures before and immediately after the FL DN intervention ($p < 0.05$). **Results:** Following DN, significant improvements were identified in the composite ($3.98 \pm 4.45\%$, $p < 0.001$, $ES = 0.89$), posteromedial ($4.85 \pm 5.75\%$, $p < 0.001$, $ES = 0.84$)

and posterolateral reach directions ($4.96 \pm 5.49\%$, $p < 0.001$, $ES = 0.90$) but not in the anterior reach direction ($2.11 \pm 5.77\%$, $p = 0.08$, $ES = 0.37$). Under eyes-open conditions, TTB improved in the mediolateral (0.27 ± 0.43 , $p = 0.004$, $ES = 0.63$) and anteroposterior (0.84 ± 1.43 , $p = 0.007$, $ES = 0.59$) directions. However, no significant changes were identified in any TTB measures with eyes closed ($p \leq 0.20$). **Conclusions:** FL DN created immediate improvements in dynamic and static balance in individuals with CAI. Future studies should examine the effects of multiple DN treatments and the mechanism behind this therapeutic effect.

1327 Board #89 May 30 10:30 AM - 12:00 PM

Postmenopausal Women: Body Composition x Postural Stability

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(No relevant relationships reported)

Several alterations of sensorimotor and motor performance processing occur during the process of normal aging. In women, aging is associated with the onset of menopause, which influences body composition with increased central adiposity, leading to changes in the gynoid to android fat distribution pattern. These changes may alter the center of gravity, compromising body stability and causing risk of falls. **PURPOSE:** The study aimed to analyze the influence of body mass on postural stability in postmenopausal women. **METHODS:** Forty women (age: 71.2 ± 5.4 years, height: 154.6 ± 5.8 cm, weight: 72.0 ± 21.2 kg and BMI: 28.9 ± 4.5 kg/m²) were evaluated. According to the body mass, participants were divided into two groups: overweight group (OWG, $n = 23$) and normal weight group (NWG, $n = 17$). Body mass assessment was performed using multiple frequency bioimpedance analysis (MF-BIA) and postural stability was evaluated on the Biodex Balance System (BBS), using Postural Stability Test (PST) at levels of oscillation 8 and 4 at the anterior-posterior (AP) and mid-lateral (ML) directions. Statistical analysis was performed by Shapiro-Wilk normality-test; comparisons between groups by Mann Withney test and correlations by Spearman correlation coefficient. Statistical significance was set at $p < 0.05$. **RESULTS:** OWG presented significantly ($p < 0.05$) lower postural stability (AP-PST-8: 1.32 ± 0.49 ; ML-PST-8: 1.05 ± 0.50 ; AP-PST-4: 2.20 ± 0.89 ; ML-PST-4: 1.78 ± 0.91) to the NWG for all the variables determined in the BBS (AP-PST-8: 0.71 ± 0.34 ; ML-PST-8: 0.70 ± 1.06 ; AP-PST-4: 1.35 ± 0.81 ; ML-PST-4: 1.24 ± 0.84). Also, there was a positive and moderate correlation between BMI with AP-PST 8 ($r = 0.58$), BMI with ML-PST 8 ($r = 0.45$), BMI with AP-PST 4 ($r = 0.51$) and BMI with ML-PST 4 ($r = 0.46$). **CONCLUSION:** These data suggest that overweight predisposes postmenopausal women to greater postural instability.

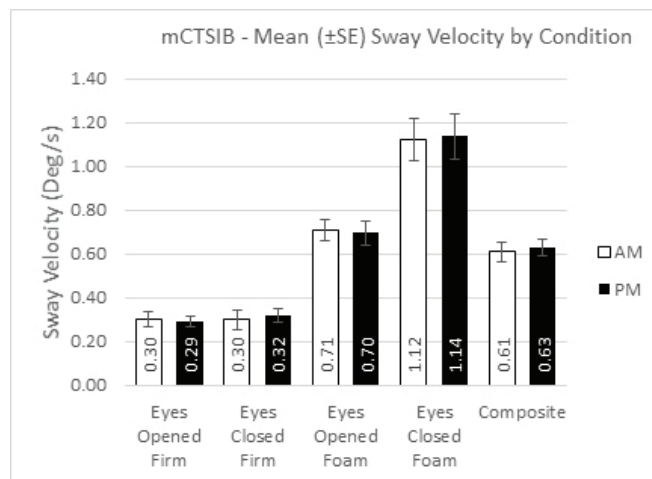
1328 Board #90 May 30 10:30 AM - 12:00 PM

Diurnal Influence On The Modified Test Of Sensory Integration And Balance (mCTSIB)

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(No relevant relationships reported)

PURPOSE: The mCTSIB evaluates sensory integration and balance, which have been shown to degrade due to brain injury and neurological disease. Time-of-day affects sensory integration and balance. The purpose of this research was to investigate diurnal effects on the mCTSIB diagnostic protocol. **METHODS:** The Georgia Gwinnett College Institutional Review Board approved this research protocol. The research participants were 21 healthy women (12) and men (9) with an average age of $22.4 (\pm 3.5)$ years, height of $165.9 (\pm 15)$ cm, and weight of $69.3 (\pm 8.2)$ kg. Participants completed morning mCTSIB trials between 7:00 AM and 10:00 AM and evening trials between 4:00 PM and 7:00 PM. Treatment order was randomized and balanced. Participants were instructed to get a normal night's sleep prior to testing and refrain from caffeine use on the day of testing. Participant sleep, physical activity, and concussion history were recorded by survey. **RESULTS:** No statistically significant mCTSIB differences were detected between time-of-day conditions. See chart below for a summary of average postural sway velocities by balance condition and time of day.



CONCLUSION: Based on this investigation, there appears to be no difference in morning compared to afternoon tests of sensory integration and balance among healthy young adults. This is an important finding; possibly informing clinicians that time-of-day is not an important factor to consider when conducting mCTSIB repeated measures or normative comparisons.

1329 Board #91 May 30 10:30 AM - 12:00 PM

The Effects of Cognitive Load and Postural Demand on Static Balance

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(No relevant relationships reported)

A growing body of research indicates that measures of static balance (e.g., postural sway) are influenced under cognitive demands. Similar measures are also impacted under different balance demands (e.g., stable vs unstable stances). However, to date, there is little known about how the difficulty of postural demands impact the relationship between balance and cognition. **PURPOSE:** Within the same individuals, we parametrically compared balance demands and cognitive demands on static balance ability using state-of-the-art inertial sensors. **METHODS:** 34 healthy young adults completed tasks of static balance with and without a cognitive demand (CD). Six wireless inertial sensors (APDM Opals) were attached to the wrists, feet, chest and lower back. The static balance task involved the participants standing for 30 seconds on a firm surface with their eyes closed in three different postural demand (PD) positions: feet apart (Low PD), feet together (Moderate PD), and feet in tandem (High PD). After completing these tasks alone (Low CD), participants were asked to complete these tasks while doing serial seven subtractions from a randomly presented three-digit number (High CD). **RESULTS:** We conducted repeated measures ANOVAs with Cognitive Demand (High vs Low) and Postural Demand (High vs. Moderate vs. Low) on measures of Path Length and Jerk. For Path Length, there was a main effect of CD [$F(1,32) = 13.19$, $p < .001$, High = 32.39, Low = 18.42] and a main effect of PD [$F(2,64) = 99.69$, $p < .001$, High = 62.32, Moderate = 8.19, Low = 5.71]; however, there was no interaction between these factors. Path Length was longer under High CD relative to Low CD, and for Tandem PD relative to Likewise, for Jerk, there was a main effect of CD [$F(1,32) = 4.28$, $p < .05$, High = 22.92, Low = 17.36] and a main effect of PD [$F(2,64) = 28.65$, $p < .001$, High = 37.08, Moderate = 14.07, Low = 9.27], but there was no interaction between these factors. **CONCLUSION:** Using two precise measurements of static balance, we observed that performance was impacted by separate cognitive and postural demands. Since these factors did not interact, our results suggest that adding a cognitive task to a balance assessment may have an impact independent of the balance demands.

1330 Board #92 May 30 10:30 AM - 12:00 PM**Relationship Between Physical Function, Diet, And Body Composition With Postural Limits Of Stability**

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(No relevant relationships reported)

Approximately one out of four older adults will fall each year. Falls are the leading cause of fatal and non-fatal injuries among older adults and represent a significant public health problem. Body composition, diet and physical function are modifiable through lifestyle and may represent potential targets to improve postural stability. However, little is known about the relationships between these variables and limits of stability (LOS) in overweight, older adults. LOS is a reliable test that incorporates maximum center-of-gravity excursion, which is associated with fall risk. **PURPOSE:** To investigate the associations between body composition, physical activity/performance and diet to components of LOS. LOS includes measures of reaction time (RT), movement velocity (MVL), maximum excursion (MXE), endpoint excursion (EXE), and directional control (DCL). **METHODS:** In twenty overweight (body mass index $\geq 27 \text{ kg/m}^2$), older adults ($\geq 58 \text{ y}$), we obtained measures of stability (force plate), habitual physical activity (7-day accelerometry), habitual dietary macronutrient intake (3-day dietary recall), cardiorespiratory fitness (graded exercise test to volitional exhaustion with indirect calorimetry), gait speed from a 4-meter walk test, and body composition (bioelectrical impedance, InBody720). Associations among variables were determined using partial correlations (controlling for age and sex). Statistical significance was set at $\alpha \leq 0.05$. **RESULTS:** Subjects (16 female, 4 male) were 64.2 ± 4.77 years old and had a body mass of $95.34 \pm 15.55 \text{ kg}$, a body mass index of $34.7 \pm 4.68 \text{ kg/m}^2$, and a maximal cycle ergometer VO_2 of $15.64 \pm 2.26 \text{ ml/kg/min}$. Average LOS component values were RT: $0.784 \pm 0.155 \text{ sec}$; MVL: $4.56 \pm 1.46 \text{ deg/sec}$; EPE: $69.41 \pm 10.6\%$; MXE: $87.24 \pm 9.24\%$; and DCL: $70 \pm 8.85\%$. Significant partial correlations were noted for DCL and gait speed, $r = -0.49$, $p = .039$ as well as MVL and height, $r = -0.60$, $p = 0.008$. **CONCLUSION:** Height and gait speed from a standard 4-meter walk test were both significantly correlated to postural limits of stability. Prospective studies are needed to examine the influence of gait speed, DCL and lifestyle interventions on fall risk. Supported by a grant from the National Institute on Aging: 1R15AG055923-01.

1331 Board #93 May 30 10:30 AM - 12:00 PM**Aerobic Rumba Training Effects on Static Balance and Lower Limb Power in Older Female Adults**

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(No relevant relationships reported)

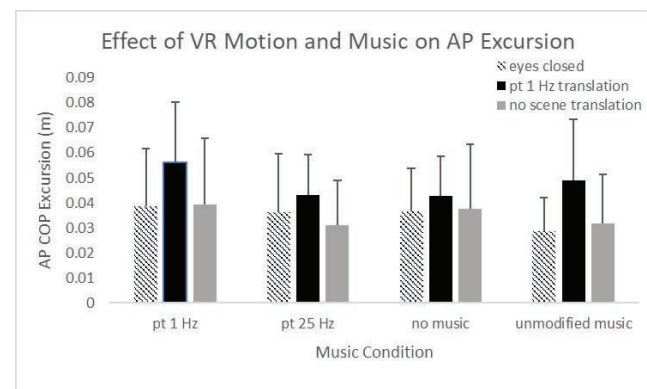
PURPOSE: The objective of this study was to identify the effects of aerobic rumba training of static balance and power in the lower limbs in elderly women. **METHODS:** Twelve healthy older adult women were randomly assigned to one intervention group (INT, $n = 6$, 67.16 ± 5.34 years), body weight ($64.88 \pm 9.79 \text{ kg}$), average weight lean muscle ($24 \pm 83 \pm 2.38\%$), body fat ($38.15 \pm 6.56\%$) and a control group (CON, $n = 6$, 67.66 ± 5.98 years), body weight ($65.3 \pm 12.90 \text{ kg}$, average weight lean muscle ($23.56 \pm 2.40\%$) and body fat (42.76 ± 6.48). A progressive dance program was carried out over a period of 8 weeks (twice a week, with a total of 16 sessions) (50 minutes per session and 10 minutes of warm-up). The intensity was measured by means of the effort perception scale. The program was taught by a professional aerobic rumba instructor, who dictated the basic steps, with forward, backward, transversal and rotational direction along with the simplest movements of different musical genres. The variables of stabilometry in the orthostatic position were determined, applying the Romberg test in a bipodal and unipodal way with eyes opened and closed for 30 seconds, using a plantar pressure platforms (BTS P Walk). To determine the power variables through the execution of 3 countermovement jump (CMJ), a force platform (BTS 6000) was used. **RESULTS:** Significant correlations (r) were found next to the p value and the effect size (ES) of the intervention group, on the stabilometric variables in the orthostatic position and those of countermovement jump respectively. Distance COP (DCOP, $p = 0.006$, $r = 0.93$, $ES = 0.5$), mean velocity (MV, $p = 0.007$, $r = 0.93$, $ES = 0.5$), lateral side flexion (LSF, $p = 0.1$, $r = 0.61$, $ES = 0.6$), left foot radius (LFR, $p = 0.02$, $r = 0.87$, $ES = 0.4$), right foot radius (RRF, $p = 0.14$, $r = 0.66$, $ES = 0.0$). CMJ performance variables: jump height (JH, $p = 0.0009$, $r = 0.97$, $ES = 2.3$), Peak Power (PP, $p = 0.02$, $r = 0.86$, $ES = 0.3$), peak concentric force (PCF, $p = 0.01$, $r = 0.90$, $ES = 0.7$) and rate of force development (RFD, $p = 0.009$, $r = 0.92$, $ES = 0.2$). **CONCLUSIONS:** the neuromuscular effect in the lower limbs through the stimulation of the aerobic rumba leads to an improvement in the muscle activation, associated to a better control of the center of pressure of the body (COP), together with the static balance and the power like a preventive factor on the risk of falls in older adults.

1332 Board #94 May 30 10:30 AM - 12:00 PM
The Effect of Music on Virtual Reality Induced Postural Sway

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(No relevant relationships reported)

The use of a moving virtual reality (VR) environment to induce postural sway is well established. The extent to which music presented along with VR motion can enhance sway is unknown. **PURPOSE:** To determine if music, presented in modified and unmodified forms, will affect postural sway while standing in a moving VR environment. **METHODS:** Twenty-eight subjects (15 females; 13 males) aged 18-35 stood barefoot on a balance plate while wearing a VR headset. AP and ML center of pressure (COP) data was collected as the subjects experienced 3 visual conditions (VR scene translating in the AP direction at 0.1 Hz, no translation, and eyes closed) and 4 music conditions (music modified to scale loudness at 0.1 Hz and 0.25 Hz, unmodified music, and no music). AP and ML COP excursions, COP RMS, and COP velocities were calculated. **RESULTS:** A significant interaction effect ($p = 0.0439$) showed that combining scene translation with 0.1 Hz modified music increased AP COP excursion ($p < 0.05$) compared to all conditions except 0.25 Hz modified and unmodified music with scene translation. Main effects ($p = 0.009$ and $p < 0.001$) showed the 0.1 Hz modified music increased excursion compared to the 0.25 Hz modified and unmodified music conditions and that scene translation increased excursion compared to the other visual conditions. Similar effects were observed for RMS and velocities. **CONCLUSION:** VR induced sway may be enhanced by music presented in a manner to reinforce visual input. These findings could be used to optimize VR-based training protocols to improve postural control.

**1333 Board #95 May 30 10:30 AM - 12:00 PM**
Comparison of Postural Changes in Esports Athletes in Gaming and Non-Gaming Chairs. A Case Series.

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(No relevant relationships reported)

Seventy to eighty percent of the population will experience one episode of neck and low back pain in their lifetime, respectively. Deviations in posture can contribute to this onset of spinal pain. One subgroup of the population that is known to experience similar pain is eSports athletes. It has been shown that 34% of forty recently polled eSports athletes experience neck and back pain when competitively gaming. Concerns have been raised over their sustained aberrant postural positioning during play and its contribution to their pain. **PURPOSE:** To examine postural changes in collegiate eSports athletes while playing in eSports gaming chairs compared to non-gaming chairs. **METHODS:** Four collegiate eSports athletes (21.75 ± 2.06 years old) were recruited to participate in this observational study. Measurements of three joint angles were performed over four days with sessions lasting one hour. Each day the athletes were randomly assigned to a different chair before the gaming session. The chairs included two commercial gaming brands from different vendors (chairs 1 and 2), an office chair (chair 3), and a standard chair (chair 4). Reflective markers were placed at specific bony prominences to capture both sagittal and coronal postures during play. Motion capture was recorded using two GoPros™ and later analyzed with Kinovea™ software. **RESULTS:** There was a significant difference within group ($t = -3.38$, $p = 0.03$) between the pre and posttest neck angle measure for chair 1 of the commercial brands. Using an ANOVA, significant differences were found between chairs 1 and 2 ($F(3,28) = 2.6$, $p = 0.028$) and chairs 2 and 3 ($F(3,28) = 2.6$, $p = 0.023$).

CONCLUSION: The differences found in posture within gaming chairs and non-gaming chairs may impact upon injuries in eSports players. These preliminary results warrant further testing to possibly help reduce injury in eSports athletes.

1334 Board #96 May 30 10:30 AM - 12:00 PM
Effects of Ankle Bracing on Postural Sway

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(No relevant relationships reported)

Ankle bracing can alter postural control strategies during static and dynamic tasks, theoretically through mechanical constraint of the ankle joint and/or sensorimotor reorganization. While a majority of studies have focused on center of pressure (COP) characteristics or clinical tests of balance to explore this theory, fewer studies have investigated sway characteristics of the center of mass (COM). Additionally, the effects of various styles of ankle braces on postural sway remains inconclusive. Assessing the effects of ankle bracing on postural sway could provide additional insight into potential systemic motor adaptations that occur in response to ankle constraint.

PURPOSE: Examine effects of lace-up and semi-rigid bracing on postural sway characteristics during a quiet-standing task. **METHODS:** Thirty-five adults between the ages of 18-30yrs (height: 1.72 ± 0.1 m; mass: 75.49 ± 18 kg) participated in the study. Participants performed a single one-minute trial of quiet-standing during each of the following conditions: No brace (NB), lace-up brace (LB), and semi-rigid brace (SRB). A ten-camera motion capture system was utilized to capture lower extremity position. To assess postural sway, mediolateral (ML) and anteroposterior (AP) lower extremity COM trajectories were extracted, and root-mean-square deviation (RMSx, RMSy) and velocity (RMSvx, RMSvy) of the COM were calculated. Repeated-measures ANOVAs were employed to assess differences in postural sway measures across all conditions. **RESULTS:** Analysis revealed a significant main effect for RMSy ($F = 7.061$; $p < .01$). Pairwise comparisons indicated that RMSy was significantly lower in the SRB condition (1.770 ± 1.698 mm) compared to C (2.182 ± 1.515 mm) ($p < .01$). **CONCLUSION:** Results from study indicate that subjects exhibited an altered AP postural sway pattern when a semi-rigid brace is applied. These findings align with previous research reporting reduced AP COP excursions with ankle bracing during quiet-standing. Altered sway patterns with ankle bracing appears to support the presence of sensorimotor reorganization, possibly due to altered proprioceptive and/or haptic feedback stemming from greater mechanical constraint of the ankle joint.

1335 Board #97 May 30 10:30 AM - 12:00 PM
Minimal Detectable Change Scores For Measures of Functional Balance in Adolescents With Chronic Ankle Instability

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(No relevant relationships reported)

Chronic Ankle Instability (CAI) is an issue that can affect individuals with a history of ankle sprains. Improving functional balance is one of the key goals in ankle rehabilitation programs. However, the threshold for defining a meaningful level of improvement for certain assessments has not been determined.

PURPOSE: To establish the minimal detectable change (MDC) values for 2 different functional balance assessments in an active adolescent population with CAI. **METHODS:** Forty-three active adolescents with CAI (20 males and 23 females, 16 ± 1 years, 171.75 ± 12.05 cm, 69.38 ± 18.36 kg). CAI inclusion criteria consisted of ankle sprain history, current symptoms of pain, weakness and instability and repeated episodes of giving-way. Participants completed 4-weeks of either strength training, balance board training, combination training (completion of both strength and balance board exercises) or no intervention. Dependent variables were pre and post-intervention scores for two measures of functional balance: side-hop test required participants to hop 30-centimeters medially/laterally for 10 repetitions and figure-of-8 hop test required participants to hop in a figure-of-8 pattern over a 5-meter distance for 2 repetitions. Both tests were completed twice on the involved leg. Hopping ability was measured in time to complete (seconds). A positive change score indicated improvement by a decrease in time needed to perform each test. The MDC with 95% confidence intervals was calculated for each variable [$MDC = 1.96SD \times (1-ICC)^{1/2} \times (2)^{1/2}$]. **RESULTS:** Average pre and post-intervention scores were 12.55 ± 4.51 sec and 10.06 ± 2.45 sec for side-hop and 14.60 ± 2.70 sec and 13.00 ± 1.80 sec for figure-of-8 hop respectively. MDC was 2.60sec for both side-hop and figure-of-8 hop. These values reflect the minimal score necessary to be 95% confident that any measured change surpasses the statistical error associated with the test. Approximately 34.38% of the intervention participants had a clinically meaningful change of >2.60 seconds for side-hop test and 31.25% for figure-of-8 hop test. **CONCLUSIONS:** When these functional

balance tests are used to detect beneficial changes from rehabilitation interventions, these MDC scores should be used as a minimum threshold to detect a true and clinically meaningful change.

1336 Board #98 May 30 10:30 AM - 12:00 PM
Relationship Between Balance And Anterior Talofibular Ligament And Superior Extensor Ankle Retinaculum Thickness

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(No relevant relationships reported)

Ankle sprains are a common injury, with affected individuals often experiencing recurrent symptoms that can progress to chronic ankle instability (CAI). Balance impairments are routinely present in subjects with CAI. Changes in tissue structure of the anterior talofibular ligament (ATFL) and superior extensor ankle retinaculum (SEAR) may occur after an ankle sprain, and may contribute to impaired balance through altered proprioception. **PURPOSE:** To determine if ATFL/SEAR thicknesses were related to dynamic balance in individuals with CAI. **METHODS:** Subjects were 14 males and 15 females (Age = 24.52 ± 3.46 years). Ankle instability was assessed using the Cumberland Ankle Instability Tool (CAIT), with a cut-off score of 25 to define two groups: those with and without CAI. Real-time ultrasound was used to assess ATFL and SEAR thicknesses. Dynamic balance was measured with the Y Balance Test (YBT) and the NeuroCom® motor control and adaptation tests. For subjects with CAI, we analyzed stable versus unstable ankles; for those without CAI, we analyzed right versus left ankles.

RESULTS: There was no difference in mean ATFL thickness (0.24 ± 0.03 vs. 0.22 ± 0.04 cm, respectively, $p=0.21$) or in SEAR thickness (0.09 ± 0.01 vs. 0.10 ± 0.02 cm, respectively, $p=0.19$) between the stable and unstable ankles in those with CAI. For those without CAI, there was also no difference between the right and left ATFL thickness (0.22 ± 0.06 vs. 0.20 ± 0.04 cm, $p=0.14$) or SEAR thickness (0.09 ± 0.01 vs. 0.09 ± 0.01 cm, $p=0.95$). There was no difference in YBT scores in those with or without CAI ($p=0.21$, $p=0.89$ respectively). Additionally, sway energy for upward or downward forces was comparable between those with and without CAI ($p=0.15$, $p=0.36$). Similarly, composite latencies were also no different ($p=0.68$).

CONCLUSIONS: There was no relationship between ligament thickness and balance, supporting a multifactorial CAI rather than dependency upon tissue changes alone. Central nervous system sensory integration, neuromuscular control compensations, or psychosomatic reactions may be the ones affecting the balance more. Likewise, subject perception of ankle instability may not coincide with impaired dynamic balance. Finally, tests used to assess dynamic balance may not be sensitive enough to identify differences caused by CAI.

1337 Board #99 May 30 10:30 AM - 12:00 PM
Lower Limb Impairments In Patients With Knee Osteoarthritis

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(No relevant relationships reported)

PURPOSE:

Self-reported knee pain is a frequent reason of consulting medical doctors. In the setting of knee osteoarthritis (KOA) care, although it has been shown that muscle function is more closely associated with joint pain than the grade of joint space narrowing, its assessment is generally neglected. In addition, knee malalignment and foot imbalance which are recognized potential risk factor for KOA are not systematically considered. The aim of our study was to determine the frequency of foot imbalance and quadriceps strength and activations disorders and their relationship with knee pain.

METHODS:

150 patients suffering from knee pain (64 men and 88 women) aged 45-74 years (mean age 58.9 , $SD = 8.1$) underwent quantitative tests of 3D foot scan, quadriceps strength, surface electromyography foot balance during maximal isometric, squat and walking exercises. Inclusion criteria included; radiographic K-L (Kellgren and Lawrence) grades less than 2. Exclusion criteria included: (1) a history of lower limb surgery; and (2) a history of arthrocentesis and acorticosteroid or hyaluronic acid injection within 3 months of study commencement.

RESULTS:

3D foot scan showed that 28% of patients had asymmetrical foot print shape during static position (normal stance) in both feet, 32% in the painful leg and 21% in the

non-painful leg. 44% of the subjects had quadriceps weakness (during isometric test, painful limb was significantly weaker). 28% and 17% unequal vastus medialis versus vastus lateralis ratio activation and 18% and 11% delay in Vastus medialis activation during squatting and walking respectively. When analysed by multiple logistic regression, quadriceps strength, vastus medialis /vastus lateralis ratio activation and foot pronation were independently associated with knee pain. Quadriceps strength and vastus medialis/vastus lateralis ratio activation were not associated with foot misbalance.

CONCLUSIONS:

The findings indicate that, knee pain is a multifactorial process in which several mechanical factors could be associated— but both weakness of the quadriceps muscles and misbalance in the foot are often altered. We may recommend lower limb biomechanics analysis, muscle activation and 3D foot print to optimise both diagnosis and treatment in patients with knee pain.

1338 Board #100

May 30 10:30 AM - 12:00 PM

Obesity and Falls in Older Women: Mediating Effects of Muscle Quality, Foot Loads and Balance

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(No relevant relationships reported)

PURPOSE: Obesity is associated with risk of falls in older women. However, it is not certain whether factors commonly associated with obesity and/or falls mediate this risk. This study examined whether muscle quality, foot loads and postural balance mediate the relationship between obesity and falls. **METHODS:** At baseline, 246 female participants underwent obesity screening ($BMI \geq 30 \text{ kg/m}^2$), and had muscle quality (isokinetic dynamometer and DXA), foot loads (pressure platform) and postural balance (force platform) evaluated. Incident falls were recorded at the end of the 18-month follow-up period. To identify mediating factors of obesity and falls, a series of modified Poisson regression analyses were conducted as per Baron and Kenny's 3 step criteria. Each potential mediator was individually assessed for its association with obesity (step 1), and if this association was significant, then each potential mediator was assessed for its association with falls (step 2). If the potential mediator was significantly and independently associated with both obesity and falls, the potential mediator and obesity were both included as independent variables in a model to assess their association with falls (step 3). If the 3 mediating conditions were all met, the intervening variable effect was examined using Freedman and Schatzkin test. Significance level was set at $p < .05$. **RESULTS:** 204 volunteers (83%) completed the follow-up. Obese participants had an increased risk of falls during the 18-month period ($RR = 2.13$, 95% $CI = 1.39-3.27$). The table below presents the mediation analysis of the relationship between obesity and falls. Of the variables analysed, only muscle quality (specific torque) was a significant mediator ($t = 4.026$, $p < .001$). **CONCLUSION:** Low muscle quality was identified as a mediator for the relationship between obesity and falls in older women. Thus, the inclusion of muscle strengthening as a part of a falls prevention program may benefit this population.

Potential mediators	Step 1	Step 2	Step 3
Muscle quality			
Knee extensors peak torque (< 88.1 Nm)	1.34 (0.81-2.23)	-	-
Leg lean mass (< 5.0 kg)	0.21 (0.08-0.56)	0.83 (0.47-1.44)	-
Specific torque (< 16.1 Nm.kg^{-1})	2.48 (1.54-3.98)	2.75 (1.78-4.26)	2.37 (1.48-3.79)
Foot loads			
Maximum force (> 848.3 N)	9.92 (5.17-19.04)	1.76 (1.11-2.77)	1.08 (0.58-2.04)
Contact area (> 141.8 cm^2)	3.28 (2.01-5.36)	1.51 (0.93-2.44)	-
Peak pressure (> 680.0 kPa)	1.20 (0.71-2.02)	-	-
Flat foot (dynamic arch index > 0.28)	1.70 (1.20-2.40)	1.37 (0.86-2.16)	-
Postural balance			
CoP speed (> 1.83 cm/s)	0.99 (0.56-1.74)	-	-
CoP anteroposterior range (> 3.3 cm)	2.03 (1.25-3.30)	1.62 (1.02-2.58)	1.38 (0.87-2.20)
CoP mediolateral range (> 1.8 cm)	1.64 (1.02-2.64)	1.29 (0.80-2.09)	-

1339 Board #101

May 30 10:30 AM - 12:00 PM

Does Movement Strategy Change Directional Balance Reach Test Performance Variability?

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(No relevant relationships reported)

The Directional Balance Reach Test (DBRT) outcome measurement is a composite score (CS) based on the maximum reach distances of three trials in each of three testing directions: anterior (ANT), posterior-medial (PM), and posterior-lateral (PL). Movement strategy, with and without specific movement cues, may alter within trial reach distance performance variability. It may provide different clinical information about individual movement control during DBRT. **PURPOSE:** The purpose of this study was to determine whether movement strategy impacted CS and performance variability in DBRT. **METHODS:** Sixteen subjects (eight males and eight females) were randomly assigned to two groups. Each group performed DBRT on the dominate support (DS) and dominate kick (DK) legs by using personal (P) and specific (S) strategies in different orders (P-S, S-P). The ANT, PM, and PL reach directions were randomized during nine reaching trials. Reach distance was normalized to the subject's leg length. Performance variability of reach distance in each direction was defined by measuring absolute error ($AE = [\sum |x_i - \bar{x}|] / 3$). Two-way mixed ANOVAs, strategy(2) x order(2), were used in a preliminary analysis to rule out an order effect in CS. Two-way repeated ANOVAs, strategy (2) x reach direction (3), were used to determine whether these independent variables affected performance variability. **RESULTS:** For CS, there was no main order effect ($p > .05$). However, there was a significant strategy effect for both legs ($p < .001$; DS: $P = 90.01 \pm 6.98\%$, $S = 82.92 \pm 5.97\%$; DK: $P = 89.53 \pm 7.93\%$, $S = 82.82 \pm 7.80\%$). For AE in DS, there was no significant strategy effect, but there was a main direction effect ($p = .001$, $\eta^2 = .376$, Power = .953; ANT = $3.48 \pm 2.02\%$, PM = $5.18 \pm 4.15\%$, PL = $6.05 \pm 4.12\%$). For AE in DK, there was a significant strategy by direction interaction ($p = .044$, $\eta^2 = .189$, Power = .606). Post-Hoc tests revealed a significant strategy effect ($p < .05$) for PL only ($P = 4.78 \pm 3.10$, $S = 7.33 \pm 5.15$). **CONCLUSION:** The movement strategy used impacted CS. However, AE was only altered in the PL direction in DK. The DBRT, a closed chain dynamic balance test, may be a novel task for assessing DK leg performance variability.

1340 Board #102 May 30 10:30 AM - 12:00 PM
Automated Identification of Postural Control for Individuals with Parkinson's Disease using a Machine Learning Approach

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(No relevant relationships reported)

Machine learning is a branch of artificial intelligence that enables computer systems to learn from data and analyze data without being explicitly programmed. Interest in machine learning has grown rapidly in clinical settings because the diagnosis of diseases or disorders can be automated by computer systems with high accuracy and minimum human intervention. However, the use of machine learning to identify postural control patterns for people with Parkinson's disease (PD) is not well established.

PURPOSE: The purpose of the study was to develop and validate an automated identification of PD postural control patterns using a machine learning approach.

METHODS: 12 participants with PD (age = 75.3 ± 6.6 yr, height = 1.71 ± 0.12 m, mass = 83.1 ± 12.4 kg) and 18 healthy controls (age = 83.3 ± 5.5 yr, height = 1.62 ± 0.08 m, mass = 73.1 ± 16.2 kg) were recruited. Participants were instructed to stand on a force plate and maintain still for 2 minutes during eyes-open and eyes-closed conditions. The center of pressure (COP) data were collected at 50 Hz; sway area, linear displacements, total distances, standard deviations of COP positions and average velocities were calculated. 3 supervised machine learning algorithms (i.e., logistic regression (LR), k-nearest neighbors (KNN) and naïve Bayes (NB)) were used to identify PD postural control patterns. All participants were divided into two datasets: 70% for training and 30% for testing.

RESULTS: KNN achieved the highest overall accuracy rate (0.90) to identify PD postural control. LR and NB also exhibited satisfactory performance. The overall accuracy of LR ranged was 0.86; and the overall accuracy of NB was 0.81. Though all three models are capable of analyzing small-sample data, model performance to identify PD postural control could be potentially improved by recruiting a larger sample size and exploring other machine learning models in future research.

CONCLUSIONS: Computer-aided machine learning models successfully identified postural control patterns of PD patients with high accuracy. The use of machine learning may provide a valid and efficient approach to better understand PD postural control features and thus, could be beneficial for the early diagnosis and early intervention in individuals with PD.

1341 Board #103 May 30 10:30 AM - 12:00 PM
Using A Kinect™ Sensor To Develop An Objective Quantification Of The 20s-march Test For Adl Assessment In Older Individuals

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(No relevant relationships reported)

PURPOSE: With increasing interest in addressing quality of life of older individuals, tests such as the Functional Independence Measure (FIM) are widely used measures of infirmity and burden of care. However, these scales are largely qualitative and especially problematic when assessing movement-based tasks. While effective, reliable analysis of human movement is technically complicated and expensive; an infrared depth sensor is potentially a low-cost, portable device which may provide a quantitative aspect to clinical testing. Our purpose was to assess the utility of the Kinect™ sensor in providing an objective evaluation of human movement using an oft measured ADL (march-in-place test; MIP). **METHODS:** Community-dwelling older adults living in 6 districts and were users of daycare 3 facilities within 4 prefectures in JAPAN. Men (n= 31) and women (n= 74) between the age of 62 and 93 years, consisting of independent (IG; n = 58) and dependent (DG; n = 47) older adults performing the March test. FIM was administered to all subjects (scored by a physical therapist). On a separate day, subjects completed a 20-s MIP test and joint point coordinate data was recorded with a Kinect™ v2 during the final 10-s of the test. Initial head position is the origin (H (0)) and head position at any time t is H (t). The Euclidean distance |H (t) - H (0)| between these two points 0) | was calculated and summed as the maximum moving distance (MMD) max {|H (t) - H (0)|}. **RESULTS:** Age, height, body mass and BMI were similar between groups. MMD was greater (p<0.05) in DG (0.293 ± 0.187m) than IG (0.153 ± 0.102m), and was related to age (r=-0.605, p=0.051). An optimal threshold for MMD identifying frailty was determined by a receiver-operator characteristic curve with a MMD of 0.207m providing the

combination of sensitivity (62%) and specificity (79%). **CONCLUSIONS:** During the 20-s MIP test, the increased MMD observed in DG appears to indicate that staggering during stepping is large. The result seems to represent instability during marching and poor balancing ability in frail adults. The 20-s MIP and associated MMD identifies frailty in the present population with good sensitivity and specificity.

1342 Board #104 May 30 10:30 AM - 12:00 PM
Time-of-day Influence On The Stability Evaluation Test (set)

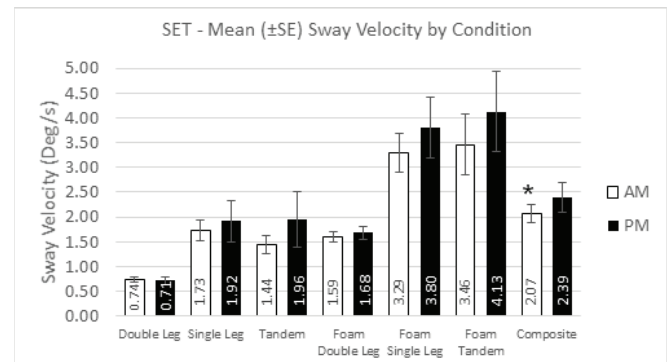
Jeff Pasley, Sara Camp, Kade Carrigan, Brandon Doan. Georgia Gwinnett College, Lawrenceville, GA. (Sponsor: Patrick O'Connor, FACSM)
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PURPOSE: Postural control is impaired following a concussion and is one diagnostic method used by medical professionals for return-to-play decisions in concussed athletes. Circadian rhythm affects human function, including postural control. The purpose of this research was to investigate time of day variation related to the SET postural control diagnostic protocol on a Neurocom Balance Master.

METHODS: The Georgia Gwinnett College Institutional Review Board approved this research protocol. The research participants were 19 healthy women (11) and men (8) with an average age of 21.7 (± 2) years, height of 165.9 (± 15) cm, and weight of 69.3 (± 8.3) kg. The participants completed the SET in the morning (between 7:00 AM and 10:00 AM) for one treatment and in the evening (between 3:00 PM and 7:00 PM) for the other treatment condition. A SET familiarization session was completed and treatment order was randomized and balanced to attempt to account for order effects. Participants were instructed to get a normal night's sleep prior to testing and refrain from caffeine use on the day of testing. Participant sleep, physical activity, and concussion history were recorded by survey.

RESULTS: There was less average postural sway during the morning testing for all conditions except for the least challenging balance condition (double-leg firm surface), trending towards larger differences in the more challenging balance conditions (see chart below). The only statistically significant difference (p < 0.05) was for the overall SET composite score, 2.07 (± .19) Deg/s in the AM versus 2.39 (± .30) Deg/s in the PM condition.



CONCLUSIONS: While greater sample size, age, athletic specificity and gender range are needed, these results may begin to inform practitioners as to the importance of controlling time-of-day between SET conditions. This may improve accuracy of comparison between baseline and post-injury diagnostic testing which would enable more confident return-to-activity decisions.

1343 Board #105 May 30 10:30 AM - 12:00 PM
Vestibular And Proprioceptive Alteration Influence Postural Instability During Dual Tasks In Adults Diagnosed With HIV

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(No relevant relationships reported)

PURPOSE: People diagnosed with HIV can exhibit impaired postural control as a consequence of infection or from secondary effects of medication. Characterize the role of the vestibular and proprioceptive systems during dual postural control tasks in Individuals with HIV. We hypothesize that postural stability will decrease with the increase of task complexity.

METHODS: The study was conducted in San Juan, Puerto Rico at a community-based program, La Perla de Gran Precio. 24 subjects (13 male and 11 female, age average 59.2 ± 1.7 years) participated in the study. Participants had to be diagnosed with HIV

with a CD4 count of >200 cells/uL to enroll in the study. After signing the informed consent and collecting demographic data, a member of the research team placed a lumbar accelerometer on each subject. Each participant was instructed to quiet stand in a static bi-pedal posture on a firm surface or a thick foam pad. Each task took 15 seconds to be performed. The first task was to stand on a firm surface (baseline), the eight remaining balance tasks were performed with a thick balance foam mat (four single and four dual cognitive tasks). For the cognitive dual tasks participants were instructed to count backward 3 numbers at a time.

RESULTS: Postural control was measured with Body-worn accelerometers (ACC). The two variables of interest in this study were jerk sway acceleration in an anterior-posterior (A-P) and mediolateral direction (M-L), m^2/s^5 . A MANOVA analysis was used to compare the variables of interest, between baseline (BL) (firm surface eyes open) and single/double tasks. AP sway increased significantly during single (BL $0.020 \pm .01 m^2/s^5$ versus single task $0.20 \pm 0.02 m^2/s^5$ $P < 0.005$) and dual tasks (BL $0.020 \pm .01 m^2/s^5$ versus dual task $0.23 \pm 0.03 m^2/s^5$ $P < 0.005$) when visual input was canceled.

CONCLUSIONS: Single and dual tasks showed a similar challenge and results regarding increased acceleration and instability. It appears that the vestibular and proprioceptive systems could be impaired in HIV diagnosed people. Because there is no fall history among the participants of this study and these findings, it seems that patients with HIV rely on the visual system to a higher degree to attain postural control.

1344 Board #106 May 30 10:30 AM - 12:00 PM
Age-associated Decline In Directional Dynamic Balance In Community-dwelling Older Women

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(No relevant relationships reported)

PURPOSE: To determine whether there is an age-associated decline in leaning directions of DB in community-dwelling older women. **METHODS:** DB was determined in 558 older women. DB was characterized by limits of stability (LOS) that measured end-point excursion (EXE) and maximum excursion (MXE) of the body's center of pressure, reaction time (RT), mean velocity (MVL), and directional control (DLC). LOS consisted of 8 leaning tests around a center square at 0, 45, 90, 135, 180, 225, 270, and 315 degrees. Average (composite) values for each variable in all directions, as well as for each variable in the forward (0 degrees), backward (180 degrees), right (45 degrees), and left (270 degrees) directions, were analyzed. **RESULTS:** For overall composite scores and the 4 directions, relationships existed between age and RT ($r = 0.18$ to 0.34 , $p < 0.001$), between age and MVL ($r = -0.13$ to -0.30 , $p < 0.001$), age and EPE ($r = -0.27$ to -0.49 , $p < 0.001$), age and MXE ($r = -0.27$ to -0.43 , $p < 0.001$), and age and DLC ($r = -0.11$ to -0.38 , $p < 0.001$). Although age had a significant effect on all balance parameters, there was a higher correlation coefficient with age and composite values compared to the directional results. The influence of age on forward, backward, right, and left directions was not clear. **CONCLUSIONS:** Age had a significant main effect on all balance measures. Balance ability declined in all directions but it is not clear if certain directions are affected differently. Not only was the distance that one can lean without losing balance (EPE and MXE) negatively affected by age, the rate of decline in RT and MVL were also large in all directions. Balance exercise should be designed to address each of these parameters when leaning in the forward, backward, and lateral directions in order to prevent falls.

1345 Board #107 May 30 10:30 AM - 12:00 PM
Is Wobble Board Balance Performance Influenced by Sex and Anthropometric Characteristics?

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(No relevant relationships reported)

It has been demonstrated that balance can be influenced by anthropometric characteristics and sex. However, controversial findings are reported, mainly due to the large variability in subjects tested and methodologies adopted. Therefore, new hi-tech approaches, able to limit this variability, are needed to accurately evaluate balance control. **PURPOSE:** To assess the influence of anthropometric characteristics and sex on computerized wobble board (WB) balance measures. **METHODS:** Forty-eight (women=24; men=24) young (age=24.0±3.0 years) adults were selected to cover a wide range of anthropometrics (mass=64.6±11.5 kg; height=167.3±8.5 cm; body mass index [BMI]=23.0±3.2 kg·m⁻²). Subjects performed three 30-second trials per limb on a WB equipped with a triaxial accelerometer. Time (s) spent on the platform keeping it flat

at 0° was collected for subsequent analysis. Pearson's correlation was used to evaluate the relationships between WB values and the anthropometrics (height, mass, BMI). ANOVA was used to examine WB performance differences between sex for dominant and non-dominant limbs ($p < 0.05$). **RESULTS:** The measured anthropometrics did not significantly correlate with the WB performance. Although women (dominant limb=19.2±4.6 s; non-dominant limb=19.8±4.9 s) presented better balance than men (dominant limb=18.8±3.5 s; non-dominant limb=19.1±4.1 s), no significant sex differences were observed for both dominant ($p = 0.73$) and non-dominant ($p = 0.60$) limb. **CONCLUSIONS:** Interestingly, anthropometrics and sex did not affect the WB performance. Due to the close relationship previously reported between WB training and ankle muscles activity, it could be hypothesized that the WB performance is affected by their strength, stiffness or activity. WB improvements after training protocol using WB exercises, can be understood as consistent change in performance not affected by other source of variability such as variation in body mass. Therefore, trainable neuromuscular factors should be targeted during training protocols to gain postural control improvements, without controlling the anthropometrics, independently from the sex. From a clinical point of view, during preventive and rehabilitative programs a special attention should be given to the ankle muscles.

1346 Board #108 May 30 10:30 AM - 12:00 PM
Adults Diagnosed with HIV Report Decreased Balance Confidence Compared to Non-Faller Older Adults

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(No relevant relationships reported)

Individuals diagnosed with HIV often experience balance impairments caused by the virus or medication. These deficiencies due to compensation of the postural control systems might be unperceived for years until the impairments are to advance.

PURPOSE: Assess perceived balance confidence in people with HIV compared to a group of older adults without an HIV diagnosis.

METHODS: The study was conducted in San Juan, Puerto Rico at an HIV Rehabilitation Clinic (La Perla de Gran Precio) for the HIV group (HIVG). 24 subjects (13 male and 11 female) participated in the study (age 59.2±1.7 years). To enroll in the study, participants needed an HIV diagnosis with a CD4 count of > 200 cells/uL. The control group (CG) was recruited from the Community Center Complejo Deportivo Carcaño Alicea, Bayamon, Puerto Rico. A total of 25 subjects in the control group (5 males and 20 females) with an age average of 71.5 ± 3.6 years old participated in the study. A member of the research team verbally asked the subjects 16 questions that involved a variety of daily functional activities from the Activities-specific Balance Confidence (ABC) Scale. Each participant was instructed to give a percentage (0-100%) on how confident their balance is while attempting to do these specific functional activities.

RESULTS: A MANOVA analysis was used to compare ABC scale data between groups. HIVG exhibited significantly reduced balance confidence in six out of sixteen subsets of the ABC scale. Chair and Reach (CG 81.20 ± 22.651, HIV group 55.67 ± 19.680, $P \leq 0.05$), Sweep (CG 93.60 ± 9.631, HIV group 76.67 ± 12.660, $P \leq 0.05$), Crowded Mall (CG 87.40 ± 21.704, HIV group 66.67 ± 12.873, $P \leq 0.05$), Mall (CG 84.40 ± 12.189, HIV group 68.00 ± 17.264, $P \leq 0.05$), Escalator (CG 77.40 ± 23.722, HIV group 52.40 ± 11.995, $P \leq 0.05$), and Icy Sidewalks (CG 74.40 ± 26.900, HIV group 43.67 ± 15.880, $P \leq 0.05$).

CONCLUSIONS: These results indicate that adults with HIV are likely to have less confidence in their balance with those tasks, which may result from decreased proprioception and also may result in increased fall risk. Clinicians should make an effort to identify perceived balance confidence in early stages of the condition to reduce the risk of fall in these population.

1347 Board #109 May 30 10:30 AM - 12:00 PM
Effect Of The Modified Broström-Gould Surgery On Balance In Chronic Ankle Instability

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(No relevant relationships reported)

Purpose: Chronic ankle instability (CAI) has a high incidence and impacts individuals ranging from young athletes to sedentary adults. CAI can result from a single ankle sprain or from repeated ankle sprains at the lateral ankle. The main deficits associated with CAI are balance impairments, poor postural control, and recurrent sprains. The modified Broström-Gould surgery is considered when conservative treatment has been ineffective at addressing CAI. This procedure involves the reattachment of the ruptured anterior talofibular and calcaneofibular ligaments, with reinforcement through the

inferior extensor retinaculum. There is a lack of research regarding objective outcome measures for balance following this procedure. The purpose of this report was to assess changes in static and dynamic balance for an individual who underwent the modified Broström-Gould surgery.

Methods: A 28 year-old female with right CAI completed pre-testing (two weeks prior to surgery) and post-testing (two months following surgery). Outcome measures included the modified STAR Excursion Balance Test (mSEBT), the Balance Error Scoring System (BESS), and Single Leg Hop Down Test for time to stabilization (TTS) using force plate testing.

Summary of Results: Postoperatively, the patient showed improvements in all directions on the mSEBT for the affected and unaffected lower extremities (LE), with greater improvement seen on the affected LE by 22-30%. The patient improved her overall score for the BESS, demonstrating a reduced number of errors on the affected LE from 20 to 15. The Single Leg Hop Down Test revealed a decrease in the average TTS on the affected LE from 1.88 seconds to 1.01 seconds.

Conclusion: After completion of the modified Broström-Gould surgery and in conjunction with rehabilitation, the patient showed an improvement in dynamic balance measures, possibly due to increased strength and reduced pain levels following rehabilitation after surgery. Future studies should examine the role of exercise interventions and fitness level in determining patient outcomes following the modified Broström-Gould surgery.

Disclaimer: The views expressed herein are those of the author(s) and do not necessarily reflect the official policy or position of the Department of the Navy, Department of Defense or the United States Government.

1348 Board #110 May 30 10:30 AM - 12:00 PM
Validation Of The Tekscan Strideway Plantar Pressure Mat Compared To A Force Platform

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(No relevant relationships reported)

Force platforms represent the criterion method of assessing external force applied to an athlete during a given task. However, force platforms have several characteristics that may limit their use in sport and clinical environments including limited portability. Therefore, a need exists for portable equipment with high validity to measure load-related variables such as vertical force. **PURPOSE:** To validate vertical force measured using the Tekscan Strideway Plantar Pressure system compared to a force platform. **METHODS:** Five participants performed three 10-second quiet standing trials in each of eight weighting conditions. Increased weighting was achieved by increasing load during a deadlift. Vertical ground reaction force was measured independently using a plantar pressure mat (PPM, 500 Hz, Tekscan Strideway Plantar Pressure Mat, Boston, MA) and a force platform (FP, 1000 Hz, AMTI, Watertown, MA). Custom software (MATLAB, MathWorks, Natick, MA) was used to analyze vertical force data from the PPM and FP. FP data were downsampled to 500 Hz and the average force across the final 5 seconds of each trial was calculated. A correlation analysis was conducted to determine the strength of agreement between the PPM and FP. A paired samples t-test was conducted to compare mean force values measured using the PPM and FP. Cohen's d effect sizes were calculated to determine the meaningfulness of differences between the FP and PPM. **RESULTS:** No differences in vertical force were observed between the PPM and FP were observed ($p = 0.483$; PPM: 227.9 ± 64.7 N/kg; FP: 237.5 ± 57.9). A small effect size ($d = 0.15$) suggests the small differences were likely not meaningful. A high level of agreement ($r = 0.959$) was observed between the PPM and FP. **CONCLUSIONS:** These data demonstrate that vertical force measured using the Tekscan Strideway plantar pressure system are comparable to the more expensive criterion method of a strain gauge-based force platform measures. Moreover, the Strideway platform is mobile providing a solution for non-laboratory based assessments of vertical forces. Further research should evaluate the validity of the Strideway plantar pressure system during more dynamic activities such as jumping and landing and for different force-related variables.

C-35 Free Communication/Poster - Disability

Thursday, May 30, 2019, 7:30 AM - 12:30 PM

Room: CC-Hall WA2

1349 Board #111 May 30 9:30 AM - 11:00 AM

Should We Stick with Step Counts after Incomplete Spinal Cord Injury? A Case-Control Investigation

Whitley J. Stone, Amanda J. Wakeman, Braden A. Younkin, Dustin W. Davis, Matthew J. Garver, H Scott Strohmeier. *University of Central Missouri, Warrensburg, MO.* (Sponsor: Thomas Scott Lyons, FACSM)

(No relevant relationships reported)

Step count is a common metric or criterion to prescribe physical activity. Step activity benchmarks were designed to reflect an overall daily energy expenditure, but this objective measure is exposed to error when gait is impaired. Individuals with functional limitations are known to expend more energy during locomotion when compared to non-impaired controls (CON).

PURPOSE: The primary goal was to evaluate metabolic cost per step for someone with an incomplete spinal cord injury (iSCI) when compared to a CON. A secondary goal was to evaluate estimated daily energy expended between the individuals to determine if step count is an appropriate metric for activity recommendations for those with functional limitations. **METHODS:** This case-control study included a participant with an iSCI and an age-, sex-, height-matched CON. Participants completed a 6-minute walk (6MWT) and timed walks at slow, moderate, and fast paces (matching the step monitor's intensity benchmarks) while wearing a portable metabolic cart. Relative oxygen consumption (VO_2) was determined using a 15-breath moving average. Daily step activity was recorded during the 7-day period between sessions. Stride length was determined using 3D motion analysis. **RESULTS:** Differences were observed between participants for average 6MWT VO_2 (iSCI=21.5 ml/kg/min; CON=28.18 ml/kg/min), step length (iSCI: 0.36m; CON: 0.73m), energy expenditure during the 6MWT (iSCI: 0.34kcal/m; CON: 0.09kcal/m), and daily step activity (iSCI: 2616, CON: 9890). Estimated energy expended from walking for iSCI and CON was 336 kcal/day and 735 kcal/day, respectively, when extrapolating VO_2 from paced walks to data retrieved from the step monitor. **CONCLUSION:** Supporting previous literature, it is likely inappropriate to standardize activity recommendations based on step metrics for those with functional limitations. Unrealistic expectations may heighten perceived barriers, undermine mobility related self-efficacy, and discourage adoption or adherence. Exercise prescription based on energy expenditure goals may serve as an alternative means to individualize recommended daily activity. Future research should attempt to establish new recommendations based on functional status for those outside of the typical gate norm.

1350 Board #112 May 30 9:30 AM - 11:00 AM

The Effects of 8-weeks Structural Exercise-Based Intervention on Autism Spectrum Disorders

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(No relevant relationships reported)

Lack of physical activity reduces the effects of interventions and brings more health risks for individuals with ASDs (Autism Spectrum Disorders). Accumulating evidences indicate exercise program integrated varied types of exercises in a structured framework would achieves maximum gains in fitness for them. However, most of existed studies focused on one special exercise type to reduce the autism-specific impairments.

PURPOSE: to observe fitness changes with a 8-weeks structured exercise-based intervention for ASDs.

METHODS: The subjects were 6 adolescents with ASDs between the ages of 11-14 yrs (male = 5, female = 1) were recruited. They were mild-moderate and severe ASD patients according scores from the Social Responsiveness Scale. The intervention program was seen in Tab1. The Physical fitness was measured by body composition analysis with indicators, including fat mass (FM), body mass index (BMI) etc. The mental fitness was evaluated by Autism Treatment Evaluation Checklist (ATEC). Data comparisons were made using paired t-test.

RESULTS: The overall weight of the subjects decreased about 2.4%, and significant decrease happened in FM at 11.7% (27.35 ± 14.36 vs. 24.16 ± 13.78 Kg, $p < 0.05$). Among 4 subclasses of ATEC, significant decrease happened in Communication (18.50 ± 3.42 vs. 12.00 ± 3.46 , $p < 0.01$) and Sociability (25.00 ± 6.38 vs. 15.75 ± 6.40 , $p < 0.01$). Average total score of subjects was in moderate category, while was in severe category before the intervention.

CONCLUSION: Structured exercise-based intervention efficiently manage weights, prompts speech and communication skills, enhances sensory ability, and improves health behaviors through whole environmental construction. It is a feasibly alternative intervention for ASDs.

Supported by the Natural Science Fund for Colleges and Universities in Jiangsu Province (17KJA330001).

Tab1. The exercise-based intervention design			
Content	Aerobic exercise	Resistance exercise	Neuromuscular exercise
Type	Outdoor walking	Jogging over circles	Playing Paper plane
Frequency (times/week)	3	3	2
Intensity	50%~75% HR _{max}	10-15RM	50%~75% HR _{max}
Time (min)	60	4 sets (2-3 mins interval), 30	30

1351 Board #113 May 30 9:30 AM - 11:00 AM
Does The Severity Of Autistic Symptoms Influence The Effects Of An Exercise Intervention Program?

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine if improvements in training-induced fitness levels are related to the severity of autistic symptoms in children with autism.

METHODS: A total of 26 children (7.88 years \pm 2.27) with a diagnosis of autism, were recruited for this study. Prior to and on completion of the exercise intervention, the children's fitness levels were assessed using the Modified Eurofit Physical Fitness Battery, which included a 20m Sprint, Stork Balance test, Standing Broad Jump, Sit & Reach and a Hand Grip Strength Test. The exercise intervention was 8 weeks duration with three 1-hour sessions per week. The exercises included push and pull upper and lower body exercises, incorporating fundamental movement skills, through games aimed at the interests of the children. The severity of autism symptoms was assessed using the Gilliam Autism Rating Scale (GARS), completed by their teacher. Based on this rating, the children were divided into low, moderate or high groups, in terms of their autism symptoms. A spearman's correlation was undertaken between the GARS score and the overall percentage change in fitness levels for each child within the 3 categories.

RESULTS: The results of the study demonstrated that children who had the greatest symptoms of autism (high group) demonstrated the greater correlation to change in fitness levels ($r=1.0$, $p < 0.01$) with a mean percentage change in fitness levels of $285.93\% \pm 322.16$. In comparison the moderate and low groups only had a correlation of $r = 0.35$ ($p > 0.05$) and $r = 0.592$ ($p < 0.05$) and their overall mean percentage changes in fitness levels were $26.87\% \pm 33.79$ and $65.93\% \pm 114.79$.

CONCLUSIONS: The results of this study suggest that exercise programs for children with autism appear to be most effective for participants with more severe autistic symptoms.

1352 Board #114 May 30 9:30 AM - 11:00 AM
Wrist-worn Actigraph Cut-points For Classifying Activity Intensity In Spinal Cord Injury

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(No relevant relationships reported)

Physical activity (PA) recommendations are often made in terms of intensity, frequency, and duration. Accelerometer-based devices are increasingly used by users to track their own PA behaviors and by researchers to examine the association of habitual PA and health indicators. There are well-recognized accelerometer cut-points to estimate time spent in sedentary, lightweight, and moderate-to-vigorous (MVPA) intensities of PA, but such estimation is often dependent on the population, sensor placement, and activities that were used to derive the cut-points. Limited work has been done to derive accelerometer cut-points for people with spinal cord injury (SCI). Many of these individuals use wheelchairs for mobility and rely on their upper extremities for almost all PA.

PURPOSE: To derive wrist-worn accelerometer cut-points for classifying activity intensity in people with SCI using a range of daily activities and exercise.

METHODS: Thirty-one subjects with SCI who use a manual wheelchair for primary mobility wore an accelerometer-based ActiGraph device on their wrist and performed 18 activities of daily living and exercise at different intensities for 10 minutes each. The criterion intensity was obtained from a portable metabolic cart. Activity counts from the ActiGraph was correlated with the criterion to derive cut-points using linear regression. Data from 80% of the subjects was used to derive cut-points using an iterative process with 1000 iterations while the derived cut-points were tested for accuracy on the remaining 20% of the subjects. Cut-points were also tested on data from 14 subjects in a separate study following a similar protocol.

RESULTS: Accelerometer cut-points derived for people with SCI yielded an overall accuracy of 84.3% with 98%, 82.3% and 65.8% accuracy for classifying sedentary, light and MVPA activities, respectively, when tested on the 20% subjects, and an overall accuracy of 86.9% with 94.7%, 86.6% and 74.7% for the three intensities, respectively, when tested on the 14 subjects in the other study.

CONCLUSION: The high accuracy of the cut-points particularly for classifying sedentary behavior may be very useful tool for interventions aiming at reducing sedentary behavior in this population.

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1353 Board #115 May 30 9:30 AM - 11:00 AM
Acute Effects of Upper Limb Vibration Exercise on Physiological Measures for Wheelchair Users

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(No relevant relationships reported)

Strong upper limb(UL) musculature is essential for people with spinal cord injury (SCI) to perform vital activities of daily living(ADL's). The benefits of UL resistance training for manual wheelchair users (MWU) include gains in muscle strength, endurance, decreased pain and improved performance of ADL's. Studies in non-SCI populations have shown the potential for vibration to enhance training benefits.

PURPOSE: The purpose of this study was to determine the acute physiological effects of heart rate (HR), blood lactate (BL), power output and ratings of perceived exertion (RPE) during upper limb vibration training compared to standard dumbbell training.

METHODS: Thirteen MWU with SCI below T2 were recruited. Participants completed two training protocols: using a Galileo vibrating dumbbell (VT) at 30hz and a standard dumbbell (DT). For VT, the participant held the dumbbell in a static position for 45-60 seconds. For the DT, participants completed 10 repetitions of each exercise. Training protocols were completed in separate study visits. Heart rate was collected throughout both trainings. Ratings of perceived exertion for each exercise were measured after completion of the exercise. Power output from a Wingate test and blood lactate were collected before and after each protocol and were examined using a two-way repeated measures ANOVA. A dependent t-test was used to examine RPE and heart rate for each exercise between training sessions.

RESULTS: Participants average (STD) age, height and weight were 48 (10) years, 175(6) cm and 83 (17) kg respectively. There were no significant differences in the physiological measures (BL: $p = .868$, Power: $p = .815$, HR $p = .116-.949$) except for RPE shown in Table 1.

Table 1. RPE Results

Exercise	Mean (std)		p-value
	VT	DT	
Side Flies	13.9 (1.7)	11.62 (1.4)	.002
Straight Arm Row	13.1 (2.8)	10.8 (2.0)	.032
Bicep Curls	12.7 (2.8)	11.9 (1.4)	.387
Triceps Extensions	13.2 (1.7)	10.9 (1.6)	.005
Front Raise	15.1 (2.5)	11.8 (1.1)	.001
Bent Over Rows	13.1 (2.3)	12.0 (1.8)	.058

CONCLUSION: All but two of the exercises were perceived by participants to be more difficult with vibration compared to a standard dumbbell. A long-term study with additional participants is needed to examine the training benefits of vibration in SCI.

1354 Board #116 May 30 9:30 AM - 11:00 AM

Differences in Exercise Effects from Static versus Dynamic Standing in Non-Ambulatory Children with Cerebral Palsy

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(No relevant relationships reported)

PURPOSE: To compare the metabolic adaptive effects to four months of two types of structured training regimes, static standing (StS) versus dynamic standing (DyS), on cardiopulmonary and metabolic parameters among non-ambulatory children with cerebral palsy (Na-CP).

METHODS: Eighteen Na-CP participated in an exercise intervention study with a crossover design, comparing four months of StS to four months of DyS. During StS, the Na-CP were encouraged to exercise according to standard care recommendations in Sweden including daily supported StS for 30-90 minutes. During DyS, daily exercise for at least 30 minutes at a speed between 30 to 50 rpm in an Innowalk (Made for movement, Norway) was recommended. We assessed adaptive effects from the exercise programs through indirect calorimetry during 30 minutes of StS and DyS. Exercise test to evaluate StS was performed in a standing frame and to evaluate DyS using an Innowalk (Made for movement, Norway). An airtight mask covering the mouth and nose was worn in order to measure breath-by-breath VO_2 , VCO_2 and VE (Oxycon Mobile, Jaeger, Germany). Heart rate was recorded continuously throughout the test (Polar T1, Polar, Finland). As many of the variables were linearly correlated, we used robust Principal Component Analysis (rPCA) to determine the components carrying most information. A multidimensional Shapiro-Wilk test indicates that the data can be well described as being multivariate normal distributed, allowing the use of a Hotelling T^2 test.

RESULTS: In a multidimensional statistical analysis of metabolic exercise effects, oxygen consumption, carbon dioxide production, and ventilation were concluded to carry most information and additionally, seen to be statistical different between StS and DyS revealing a p-value for the two groups having different means of $4.6 \cdot 10^{-3}$.

CONCLUSIONS: A highly statically significant difference was found in the metabolic adaptation, described as VO_2 , VCO_2 and VE, to StS versus DyS.

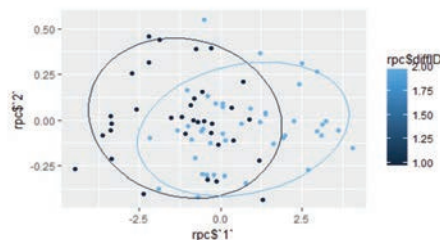


Figure. Shows the two most relevant components (rpc1 and rpc2), computed using Robust PCA (RPCA). The dark points are the differences of the second and first measurement for StS, the lighter points are the same difference for DyS. A multidimensional Shapiro-Wilk test was used to define the 95 % confidence level ellipses to be drawn.

1355 Board #117 May 30 9:30 AM - 11:00 AM

Effects of Inpatient Multicomponent Occupational Rehabilitation on Physical Activity Levels

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PURPOSE: To assess whether inpatient multicomponent occupational rehabilitation, including physical activity (PA), increases the PA level of participants more than an outpatient program without PA, and whether changes in PA are associated with future work outcomes. **METHODS:** 265 participants were included in one of two randomized clinical trials. Participants had been sick listed 2 to 12 months with a musculoskeletal, psychological or general/unspecified diagnosis. We measured PA by questionnaires at the start of the programs, and at 3, 6 and 12 months of follow-up. Between-group differences in PA were assessed using linear mixed models. Associations between change in PA and future work outcomes were assessed by logistic and linear regression. **RESULTS:** There was no difference in change in PA between the inpatient and outpatient programs during 12 months of follow-up. We did not find any associations between the amount of PA and future work outcomes. However, intensity of PA was positively associated with return to work (RTW); participants reporting

increased vigorous PA had an odds ratio (OR) for RTW of 4.1 (95% confidence interval [CI] 1.1 to 15.7) whereas participants reporting consistently high intensity of PA had an OR of 3.1 (95% CI 1.0 to 9.7), compared to participants reporting low intensity PA. **CONCLUSION:** Inpatient occupational rehabilitation, including PA, did not increase PA-level in the follow up period more than a less comprehensive program without PA. The amount of PA was not associated with future work outcomes. However, vigorous PA showed a positive association with RTW.

1356 Board #118 May 30 9:30 AM - 11:00 AM

Sedentary And Physical Activity Patterns In Adults With Intellectual Disability

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Introduction: Adults with intellectual disabilities (ID) present higher health risks due to their extremely low physical activity (PA) levels. It is important to enhance our knowledge about PA levels and sedentary time (ST) among this specific population.

Purpose: This study describes and compares PA levels and ST of active (AG) and a non-active (NAG) groups of adults with ID versus a group of adults without ID (AWID).

Method: Thirty-seven participants from an AG with ID, 29 participants from a NAG with ID and 31 adults AWID participated in this study. An informed consent and a health screening questionnaire were completed by each participant and each legal guardian. Height and weight were obtained to calculate BMI. PA and ST levels were assessed with ActiGraph accelerometers for 7 consecutive days. A chi-square test of independence was performed to examine the relation between groups and ID levels. Variables of age and anthropometry were analyzed by using a one-way analysis of variance (ANOVA). Total PA and PA levels of each group were compared by using a one-way analysis of covariance (ANCOVA).

Results: The AG performed higher values of moderate to vigorous PA compared to the NAG ($p = 0.018$), but, similar to the group of AWID. The group of AWID spent less time in ST and more time in light PA than both groups of adults with ID (all $p < 0.001$). The participants of the AG did not demonstrate less ST than the NAG.

Conclusion: When assessing PA levels in ID participants, it was observed that participants presented large amounts of sedentary behaviors in both groups. The participants of the AG, despite participating in PA programmes did not demonstrate less ST. We believe that, by including well designed and structured PA programmes into their workdays, as well as incorporating breaks to reduce bouts in ST and total ST, could be of great help to increase daily PA levels in adults with ID. **Partially supported by:** MEC (DEP2017-86862-C2-1-R)

Table 1
Participants' characteristics, anthropometry indices and PA data.

Variables	Adults without ID (n = 31)	Active Group w/ ID (n = 37)	Non-Active Group w/ID (n = 29)	p-value
	Mean (SD)	Mean (SD)	Mean (SD)	
Characteristics				
Age (years)	43 (11)	41 (11)	46 (12)	.196
Gender (male/female)	14/17	22/15	17/12	
Level of ID				
Mild	--	11	7	.613
Moderate	--	26	22	
Anthropometry				
Height (cm)*	167.90 (7.79)	160.43 (10.87)	162.03 (9.30)	.017
Weight (kg)	73.64 (12.04)	70.07 (13.55)	74.24 (12.52)	.350
BMI (kg/m ²)	26.08 (3.71)	27.38 (5.00)	28.56 (6.35)	.174
PA data[†]				
Total PA (counts•min ⁻¹)*, **	316.86 (78.71)	306.86 (85.71)	236.54 (107.90)	.002
ST (mins•day ⁻¹)*, **	513.71 (81.88)	614.98 (106.77)	615.04 (80.57)	<.001
LPA (mins•day ⁻¹)*, **	252.39 (69.78)	117.37 (39.57)	136.69 (49.92)	<.001
MPA (mins•day ⁻¹)*, **	33.92 (17.35)	37.48 (26.29)	25.26 (19.87)	.069
VPA (mins•day ⁻¹)*, **	0.69 (1.08)	1.24 (0.99)	0.67 (0.45)	.044
MVPA (mins•day ⁻¹)*, **	34.61 (17.08)	38.72 (26.64)	25.95 (20.58)	.059
Sedentary bouts >1 min*, **	99.76 (43.64)	123.34 (20.13)	124.69 (20.79)	.022
Sedentary Breaks/ Sedentary Hour	11.26 (2.16)	11.64 (1.80)	12.37 (2.15)	.206
Accelerometer wearing time (mins•day ⁻¹)	800.72 (76.14)	771.08 (111.52)	777.68 (73.10)	.416

Note: values are means (Standard Deviation).

Abbreviations: ID (intellectual disability); BMI (body mass index); PA (physical activity); ST (sedentary time); LPA (light physical activity); MPA (moderate physical activity); VPA (vigorous physical activity); MVPA (moderate to vigorous physical activity).

[†] n = 35 for active group w/ID; n = 28 for non-active group w/ID.

Statistically significant values are showed in bold ($p \leq .05$).

* Significant difference ($p \leq .05$) between adults without ID vs Active Group w/ID.

** Significant difference ($p \leq .05$) between adults without ID vs Non-Active Group w/ID.

*** Significant difference ($p \leq .05$) between Active Group w/ID vs Non-Active Group w/ID.

1357 Board #119 May 30 9:30 AM - 11:00 AM

The Fitness Effects Of A School-based Exercise Program On Children With Autism.

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(No relevant relationships reported)

PURPOSE: To examine the effects of a school-based exercise program on the fitness level of elementary school children who attend an autism class.

METHODS: A total of 35 (7.66 years \pm 2.1) children with a diagnosis of autism were recruited for this study. Prior to and on completion of the exercise intervention the fitness levels of the children was assessed using the Modified Eurofit Physical Fitness Battery, including a 20m Sprint, Stork Balance test, Standing Broad Jump, Sit & Reach and a Hand Grip Strength Test. The exercise program was 8 weeks duration, with

the children partaking in 3, 1-hour supervised sessions per week. The intervention was comprised of push and pull upper and lower body exercises and incorporated fundamental movement skills. These movements were achieved through games aimed at the interests of the children and were adapted to each child's specific needs through the use of visual aids using an iPad. The data were analysed using paired t-tested.

RESULTS: All variables except Hand Grip strength significantly improved ($p < 0.05$) over the eight-week period. 20m sprint times improved ($p < 0.05$) by $0.46s \pm 1.36$. The Stork balance test significantly improved ($p < 0.05$) by $17.82s \pm 38.86$. The standing broad jump significantly increased ($p < 0.05$) by $14.54cm \pm 20.29$. The Sit and Reach score significantly increased ($p < 0.05$) by $3.05cm \pm 4.51$. No significant ($p > 0.05$) change was noted in the Hand Grip strength which increased by $0.38psi \pm 1.38$.

CONCLUSIONS: These preliminary findings indicate that an 8-week school-based exercise intervention can significantly improve selected fitness variables in children with autism.

1358 Board #120 May 30 9:30 AM - 11:00 AM

The Examination of Judo on Physical Activity and Sleep in Children with Autism Spectrum Disorder

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(No relevant relationships reported)

PURPOSE: The aim of this study was to examine the effects of an 8-week judo program on moderate-to-vigorous physical activity (MVPA), sedentary behavior (SB), and sleep quality in children with Autism Spectrum Disorder (ASD).

METHODS: Participants included 15 children (ages 8-17, with a formal diagnosis of ASD). The sample participated in an 8-week judo program (45 minutes, 1X week), with measures taken at baseline and at the end of the 8-weeks. In order to assess activity levels and sleep quality, participants were instructed to wear Actigraph GT9X Accelerometers for 7 days and nights, only removing the device during water-based activities. Non-parametric paired t-tests were conducted to compare differences in MVPA, SB, and sleep quality (i.e. sleep efficiency, total sleep time, number of awakenings, and wake after sleep onset) pre and post judo. Chi-square tests compared the number of participants who met sleep and MVPA recommendations.

RESULTS: Results indicate participants spent a significantly greater percentage of time in daily MVPA (8% vs 4%, $p=0.05$) following the program, however, actual MVPA minutes per day did not reach statistical significance (74.46 vs. 48.58 minutes per day, $p=0.1$). There was a significant increase in total sleep duration (572.56 vs 333.8, $p=0.008$) following the program, and although not statistically significant, a trend existed for improved sleep efficiency (92% vs 88%, $p=0.1$). There was an increase in the number of participants meeting MVPA (53% vs 27%) and sleep recommendations (40% vs 7%), although results were not statistically significant.

CONCLUSIONS: Improvements in MVPA and sleep quality were observed following the 8-week judo program, although statistically significant findings were limited due to the small sample size. Future studies should include larger samples of youth with ASD, over a longer intervention period.

1359 Board #121 May 30 9:30 AM - 11:00 AM

A Community-based Running Program Enhances Gait Parameters in Children and Young Adults with Developmental Disabilities

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(No relevant relationships reported)

PURPOSE: This study aimed to substantiate the efficacy of a voluntary 10-week running program for children and young adults with developmental disabilities. We hypothesized that the running intervention would positively influence temporal-spatial parameters (TSPs) of gait. **METHODS:** Sixteen children and young adults with developmental disabilities, ages 7-24 years ($M=15.3 \pm 4.4$ years) enrolled in a "Sit to Fit" training program. Participants engaged in group running practices in an outdoor community setting, twice weekly for 10 weeks. Training sessions followed a time-based progression of walk-run intervals with a gradual increase (~15%) in total run time each week. At the conclusion of the training, all participants completed a 5K race. TSPs of gait were measured one month prior to program start and repeated within one month of program conclusion, using the GAITRite Portable Walkway System (CIR Systems Inc. Clifton, NJ). Participants completed the Six Minute Walk Test at a self-selected speed on a walking loop that included the GAITRite mat. Each participant walked across the mat 6-10 times. TSPs were averaged across all trials for each visit. Analysis included cadence (steps/minute), normalized walking velocity (leg length/second), stride length (cm), and step width (cm). Descriptive statistics, effect size (mean change score/mean standard deviation), and a two-tailed paired t-test for each TSP were computed. **RESULTS:** Cadence (mean difference 7.25 steps/min, $p < 0.05$), walking velocity (mean difference 0.14 leg length/sec, $p < 0.05$), and stride

length (mean difference 8.16 cm, $p < 0.05$) increased significantly following the 10-week training period. We calculated a moderate effect size for stride length ($d = 0.50$), small to moderate effect sizes for cadence ($d = 0.38$) and walking velocity ($d = 0.26$), and negligible effect size for step width ($d = 0.06$). **CONCLUSION:** A community-based running program contributed to improved gait mechanics in a cohort of children with mobility impairments. Others have shown that walking ability gains are associated with improved bipedal gross motor skills like running. The results of this study indicate that the reverse may also be true: running was associated with gains in walking ability in children and young adults with developmental disabilities.

1360 Board #122 May 30 9:30 AM - 11:00 AM
Flourishing and Physical Activity in Adolescents With and Without Autism Spectrum Disorder

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 (No relevant relationships reported)

Autism spectrum disorder (ASD) is characterized by behaviors that can negatively affect daily life. However, little is known about the effects of physical activity (PA) participation on measures of flourishing (i.e. resilience in functioning) as well as excessive arguing and behavioral conduct problems in those with ASD vs. typically developing (TD) youth. **PURPOSE:** To compare measures of flourishing, excessive arguing, and behavioral conduct problems in youth with ASD compared to TD peers and determine if physical activity participation mediates these differences. **METHODS:** Analyses included 22,873 youth (51% male) aged 10 to 17 years (mean 13.8 ± 2.3 yrs) from the 2016 National Survey of Children's Health. Youth were grouped into those with ASD ($n = 656$), and TD ($n = 22,217$). Outcome variables included measures of flourishing (finishing tasks, staying calm, showing interest in new things), excessive arguing, and behavioral conduct problems. Logistic regression models, adjusted for age, race, gender, SES, ASD severity, and medication assessed the odds of each outcome comparing ASD to TD. Further analyses examined whether participation in PA (≥ 4 d/wk) mediated the relationships between ASD and outcome variables. **RESULTS:** Within youth with ASD, only 31% engaged in regular PA (≥ 4 d/wk) vs. 51% of TD youth. In adjusted models, those with ASD were 58% less likely to finish tasks ($OR = 0.42$; $p < 0.001$), and 65% less likely to stay calm when faced with a challenge ($OR = 0.35$; $p = 0.009$) compared to TD youth. Additionally, those with ASD were 3.48 times more likely to argue excessively ($OR = 2.98$; $p < 0.001$), and 5.54 times more likely to experience behavioral conduct problems ($OR = 5.54$; $p < 0.001$) compared to TD youth. After adjustment for PA, relationships were slightly attenuated for flourishing ($OR = 0.46$, $p = 0.001$; $OR = 0.38$, $p = 0.014$), excessive arguing ($OR = 2.80$; $p < 0.001$), and behavioral conduct problems ($OR = 5.10$; $p < 0.001$). ASD was not associated with showing interest in learning new things. **CONCLUSIONS:** Those with ASD were significantly less likely to flourish, and more likely to experience behavioral conduct problems and argue excessively compared to TD youth. However, PA attenuated these relationships. These findings suggest that regular PA may increase positive flourishing behaviors and decrease negative behaviors.

1361 Board #123 May 30 9:30 AM - 11:00 AM
Age-related Changes In Para-athletics And Racing Wheelchair Performance

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 (No relevant relationships reported)

PURPOSE: How aging affects para-athletics performance? During the last decades, following the motto "Citius, Altius, Fortius", all the para-athletic categories have significantly increased their performance levels. Such an improvement is not only reached by highly optimized prosthetics, but also by a gradual improvement on training, of nutrition, and recovery methods. Few studies have investigated the performance determinants in para-athletics. We studied the effect of age on maximal performances for racing wheelchair- and para-athletes. **METHODS:** We collected data on the 53,554 results from previous international competitions between 2009 and 2017 for women and men para-athletics and racing wheelchair disciplines for a total of 472 sport disciplines (considering impairment types for each discipline). We fitted maximal performance by age through the validated Moore equation for each para-athletics and racing wheelchair disciplines. **RESULTS:** We found a similar age-related pattern in maximal performance between able-bodied, para-athletes and wheelchair athletes. However, the age of peak performance varies according to sex, impairment type and discipline. The top 100 best performances include a large age range (from 15 years to 55 years) in each discipline suggesting that performance haven't probably been optimized yet for most elite racing wheelchair and para-athletes. Maximal performance differences appear for running disciplines between the two categories: in sprinting disciplines para-athletes are faster than wheelchair athletes. To the contrary, para-athletes are slower than wheelchair athletes in endurance discipline, and the difference increases with distance **CONCLUSIONS:** Data reveal that only a few

disabilities classes contributed to the maximal performance both in para-athletes and racing wheelchair discipline. Further studies will contribute to increase knowledge about age-related changes in para-athletes and racing wheelchair athletes.

1362 Board #124 May 30 9:30 AM - 11:00 AM
Comparison Of Physical Activity Levels During Therapeutic Camp Activities In Youth With Disabilities

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Youth with disabilities have limited opportunities to engage in leisure time physical activity (PA). Outdoor therapeutic recreation (TR) camps provide diverse PA opportunities that include structured (dramatic, functional, game, constructive) and unstructured (free time) activities that have the potential to benefit these individuals cognitively and physically. However, little is known about the PA levels during these activities. **Purpose:** To compare the PA levels of youth attending an outdoor TR camp, across various activity contexts. **Methods:** Youth ($n = 25$; 14.6 ± 3.9 y) with disabilities attending an overnight TR camp, participated in the study. PA was assessed using ActiGraph GT3X or GT3X+ accelerometers worn on the wrist during camp activities. Participants engaged in 14 activities of varying contexts based on the primary skill addressed, creating five distinct areas. Gross/Functional activity involves simple motor activities (e.g., yoga, ropes course). Game play is activity that involves set rules (e.g., sports, games). Dramatic play includes pretend play (e.g., theatre, team building activities). Fine/constructive play involves manipulation of objects for creative purposes (e.g., science experiments, cooking). During free time, the youth choose their activities (e.g., playground activity, hang out in cabin). The mean vector magnitude [VM; counts per minute (counts·min⁻¹)] of individual activities was used to calculate the PA level of each area. One-way ANOVAs were used to determine differences in VM for each area as well among individual activities within an area. **Results:** There were no differences ($p = .999$) in the mean VM for any area: Gross/Functional (2601.4 ± 1648.9 counts·min⁻¹), Game (2599.3 ± 1551.9 counts·min⁻¹), Drama (2569.3 ± 1420.9 counts·min⁻¹), Fine/Constructive (2601.3 ± 1552.29 counts·min⁻¹), and Free Time (2557.9 ± 1398.8 counts·min⁻¹). Additionally, there were no differences ($p = .999$) among activities within each domain. **Conclusion:** The results revealed a consistent level of PA across all areas of activity. These findings suggest the activities offered in this outdoor TR program provide an opportunity for youth with disabilities to accumulate PA that may also benefit them cognitively and physically.

1363 Board #125 May 30 9:30 AM - 11:00 AM
Recreational Ballroom Dance and Multiple Sclerosis

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 (No relevant relationships reported)

Multiple Sclerosis (MS) symptoms include fatigue, pain, spasticity, sensory changes, motor dysfunctions, postural instability, sexual and bladder dysfunctions, as well as cognitive impairments and depression. Despite the known benefits of exercise in mitigating symptoms in persons with MS, adherence to physical activity recommendations is low and often MS patients are sedentary. Recreational ballroom dancing is a fun form of exercise, or physical activity, in which partners can support each other while learning basic to more complex dance steps. **PURPOSE:** This study investigated the physical and psychological changes perceived by persons with MS who participated in a novel structured ballroom dance intervention. A secondary purpose was to gather suggested improvements for the intervention with the aim of promoting physical activity among persons with MS. **METHODS:** Community-dwelling persons with MS ($n = 13$) participated in a ballroom dance pilot intervention which met twice/week for 8 weeks. Dances included rumba, foxtrot, waltz, salsa, swing, and tango. One week after program completion, participants were invited to one-hour focus group sessions. The focus groups were audiotaped and transcribed verbatim. Thematic analysis was completed using NVivo qualitative analysis software. **RESULTS:** Four major themes emerged, which identified several benefits of ballroom dance among participants: (1) Physical and Psychological Benefits: Ballroom dance improved their perceived symptoms including improved strength, endurance, coordination, and balance, along with less fatigue and depression; (2) Positive Social Support: Ballroom dance provided positive social support and was a fun date night activity with their partners; (3) Improved Confidence: The dance intervention built confidence in future exercise and lifestyle change; and (4) Barriers to Exercise Removed: Ballroom dancing removed barriers for exercise specific to MS patients. Participants noted difficulty with classes late in day and at inconvenient locations. **CONCLUSIONS:** Recreational ballroom dancing was well-tolerated and

was perceived to be beneficial for promoting positive physical and psychological changes in people with MS. Future interventions could be improved regarding times and locations.

C-36 Free Communication/Poster - Physical Activity Assessment and Measurement Methods

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1364 Board #126 May 30 9:30 AM - 11:00 AM Accelerometer-Based Activity Classification Algorithm for Toddlers: Machine Learning Approach

Soyang Kwon¹, Pinky Sindu², Katherine Nickle¹, Patricia Zavos¹, Albert Sugianto², Mark V. Albert². ¹Ann & Robert H. Lurie Children's Hospital of Chicago, Chicago, IL. ²Loyola University Chicago, Chicago, IL.
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(No relevant relationships reported)

PURPOSE: To develop activity classifiers based on accelerometer data to recognize toddler's eight distinct activities: walking/running, climbing up/down, standing, crawling, sitting, lying down, being carried, and riding a stroller/wagon.

METHODS: Twenty-four toddlers aged 13 to 35 months (50% girls) performed various prescribed activities during free play in a commercial indoor playroom, while wearing Actigraph wGT3X-BT accelerometers on the hip and wrist. Their activities were video recorded. The video data were annotated and synchronized with accelerometer data. Five machine learning classifiers, including random forest, support vector machine, decision tree, K-nearest neighbors, and logistic regression, were trained and tested. Classifier performance was evaluated using subject-wise cross-validation.

RESULTS: Activity classifiers were developed based on 1,011 two-second window accelerometer signal clips from the 24 participants. Of the five classifiers tested, the random forest classifier presented the highest overall accuracy (69% for hip and 55% for wrist). Overall, hip data showed higher accuracy than wrist data. Based on the hip random forest classifier, 91% of "walking/running" activities and 84% of "sitting" activities were correctly identified. However, 35% of "being carried" activities and 30% of "standing still" activities were misclassified as "walking/running". Only 8% of "stroller/wagon ride" activities were misclassified as "walking/running".

CONCLUSIONS: This pilot study demonstrates that the machine learning approach can be used to detect toddler's "walking/running" activities at a high level of sensitivity. However, the algorithm developed in this pilot study often misclassified "standing still" or "being carried" as "walking/running". "Stroller/wagon ride" was less frequently misclassified as "walking/running". Overall, hip data demonstrated higher accuracy than wrist data in detecting key activities for toddlers. Future research should follow to refine the algorithms and test external validity.

1365 Board #127 May 30 9:30 AM - 11:00 AM Thresholds of Sedentary Behavior in Children Based on Various Measures

Ying Gao, Eero A. Haapala, Anssi Vanhala, Martti Melin, Arja Sääkslahti, Merja Rantakokko, Arto Laukkanen, Arto J. Pesola, Timo Rantalainen, Taija Finni. University of Jyväskylä, Jyväskylä, Finland.
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(No relevant relationships reported)

PURPOSE: To investigate the classification accuracy of estimates of energy expenditure (EE), accelerometry (ACC), muscle EMG, and heart rate (HR) for sedentary and non-sedentary activities in children. The agreement of directly measured value of metabolic equivalent of task (MET) with commonly used adult MET value was assessed.

METHODS: $\dot{V}O_2$, HR, triaxial ACC and thigh muscle EMG were simultaneously recorded from 35 healthy 7-12 year-old children, who performed 3 pre-determined sedentary and 5 non-sedentary tasks in a random order. Mean values of the concurrent 2 minutes epochs from the measures for each activity were analyzed. Resting EE (REE) was determined during 30 minutes rest in supine position. Adult-estimated MET (METa), $\dot{V}O_{2\text{ tasks}} / \dot{V}O_{2\text{ estimated for adult}}$ in 3.5ml/kg/min and REE-based measured MET (METr), $\dot{V}O_{2\text{ tasks}} / \dot{V}O_{2\text{ REE}}$ were calculated. Mean amplitude deviation (MAD) was computed for ACC and EMG was normalized to mean muscle activity during self-paced walking. The classification accuracy of METr, METa, HR, ACC and EMG for SB was investigated by receiver operating characteristic (ROC) curves, the area under

the ROC curve (AUC) with (95% confidence interval (CI) and optimal cut-points with sensitivity (Se) and specificity (Sp) for METr, METa, HR, ACC, and EMG were computed.

RESULTS: METa was 28.5% lower than METr in any activity ($p < 0.001$). Measured REE in children was 5.0 ± 0.8 ml/kg/min. Figure 1 shows the ROC curves with AUC and its 95%CI for METr, METa, HR, MAD and EMG. The optimal cut-points for SB was 1.3 for METr (Se=80% Sp=80%), 1.9 for METa (Se=80% Sp=82%), 104 beats/min for HR (Se=78% Sp=82%), 0.003g for MAD (Se=83% Sp=89%) and 13% for EMG (Se=81% Sp=94%).

CONCLUSIONS: The SB threshold based on adult METs (≤ 1.5 METs) did not appear to be appropriate for children. All of the used indicators had reasonable classification accuracy with appropriate sensitivity and specificity for sedentary and non-sedentary activities in children.

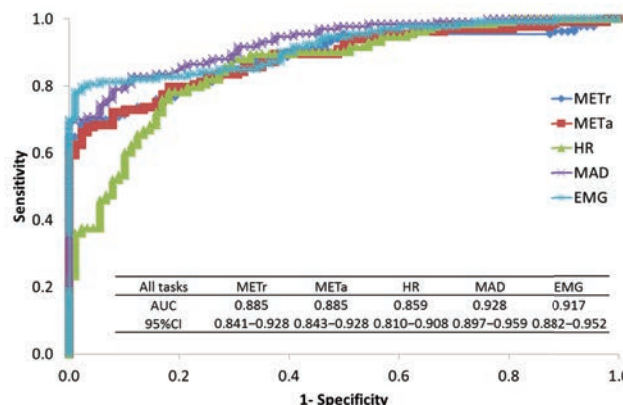


Figure 1. Receiver operator characteristic curves for classifying of "sedentary" and "non-sedentary" activities among METr, METa, HR, MAD and EMG. The tasks included lying down, sitting quietly, sitting while playing mobile game, standing quietly, standing while playing mobile game, walking on a treadmill at 4km/h and 6km/h, and walking over ground.

Funding OKM/59/626/2016.

1366 Board #128 May 30 9:30 AM - 11:00 AM Associations Among School Day Sedentary Behavior, Physical Activity, and Motor Skills: A Compositional Data Analysis

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(No relevant relationships reported)

PURPOSE: A novel analytic approach, Compositional Data Analysis (CoDa), has recently been used to analyze physical activity data. CoDa assumes co-dependence among physical activity compositional parts within a time-constrained data analytic framework, which makes it appropriate for assessing and analyzing physical activity behavior during school hours. The purpose of this study was to examine the relationships among school day sedentary times (SED), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) with gross motor skills in children using Compositional Data Analysis (CoDa). **METHODS:** Participants were 409 children (Mean age = 8.4 ± 1.8 years) recruited across five low-income schools. Gross Motor Skills were assessed using the Test of Gross Motor Development - 3rd Edition (TGMD-3) and physical activity was assessed using accelerometers. Isometric Log Ratio coordinates (ILRs) were calculated quantifying the relative proportion of percent of the school day (%) spent in SED, LPA, and MVPA. The associations of the ILRs with the TGMD-3 scores were estimated using general linear mixed effects models adjusted for age, BMI, and estimated $\dot{V}O_{2\text{Peak}}$. **RESULTS:** A higher proportion of the school day spent in %MVPA relative to %SED and %LPA significantly associated with higher TGMD-3 total scores ($\gamma\text{MVPA} = 14.44$, $P = 0.012$). This relationship was also observed for the ball skills subtest scores ($\gamma\text{MVPA} = 16.12$, $P = 0.003$). A 5% reallocation in % of time spent in SED and LPA to MVPA was independently associated with a 0.48 and 1.74-point increase in ball skills scores, respectively, after controlling for the potential confounders of age, BMI, and estimated $\dot{V}O_{2\text{Peak}}$. **CONCLUSIONS:** Replacing %SED and %LPA with %MVPA during school hours may be an effective strategy for improving gross motor skills, specifically ball skills, in low-income elementary school-aged children.

1367 Board #129 May 30 9:30 AM - 11:00 AM

Validity Of Objectively-measured And Self-reported Sedentary Behavior Across Three Trimesters Of PregnancyBethany Barone Gibbs¹, Melissa A. Jones¹, Joshua L. Paley¹, Kara M. Whitaker², Christopher P. Connolly³, Janet M. Catov¹.¹University of Pittsburgh, Pittsburgh, PA. ²University of Iowa, Iowa City, IA. ³Washington State University, Pullman, WA.

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(No relevant relationships reported)

PURPOSE: Sedentary behavior (SED), low intensity behavior in a seated, reclining, or lying posture, is a potential risk factor for poor pregnancy outcomes. We evaluated the validity of commonly used methods to assess SED across three trimesters of pregnancy. **METHODS:** This cohort study of pregnant women measured objective and self-reported SED during each trimester including: 7 days (valid if ≥ 4 days with ≥ 10 hr) of thigh-worn activPAL micro3 (criterion) and waist-worn Actigraph GT3X and self-report from the Global Physical Activity Questionnaire (GPAQ; modified SED question in hr/day and relative Likert scale) and the Pregnancy Physical Activity Questionnaire (PPAQ; SED subscale, hr/day only). SED hr/day and percent time in SED (SED%) from activPAL were compared to GT3X, GPAQ, and PPAQ using paired t-tests and Pearson's r . Correlations were rated as: <0.5 poor; $0.5-0.69$ moderate, $0.7-0.89$ good, and ≥ 0.9 excellent. **RESULTS:** Fifty-eight women (mean age 32 ± 5 yr; pre-pregnancy BMI 25 ± 6 kg/m²; 76% white) provided three trimesters of valid activPAL data. Compared to activPAL, GT3X SED was similar in the 1st and 2nd trimester, slightly lower in the 3rd ($p=0.03$), and moderately correlated (Table). Self-reported SED was systematically lower by GPAQ and higher by PPAQ (all $p<0.001$); correlations with activPAL were poor-to-moderate (GPAQ) or poor (PPAQ). SED% was slightly higher by GT3X vs. activPAL in the 1st trimester ($p=0.04$), but otherwise similar, with moderate correlations throughout pregnancy. GPAQ (Likert) underestimated %SED ($p<0.01$) from activPAL in the 1st and 2nd trimesters, but not the 3rd, and had poor-to-moderate correlations. **CONCLUSIONS:** Compared to activPAL, waist-worn GT3X resulted in only moderate correlations with SED and SED% across pregnancy, though differences in mean estimates were minimal. Self-report questionnaires had large absolute error and were poorly correlated to SED hr/day during pregnancy; GPAQ SED% was the best self-report method.

Table. Sedentary behavior (SED) in hr/day, percent time in SED (SED%), and correlations (r) between activPAL and GT3X, the Global Physical Activity Questionnaire (GPAQ), and the Pregnancy Physical Activity Questionnaire (PPAQ)

	1 st Trimester (<14 weeks)		2 nd Trimester (20-22 weeks)		3 rd Trimester (32-34 weeks)	
	mean (SD)	r	mean (SD)	r	mean (SD)	r
SED hr/day						
activPAL3	9.66 (1.55)	-	9.50 (1.23)	-	9.46 (1.26)	-
GT3X	9.50 (1.38)	0.62***	9.08 (1.39)	0.58***	9.08 (1.28)*	0.54***
GPAQ	5.80 (0.30)***	0.50***	5.87 (0.33)***	0.27*	6.08 (0.41)***	0.36**
PPAQ	12.25(0.65)***	0.37**	13.2 (0.63)***	0.27	11.87 (0.57)***	0.24
SED%						
activPAL3	0.64 (0.10)	-	0.63 (0.09)	-	0.63 (0.09)	-
GT3X	0.66 (0.08)*	0.66***	0.64 (0.08)	0.64***	0.64 (0.08)	0.66***
GPAQ - Likert	0.57(0.21)**	0.44***	0.55 (0.25)**	0.52***	0.60 (0.21)	0.45***
PPAQ	n/a		n/a		n/a	

* $p<0.05$; ** $p<0.01$ *** $p<0.001$

participants averaged 56.62 ± 31.1 min/day in MVPA. An average $42.12 \pm 25.25\%$ of this time was spent dog walking. Of time spent dog walking, $65.19 \pm 26\%$ was MVPA. There was no significant difference in % of MVPA min/day attributable to dog walking or % of dog walking in MVPA based on dog age or size ($p \geq 0.4$). Combined ActiGraph and self-report data provides context for participants' PA, and further insight for investigation (Figure 1). **CONCLUSION:** The sample demonstrated large variability, with some participants accumulating almost all MVPA from dog walking, and others accumulating little or none. Two-thirds of dog walking minutes were MVPA, but also varied by individual. Variations were not explained by dog size or age. Given the prevalence of dog ownership in America, further investigation into how dog ownership affects PA is warranted.

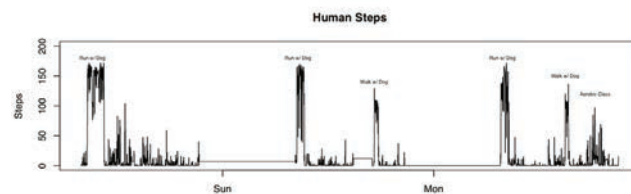


Figure 1. Combined ActiGraph and self-reported data of sample participant.

1369 Board #131 May 30 9:30 AM - 11:00 AM
Unidimensionality and Internal Consistency Reliability of Step Counts and Floors Climbed in 4th-5th Grade Students

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(No relevant relationships reported)

PURPOSE: To determine if weekday and weekend days step counts and floors climbed are unidimensional and internally consistent indicators of physical activity 4th- and 5th-grade students.

METHODS: Students in 4th and 5th grade ($n = 83$, age [$mean \pm SD$]: 10.1 ± 0.6 years) at two Title I schools participated in a 12-week after-school program focused on nutrition, cooking skills, and physical activity. At the beginning (T1) and end (T2) of the program the students wore commercial activity trackers for six days, including two weekend days. Unidimensionality and internal consistency reliability (Cronbach's coefficient α) of the six daily step counts (ST) and floors climbed (FL) values were analyzed at T1 and T2. Days with ST < 500 were excluded. Complete ST data was available for 67 (T1) and 68 (T2) students and complete FL data was available for 41 students at both T1 and T2. Principal axis factoring (initial, unrotated solution) was used to confirm unidimensionality.

RESULTS: Both ST and FL at T1 and T2 were unidimensional based on visual inspection of the scree plots (Figure 1) and interpretability of the factors. Variance explained by the first factor was 32.9% (T1) and 42.0% (T2) for ST and 30.2% (T1) and 31.5% (T2) for FL, respectively. Coefficient α was 0.74 (T1) and 0.80 (T2) for ST and 0.69 (T1) and 0.68 (T2) for FL. **CONCLUSIONS:** In this sample of 4th-5th grade students step counts and floors climbed are unidimensional indicators of physical activity. Step counts across six days are a reliable indicator of physical activity in 4th and 5th grade students, but the lower reliability of floors climbed suggests these data should be interpreted with caution.

1368 Board #130 May 30 9:30 AM - 11:00 AM

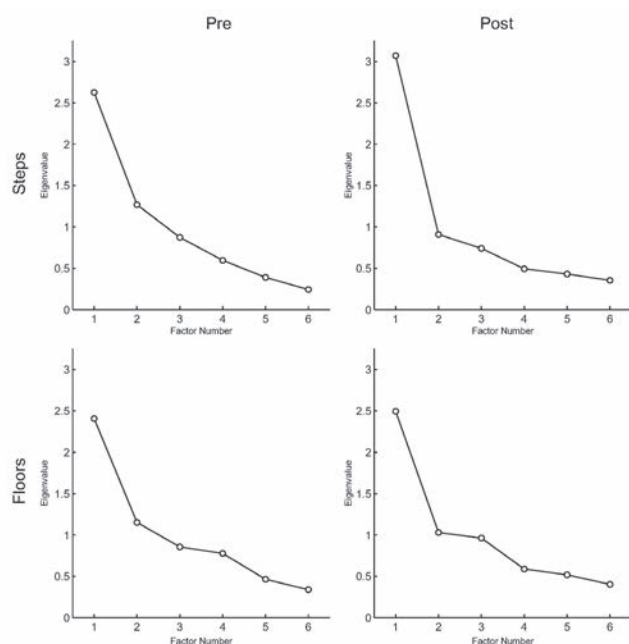
Dog Walking Intensity And Its Contribution To Owners' Total Moderate-to-vigorous Physical Activity

Caitlin Rajala, Robert T. Marcotte, Greg J. Petrucci, Jr., Connor Saleeba, Katie Becofsky Potter. University of Massachusetts, Amherst, MA.

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(No relevant relationships reported)

Approximately half of American households own a dog, and dog ownership is associated with higher levels of physical activity (PA). These increased PA levels are assumed to be dog-related, but there is limited scientific evidence to support this assumption. Though dog walking is classified as moderate intensity PA (3 METS) in the PA compendium, few studies have used objective PA measures to track intensity during dog walking bouts. **PURPOSE:** To 1) determine the % of daily accelerometer-estimated moderate-to-vigorous PA (MVPA) minutes that are accumulated during self-reported dog walking bouts, and 2) quantify the % of dog walking minutes that qualify as MVPA. **METHODS:** Thirty-three healthy dog owners (30 female; BMI 27.2 ± 5.3 ; age 45.2 ± 15.3) wore an ActiGraph GT3X+ accelerometer on their right hip for 7 days. Dogs were a mean age of 5.85 ± 3.7 (size: 11 small, 12 medium, 9 large). Participants were asked to maintain their normal routine, log leisure-time activity with and without their dog, and ActiGraph on/off periods. T-tests were used to compare differences in MVPA for dog age (<7 vs. >7) and size (med/large vs. small). **RESULTS:** Thirty-three



1370 Board #132 May 30 9:30 AM - 11:00 AM

Sleep Like a Baby: A Case Study Examining Objectively-Measured Newborn and Parental Sleep Patterns

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(No relevant relationships reported)

PURPOSE: To determine sleep patterns of a newborn and his parents during the first months following birth.

METHODS: A family expecting a child in May 2018 agreed to be in the study. Both parents wore a wrist-worn sleep tracking device (GA) on their non-dominant wrist while sleeping at night. The newborn was fitted with a calf-worn sleep tracking device (SP), which was fitted just before the final feeding prior to bed time. The GA recorded sleep (total, light, deep) and wake (time, number) data, and the SP recorded sleep (total, stirring) and wake (time, number) data during the night. Number of feedings during the night were also documented by parents. Sleep tracking started on the second night following the baby's birth and continued for four months. Month-by-month comparisons of sleep variables were compared using repeated-measures ANOVA. Additionally, comparisons of parents' sleep patterns to a control condition (four months of GA data) a year previously was conducted using paired-samples t-tests. **RESULTS:** Newborn's total sleep time increased progressively by month (month 1: 338.4 vs. month 4: 445.4 minutes/night) and number of feedings decreased significantly from month 1 (1.9 feedings/night) to months 2-4 (0.3-0.7 feedings/night). Time stirring (5.3-14.1 minutes/night) and time awake (15.2-18.0 minutes/night) were not significantly different among months. For both parents, the first month post-birth resulted in significant differences in wake variables compared to control (mother: +71.8 minutes awake/night, +2.6 awakenings/night; father: +25.7 minutes awake/night, +1.8 awakenings/night). Differences from control persisted for all four months for the mother and non-significantly trended for the father. Sleep variables were not significantly different among months 2-4 for the mother or father. Total sleep time was not different for either parent following birth compared to control, although the mother had significantly more deep sleep (+38.7 to +51.8 minutes/night) and significantly less light sleep (-50.6 to -84.9 minutes/night) during all four months, while the father's were not different from control. **CONCLUSIONS:** The first month following childbirth resulted in substantial changes to newborn and parental sleep patterns, which largely seemed to reach a "new normal" in month 2.

1371 Board #133 May 30 9:30 AM - 11:00 AM

Assessment of Machine Learning Performance for the Detection of Activity Type in Military Training

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(No relevant relationships reported)

Recognition of activities performed during military training may benefit the identification and quantification of factors that may predispose to the high prevalence of injury. There is evidence to suggest that the use of machine learning classifiers along with features from accelerometry data can achieve accurate activity recognition; however, there is no evidence to this application within military activities. **PURPOSE:** To develop and determine the accuracy of decision tree (DT), support vector machine (SVM), k-nearest neighbour (KNN) and ensemble bagged tree (EBT) models to classify military training type activities. **METHODS:** 15 male participants (mean \pm SD: age: 25.9 \pm 3.0 height: 177.9 \pm 6.8cm body mass: 80.9 \pm 8.7 kg) completed three sessions that consisted of performing military activities (walking, running, marching, weighted marching, halt to attention, countermovement jump and sedentary) with a low cost accelerometer (Axivity AX3, UK) mounted on the distal third of the medial tibia. Accelerometer data were segmented into two-second windows with a 50% overlap to introduce activity variance. Raw data along with filtered (butterworth, chebyshev and elliptic) were processed through a variety of features and classifiers (DT, SVM, KNN, EBT). Models were trained (80%) and hold-out validated (20%) using the classification learner within MATLAB (MathWorks Ltd, UK). Accuracy was determined by the percentage of true values during validation. **RESULTS:** 40,207 two second episodes of activities were recognized (1340 minutes). Hold-out validation accuracy for the EBT model and raw data (no improvement through filtering) was 0.96 (95% confidence interval (CI), 0.96- 0.96). Other models demonstrated good validation accuracies [DT - 0.90 (95% CI, 0.88- 0.91), SVM - 0.94 (95% CI, 0.93-0.95) and KNN - 0.91 (95% CI, 0.90-0.92)]. Validation accuracy was moderate to excellent (>80%) for walking and excellent (>90%) for all other activities. **CONCLUSIONS:** All machine learning models (especially EBT) provided excellent classification accuracy with the use of a tibial mounted accelerometer. These low-cost sensors and models thus offer potential for characterising military activity and examining relationships of activity parameters with injury. Supported by EPSRC and Loughborough University Studentship 1814563

1372 Board #134 May 30 9:30 AM - 11:00 AM

Cross-cultural Adaptation and Validation of the Arabic Version of the Rapid Assessment Of Physical Activity

Bader A. Alqahtani, Aqeel M. Alenazi. *Prince Sattam Bin Abdulaziz University, Alkharij, Saudi Arabia.*

(No relevant relationships reported)

Measuring physical activity (PA) is a challenge especially with lack of validated questionnaires for specific populations such as Arabic population. Rapid Assessment Physical Activity (RAPA) is an easy to administer, valid and reliable measure. However, this questionnaire is in English and has not been translated or culturally adapted for Arabic speakers. **PURPOSE:** The aim of the study was to cross-culturally adapt the Rapid Assessment of Physical Activity (RAPA) for Arabic speaking people and examine the test-retest reliability and the construct validity in Saudi older adults. **METHODS:** A total of 46 older adults (67% male, mean age 71 \pm 5 years) were included in this study. The original RAPA was translated into Arabic following standardized guidelines including the following steps: forward translation, synthesis of the translation, backward translation, expert committee and testing the pre-final version. Test-retest reliability was assessed over two testing visits occurring one week apart, and analyzed using weighted Kappa (K). The construct validity between RAPA and Short Physical Performance Battery (SPPB) and Timed Up and Go (TUG) was examined by Spearman's rank correlation coefficient. A weighted K value of > 0.7 for the reliability and a value of greater than or equal to 0.3 for the construct validity were considered acceptable for physical activity measurements. **RESULTS:** Data from the RAPA shows, about 9 (19.6%) of participants were categorized as sedentary, 12 (26%) as underactive, 7 (15%) as regular underactive, 13 (28%) as regular underactive, 5 (11%) as regular active. About half of the subjects (52%) reported that they did not participate in flexibility or strength activities. For the test-retest reliability, the weighted K was 0.87 (95% CI=0.76-0.98), which indicates very good reliability. There was a significant correlation between the Arabic version of RAPA and the SPPB (Spearman ρ = 0.536, P < 0.001), and the TUG test (Spearman ρ = -0.435, P < 0.01). **CONCLUSIONS:** The Arabic version of the Rapid Assessment of Physical Activity questionnaire adapted for Saudi older adults provides an easy, valid and reliable way to measure physical activity. Researchers in Saudi Arabia can use this questionnaire to quickly assess PA levels because of short time required to complete and its suitability to the Saudi culture.

1373 Board #135 May 30 9:30 AM - 11:00 AM

A Comparison of Two Algorithms for Generating ActiLife Equivalent Activity CountsJohn M. Schuna, Jr., *Oregon State University, Corvallis, OR.*
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(No relevant relationships reported)

Previous algorithms have been developed to approximately replicate ActiLife software's activity counts when used with raw acceleration data from physical activity accelerometers.

PURPOSE: To compare a new algorithm based upon two cascaded infinite impulse response filters (ALG1) to an existing algorithm (ALG2; Brond, Andersen, & Arvidsson [2017]) for generating activity counts from raw acceleration data.

METHODS: Sixteen adult participants (19-81 yrs; 56-85 kg) completed a series of simulated free-living activities (e.g., walking, climbing stairs, eating, sitting down, brushing teeth, etc.) while wearing an accelerometer on their right wrist initialized at a sampling frequency of 32 Hz. These activity data are publicly available (<https://archive.ics.uci.edu/ml/machine-learning-databases/00283/>) within the UCI Machine Learning Repository. Activities varied in duration but averaged 155 seconds each. Vector magnitude activity counts/second (cps) were calculated using ALG1, ALG2, and ActiLife for each participant. Equivalence testing (equivalence margin: $\pm 5\%$ error from ActiLife cps) was used to compare mean cps values from ALG1 and ALG2 with those from ActiLife (criterion). Correlations and mean absolute errors for ALG1 and ALG2 with ActiLife cps were also quantified. Correlation magnitudes were compared between algorithms using Meng's z-test.

RESULTS: Mean error (% error from ActiLife [$M = 65.4$ cps]) for ALG1 (1.7%; 99%CI: 0.8 to 2.7%) and ALG2 (-1.0%; 99%CI: -2.2 to -0.2%) was small and indicates both algorithms provided equivalent estimates to those obtained from ActiLife. Correlations for ALG1 ($r = 0.992$) and ALG2 ($r = 0.987$) with ActiLife cps were strong; however, the ALG1 correlation was of a significantly greater magnitude than the ALG2 correlation ($p = 0.025$). Moreover, mean absolute error was smaller for ALG1 (4.9 cps) than for ALG2 (6.4 cps).

CONCLUSION: Mean vector magnitude cps values from ALG1 and ALG2 were comparable to those generated by ActiLife. Estimates from ALG1 appear to be more strongly correlated with ActiLife cps and have smaller absolute errors than ALG2. Additional research is needed to evaluate the performance of each algorithm for generating estimated ActiLife activity counts with acceleration data collected at other body locations (e.g., waist, chest, ankle, etc.).

1374 Board #136 May 30 9:30 AM - 11:00 AM
Validity Of Self-report Methods For Measuring Physical Activity And Sitting Time In Chilean WorkersPia Martino, Nicolas Aguilar. *Universidad de La Frontera, Temuco, Chile.* (Sponsor: Wendy J Brown, FACSM)
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(No relevant relationships reported)

PURPOSE: to test the validity of a single question (SQ) for measuring sitting time (ST) and the GPAQ for measuring physical activity (PA) and ST in workers using the ActivPAL μ (AP) as reference.

METHODS: Workers wore an AP for 7 days to measure ST, standing and walking time (WT). The volunteers answered the SQ: How many hours each day do you typically spend sitting down while doing things like visiting friends, driving, reading, watching television, or working at a desk or computer on (a) an usual weekday, (b) usual weekend day?. They also answered the GPAQ that measures PA (at work, leisure and travel) and ST. Reliability of the SQ was tested with intraclass correlation (ICC). Validity was tested using correlation, mean bias and limits of agreement (LoA), and kappa to assess agreement between AP and both the SQ and GPAQ.

RESULTS: 91 workers (50.6% male) provided valid data. For AP, mean wear time was 16.2 ± 1.17 h/day; on average, participants spent 9.0 ± 1.87 h/day in ST, with no difference by sex ($p = 0.052$) or week and weekend days ($p = 0.066$). Mean standing time was 5.1 ± 1.47 h/day, with women standing more than men (5.4 ± 1.33 vs 4.8 ± 1.55 , $p = 0.044$). WT was 2.1 ± 0.71 h/day on average, with no differences by sex ($p = 0.96$), but more WT on week than weekend days (2.2 ± 0.82 vs 1.9 ± 0.88 h/day, $p > 0.001$). For the SQ, the ICC for ST was 0.53 for a usual day, 0.36 for weekdays and 0.45 for weekend days. The SQ showed fair correlation with AP on a usual day ($r = 0.24$) and week days ($r = 0.23$), but poor for weekend days ($p = 0.17$), with mean biases of about -2 h/day when compared with AP. When ST was categorized into tertiles, agreement was significant but poor between the SQ and AP (46.1%, $k = 0.19$, $p = 0.019$). The GPAQ showed fair correlation with AP for measuring PA ($r = 0.39$) with mean bias of -5.7 h/day (LoA: -14.5, 3.0 h/day). Moderate correlation was observed between the GPAQ and AP for PA at work ($r = 0.41$, mean bias: -4.3 h/day; LoA: -11.1, 2.6 h/day). The GPAQ question for ST showed fair correlation with AP ($r = 0.37$, mean bias: -2.7 h/day, LoA: -10.2, 4.8 h/day). When categorized into tertiles, agreement between GPAQ and AP was fair for both ST ($k = 0.22$) and PA ($k = 0.22$).

CONCLUSION: Both instruments showed fair to moderate validity and poor ability for correctly classifying individuals into tertiles of ST and PA when compared with the AP.

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1375 Board #137 May 30 9:30 AM - 11:00 AM

Rapid Assessment Of Physical Activity And Yale Physical Activity Survey Convergent Validity For Cancer Survivors.Amerigo Rossi¹, Alyssa Graham¹, Carol Ewing Garber, FACSM², Dennis YS Kuo³, Nicole Nevadunsky³. ¹Long Island University Brooklyn, Brooklyn, NY. ²Teachers College, Columbia University, New York, NY. ³Montefiore Medical Center, Bronx, NY.

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(No relevant relationships reported)

PURPOSE: The Rapid Assessment of Physical Activity (RAPA), a simple physical activity survey containing nine questions with accompanying images, may be a valid method for assessing underserved populations. The purpose of this study was to evaluate the convergent validity of the RAPA and Yale Physical Activity Survey (YPAS) for socioculturally diverse endometrial cancer survivors.

METHODS: Fifty-nine endometrial cancer survivors were approached during their gynecologic oncology follow-up appointments. The 52 survivors who agreed to participate were administered the nine-item RAPA, which requires approximately 3 minutes to complete, and 35-item YPAS, which requires approximately 15 minutes to complete. The RAPA is scored by stratifying respondents into one of five groups; group 1 was sedentary, groups 2 - 4 engaged in insufficient activity of progressively higher volumes, and group 5 achieved the recommended targets for aerobic physical activity. The YPAS provided Energy Expenditure (EE) and Summary Indices. Kendall Rank Correlation Coefficients (τ) were analyzed to evaluate the convergent validity between the RAPA and YPAS. Data are presented as mean \pm standard deviation. Statistical significance was set *a priori* at $p < 0.05$.

RESULTS: Mean age (64 ± 10 yrs) and Body Mass Index (34 ± 8 kg·m⁻²) indicated an older, mostly overweight and obese sample. Mean time since diagnosis was 2.6 ± 1.7 years. The sample was socioculturally diverse, with 31% non-Hispanic black, 31% non-Hispanic white, 29% Latina, and 8% other race/ethnicity. Forty-two percent reported having earned a college degree, and 11% reported not having graduated high school. According to the RAPA results, 4% of the participants were sedentary, 44% were insufficiently active, and 52% were active (27 out of 52). The five RAPA categories were significantly correlated to the YPAS Summary Index ($\tau = 0.34$, $p = 0.001$) and the YPAS Energy Expenditure Index ($\tau = 0.23$, $p = 0.016$). Although there were significant correlations between measures, the strength of the associations was not large. **CONCLUSIONS:** There was convergent validity between the RAPA and YPAS questionnaires, but with relatively weak strength of association. Further research should be conducted to validate each measure with an instrumented criterion, such as accelerometry, among cancer survivors.

1376 Board #138 May 30 9:30 AM - 11:00 AM

Validation of Apple Watch for Estimating Moderate-to-Vigorous Physical Activity in ChildrenSunkukwon, Youngwon Kim, Wonwoo Byun. *The University of Utah, Salt Lake City, UT.*

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(No relevant relationships reported)

Identifying accurate instruments for assessing physical activity (PA) is crucial for surveillance and promotions of PA in children. Apple Watch has been appeared as one of the most popular wearable devices that are designed to monitor individual's PA. However, little knowledge is available whether it provides an accurate estimate of time spent in moderate-to-vigorous PA (MVPA) in children. **PURPOSE:** To examine the validity of Apple Watch 3 in measuring MVPA in children using a portable indirect calorimetry system (Cosmed K5) as a criterion measure. We hypothesized the estimate of MVPA from Apple Watch would be comparable with that from Cosmed K5 for simulated free-living activities. **METHODS:** 20 school-age children (girls: 45%; age: 9.7 ± 2.0 yrs, BMI: 16.3 ± 3.2 kg/m²) were fitted with an Apple Watch 3 on their dominant wrist and Cosmed K5 portable indirect calorimetry. All participants performed sedentary (i.e., sitting, watching TV), light PA (i.e., slow walking, playing with toys), and MVPA (i.e., brisk walking) over a 45-minute period. We calculated MET_{RMR} by dividing obtained VO₂ values from Cosmed K5 by child's predicted resting metabolic rates using the age- and sex-specific Schofield equations. We used ≥ 3 MET_{RMR} as a cut-off value to define a criterion measure of MVPA time (i.e. Cosmed K5) against which Exercise Time from Apple Watch was compared. Pearson's correlation coefficient and mean absolute percent error (MAPE) were calculated, and equivalence test using SAS Proc Mixed procedure was performed to examine whether the Apple Watch's Exercise Time is comparable to MVPA time from Cosmed K5. **RESULTS:** The Exercise Time from Apple Watch showed a moderate correlation (r

= 0.35, $p = 0.13$) and relatively high MAPE ($30.2 \pm 4.9\%$) in relation to MVPA time from Cosmed K5. The 90% confidence interval of the Apple Watch's Exercise Time was from 16.7 to 22.9 min, which was not completely included within the zone of equivalence defined as $\pm 10\%$ of the values of Cosmed K5 (22.8 to 27.9 min); this indicates non-equivalence between Apple Watch and Cosmed K5. **CONCLUSION:** Apple Watch showed poor agreement with Cosmed K5 for estimating MVPA time in this convenient sample of children. Subsequent research is needed to further examine the validity of Apple Watch monitor for quantifying various intensities of PA under free-living conditions.

1377 Board #139 May 30 9:30 AM - 11:00 AM

Multi-phased Step Detection Algorithm For A Wrist-worn Triaxial Accelerometer

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Purpose: To test a multi-phased, signal pattern-specific step detection (SD) algorithm for a wrist-worn triaxial accelerometer

Methods: Adults [N=30; age: 37(11); female: 65%; BMI: 25.4(3.8)] wore accelerometers while engaged in 5-minute activity bouts (see Table 1), and hand-tallied steps were simultaneously recorded as the ground truth. Phase 1—Raw signals sampled at 60Hz were downloaded and processed by: 1) low-pass filtering, 2) calculating the bandpass filtered vertical accelerations (VA) in gravity seconds (gs), and 3) calculating the integrated area under the curve for the VA time series. For all activities, the VA peak heights (VAPH) that minimized SD error relative to the ground truth were determined by brute force. Phase 2—Signal features for each activity (triaxial vector magnitude, signal variability, and device angle) were passed to a k-means clustering algorithm, which grouped all activities into 3 clusters. Phase 3—A Random Forest (RF) algorithm was used to estimate VAPH for each cluster using activity signal features as inputs, and the cross-validated root-mean-square (RMS) for the RF-determined VAPH were calculated. Phase 4—RF-determined VAPH were applied to the original VA time series for SD. Bias (mean difference) and accuracy (median absolute percentage error) were calculated to evaluate SD performance. Sign tests were used to check for significant bias ($p < 0.05$).

Results: SD performance is shown in Table 1. RMS for the VAPH ranged from 0.011 to 0.019gs across clusters. Bias and accuracy were acceptable for most ambulatory activities and seated non-ambulatory activities, but not for non-ambulatory upper body activities and slow walking.

Conclusions: A signal pattern-specific algorithm provides reasonable step estimates for a wrist-worn accelerometer across ambulatory and non-ambulatory activities. Further research is needed to optimize SD during non-ambulatory upper body activities and slow walking.

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	Observed Steps (steps/min) ^a	Estimated Steps (steps/min) ^a	Vertical Acceleration Peak Heights (gs) ^b	Bias (steps/min) ^c	MdAPE (%) ^d
Activity					
Seated					
Rest	0(0)	0(0)	[0.059; 0.057]	<1	-
Computer Work	0(0)	0(0)	[0.059; 0.059]	<1	-
Movie Viewing	0(0)	0(0)	[0.071; 0.070]	<1	-
Standing					
Laundry	6(8)	29(19)	[0.085; 0.059]	23*	633
Vacuuming	48(13)	33(22)	[0.017; 0.025]	-15*	39
Stair Stepping	93(15)	94(20)	[0.035; 0.036]	<1	11
Self-paced corridor walking	112(16)	104(34)	[0.033; 0.036]	-7	19
Treadmill					
0.5mph	52(19)	15(24)	[0.012; 0.017]	-37*	86
1.0mph	72(15)	60(37)	[0.022; 0.023]	-12	38
1.5mph	87(13)	78(39)	[0.029; 0.029]	-8	34
2.0mph	97(9)	110(31)	[0.034; 0.032]	12	20
2.5mph	107(8)	110(37)	[0.034; 0.033]	3	24
3.0mph	115(7)	122(27)	[0.033; 0.032]	7	10
3.5mph	123(7)	116(18)	[0.029; 0.031]	-7*	5
4.0mph	132(7)	118(16)	[0.024; 0.026]	-14*	5
4.5mph	143(8)	129(10)	[0.028; 0.026]	-13*	8

Table 1. Bias (mean difference) and accuracy (MdAPE) for the hand-counted (observed) algorithm-determined (estimated) steps/minute. Abbreviations: gravity seconds (gs), median absolute percentage error (MdAPE), min (minute).
^a Mean (Standard Deviation)
^b Vertical Acceleration peak height thresholds are the average best observed versus algorithm-derived values for step detection [observed; estimated]
^c Negative values indicate underestimation of steps/min relative to the observed steps/min while positive values show overestimation. Asterisks indicate significant bias ($p < 0.05$), as determined by a two-sided sign test
^d Note: By definition, MdAPE values are not available for conditions wherein the observed step counts are equal to zero

1378 Board #140 May 30 9:30 AM - 11:00 AM

Using Heart Rate to Predict Energy Expenditure: A Validity Generalization Study

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(No relevant relationships reported)

Physical activity (PA) plays a critical role in preventing chronic diseases. Heart rate has been frequently used to predict PA energy expenditure (PAEE). While a number of prediction equations has been developed, their generalizability has not been confirmed.

PURPOSE: To examine the validity generalization of heart rate prediction equations for PAEE. **METHODS:** Key words such as "energy metabolism," "energy expenditure," "heart rate," "heart rate determination," "prediction," and "equation," were searched in the scientific databases including PubMed, Web of Science, Google Scholar etc. Eligibility criteria was restricted to studies that predict PAEE using heart rate. The validity generalization model (Pearlman, Schmidt, & Hunter, 1980) was utilized for the analysis. Four components including sample size, observed validity coefficients, test reliability coefficients, and criterion reliability coefficients were summarized and examined from each study. When test and criterion reliability coefficients were not reported, the information was derived from the literature. The percentages of variance accounted for "by artifacts" were computed. **RESULT:** 98 validity studies were screened and 27 studies (M±SD: Sample size = 45±13; Validity coefficients = .70±.13; Test reliability coefficients = .83±.03; & Criterion reliability coefficients = .95±.02) were analyzed to determine the degree of validity generalization using heart rate to predict PAEE. The percentage of variance accounted

for “by the artifacts” was only at 65%. Thus, the needed “75% decision rule” was not met. The estimated “90% credibility value” for the true validity was at .55, and the estimated average true validity was at .69. **CONCLUSION:** The validity to use heart rate predicting PAEE did not appear to be generalizable and these heart rate prediction equations should be used with caution, especially when it is used for another population.

1379 Board #141 May 30 9:30 AM - 11:00 AM
**Aerobic Exercise Training and Blood Lipids-
 Lipoproteins Among Healthy Adults: A Methodological
 Umbrella Review**

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(No relevant relationships reported)

PURPOSE: Meta-analyses (MA) that have examined whether aerobic exercise training (AET) affects blood lipids-lipoproteins have yielded conflicting findings. Since methodological characteristics and completeness of reporting may influence interpretation and generalizability of MA results, we sought to assess the quality of these parameters in published MA that examined the blood lipids-lipoproteins response to AET. **METHODS:** We used search terms related to AET and blood lipids-lipoproteins in six databases to find MA published in English, Portuguese, or Spanish. The MA included trials that: (1) enrolled adults with no established disease; (2) compared AET to a non-exercising, non-dieting arm (CONTROL); and (3) measured lipids-lipoproteins pre- and post-intervention. Study selection and data coding were conducted in duplicate. Methodological quality was assessed using a modified exercise-specific version of Assessing the Methodological Quality of Systematic Reviews 2 (AMSTAR2). **RESULTS:** Seven MA qualified for our umbrella review, with a total of 8,721 subjects (mean 1,245.8±602.2, range 393 to 2,024). Of these, five reported the number of AET groups for lipids-lipoproteins analysis (mean 10.3±8.3, range 2 to 35). Effect sizes (ES) for AET versus CONTROL ranged from +0.9mg/dL to -8.5mg/dL for total cholesterol, 0 to +4.6mg/dL for high-density lipoprotein, 0 to -10.1mg/dL for low-density lipoprotein, and 0 to -13.7mg/dL for triglycerides. Only one of 20 items on the modified AMSTAR2 was fully satisfied by all MA which was the reporting of the Population, Intervention, Comparator, and Timing (PICOT). Meanwhile, most MA lacked *a priori* study design (n=6, 85.6%), failed to explore the relationship between features of the exercise interventions and ES (n=4, 57.1%), and interpreted results without discussing risk of bias (n=5, 71.4%). **CONCLUSION:** Overall, included MA showed low adherence to current methodological standards, which may partially explain the disparate findings of the effects of AET on blood lipids-lipoproteins. Future MA following current methodological standards that explore possible effect modifiers are needed to more precisely estimate the influence of AET on lipids-lipoproteins.

1380 Board #142 May 30 9:30 AM - 11:00 AM
**Regression Equation To Predict Body Fat In Elderly
 Women Using Body Circumference Measures**

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(No relevant relationships reported)

Purpose: The purpose of this study was to develop and validate an equation to estimate body composition in elderly women above 60 years of age using body circumference measures. **Methods:** The sample consisted of 60 women individuals with an average age of 68.23 ± 5.84 years, 63.97 ± 10.65kg, 1.542 ± 0.52m from the Vitoria metropolitan area. The group was split into two subgroups: a regression group (n=50) used to develop the equations and a validation group (n=10) used for cross reference. A multiple linear regression was used to develop the equation. Both equations were compared using the Student's *t* test for paired samples. The reliability of the equations was analyzed by the *Blant and Altman* method. **Results:** The regression group had the following descriptive metrics: age 67.62 ± 5.87 years, body weight 64.27 ± 11.11kg, height 1.53 ± 0.11m; and percent body fat 41.73 ± 5.69%. The validation group had the following descriptive metrics: 71.3 ± 4.8 years, body weight 62.49 ± 8.34kg, 1.55 ± 0.53m; and percent body fat 41.75 ± 4.04%. Body circumference variables were used to develop equations to predict body fat. Using the stepwise selection criteria, the following equation was developed: % body fat = 0.343 (hip) + 0.289 (waist) - 0.0714 (handle)². Several parameters validated the strength of the equation: R² = 0.997; EPE = 3.29; EPE ≤ 3.5%; and validation of the model based on the partial significance (F) of the subset of variables that showed the strongest effect. **Conclusion:** It is possible to develop an accurate and specific equation to estimate of body fat percent in elderly women using circumference measurements. The more important is that is easy to use by health professionals.

1381 Board #143 May 30 9:30 AM - 11:00 AM
**Is Cadence A Better Predictor Of The Walk-to-run
 Transition Than Speed And/or The Froude Number?**

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(No relevant relationships reported)

Preliminary evidence suggests that a cadence of 140 steps/min is associated with the walk to run transition (W2R). However, this cadence threshold does not take into consideration leg length. Alternatively, the Froude number is used to compare the similarities of locomotion across individuals by incorporating leg length, and provides a theoretical prediction of the W2R at a value of 0.5. Additionally, the W2R has been shown to occur at an estimated speed of 2.09 m/s. If supported, a W2R cadence value could be used to identify running in free-living accelerometer-based data sets. **PURPOSE:** To examine whether 140 steps/min is a more accurate predictor of the W2R than a Froude number of 0.5 or a speed of 2.09m/sec. **METHODS:** Twenty-eight healthy adults (20 men, 8 women; age=22.6±1.9 years, height=172.5±11.8 cm, weight=79.3±18.8 kg) completed a treadmill protocol consisting of 5-minute bouts during which speed increased by 0.5 mph per trial from 0.5-6.0 mph. Participants could choose to run or walk each bout, and the protocol was terminated following the first bout at which the participant chose to run. The analytic sample consisted of two bouts for each participant (the running bout, and the bout immediately preceding walking) to identify the W2R transition. Cadence was derived by dividing directly-observed step counts (hand-tally) by 5 minutes. Froude numbers were calculated as $Froude = v^2 / (g \cdot d)$, where v =walking velocity, g =gravity, and d =leg length. W2R sensitivity, specificity and overall accuracy were calculated. **RESULTS:** 140 steps/min predicted the W2R with a sensitivity of 85.7%, a specificity of 100%, and an overall accuracy of 92.9%. A Froude number of 0.5 predicted the W2R with a sensitivity of 35.7%, a specificity of 96.4%, and an overall accuracy of 66.0%. A speed of 2.09 m/s predicted the W2R with a sensitivity of 14.3%, a specificity of 96.4%, and an overall accuracy of 55.4%. **CONCLUSION:** A cadence of 140 steps/min was a more accurate predictor of the W2R than the traditionally supported Froude or speed values. Given the high sensitivity, specificity and overall accuracy values, 140 steps/min may be used to identify running behaviors in free-living accelerometer-based data.

1382 Board #144 May 30 9:30 AM - 11:00 AM
**Validation Study of Inbody Band2 and Agreement
 Between Inbody Band2 and Omron 306 in Adults**

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Activity trackers (AT) continue to be one of the top fitness trends as the wearable market continues to diversify. As new features of AT's emerge, the need for evidence-based research is needed for reporting the reliability and validity of existing devices. **Purpose:** The purpose of this study was to assess the validity and reliability of the single frequency bio-impedance analysis (SF-BIA) device, InBody Band2 (IB2) compared to the Omron HBF-306c (O306c). **Methods:** A total of 54 individuals participated in the reliability and validation study (23 males and 31 females; average age 45.27 years). Each instrument provided percent body fat (%BF). The Pearson correlation, Bland-Altman analysis, t-test and one-way ANOVA were used to determine significance of relationship between the two SF-BIA devices and reliability of the IB2. **Results:** A Pearson's product-moment correlation was run to assess the relationship between measurements of %BF in adults using the IB2 and O306c. Analysis showed a statistically significant and a strong positive correlation between the instruments, $r(49) = 0.91$, $p < 0.01$. The mean difference (i.e., IB2 - O306c) was -0.11 with a 5.85 upper confidence line and a lower confidence line of -2.92. No proportional bias or statistical difference between the IB2 and O306c was found. Examination of the residuals obtained from multiple linear regression indicated there was not a statistical difference between the measurements of the IB2 and O306c ($t = -1.5$) The one-way repeated measures ANOVA determined that the IB2 measurements of %BF did not result in statistically significant changes, $F(1.683, 84.141) = 1.690$, $p = 0.195$, partial $\eta^2 = 0.01$. The IB2 showed excellent reliability with repeat measurements differing by 0.125 (95% CI, 0.14 to 0.39). **Conclusions:** Findings indicate that the estimates of %BF obtained from the IB2 did not exceed estimates from O306c. Overall the measurements were equivalent. IB2 showed excellent reliability.

1383 Board #145 May 30 9:30 AM - 11:00 AM**Comparing ActiGraph Data Processing Methods For Measuring Sedentary Behavior In Older Adults With COPD**Katelyn Webster, Ronald Dechert, Janet Larson. *University of Michigan, Ann Arbor, MI.*

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(No relevant relationships reported)

Accelerometers, such as the ActiGraph (AG), are commonly used for measuring sedentary behavior, but the ActivPAL (AP) has been validated as the gold standard. The use of various AG processing methods, including filters and non-wear time algorithms, influences sedentary time estimates. The optimal combination of AG filter and non-wear algorithm may depend on the population being studied. **PURPOSE:** To perform a secondary data analysis to identify which AG filter and non-wear algorithm produce estimates of sedentary time that have the strongest agreement with AP-measured sedentary time in a sample of 34 older adults with chronic obstructive pulmonary disease (COPD). **METHODS:** Participants wore AG and AP monitors concurrently for 7 consecutive days. Each participant's AG data was processed using six different methods, using all possible combinations of two filters (normal and low frequency extension) and non-wear algorithms with three different minimum lengths (60 minutes, 90 minutes, and 120 minutes). The Bland-Altman method was used to assess concordance in sedentary behavior time (minutes per day) between AP and each of the six AG estimates. **RESULTS:** Concordance correlation coefficients between AP-measured sedentary time and AG-measured sedentary times range from 0.388 to 0.511 (see table). The AG low frequency extension filter with the 60-minute non-wear algorithm resulted in the highest concordance correlation, along with a low mean difference between sedentary minutes per day measured by the two devices. **CONCLUSIONS:** Although concordance correlations showed moderate agreement, the AG measures of sedentary time are reasonably accurate if the appropriate filter and non-wear algorithm are used. This analysis provides evidence supporting the combination of the AG low frequency extension filter with the 60-minute non-wear algorithm as the optimal method of processing AG data to measure sedentary time in older adults with COPD.

Processing Method (Filter & Non-Wear Algorithm Length)	Concordance Correlation (SE)	Mean Difference AP-AG (SD)
Normal & 60 min.	0.409 (0.149)	-12.9 (114.7)
Normal & 90 min.	0.388 (0.146)	-20.8 (119.7)
Normal & 120 min.	0.409 (0.139)	-36.5 (117.0)
Low Frequency Extension & 60 min.	0.511 (0.132)	4.4 (106.3)
Low Frequency Extension & 90 min.	0.490 (0.134)	-2.2 (112.4)
Low Frequency Extension & 120 min.	0.510 (0.129)	-12.9 (109.3)

1384 Board #146 May 30 9:30 AM - 11:00 AM
Accuracy of Activity Trackers during Treadmill Walking Versus Outdoor WalkingMerrill D. Funk¹, Ivan A. Figueroa², Jose L. Gamez², Murat Karabulut, FACSM². ¹*Southern Utah University, Cedar City, UT.* ²*University of Texas Rio Grande Valley, Brownsville, TX.*

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(No relevant relationships reported)

Establishing the accuracy of devices that measure daily activity is important in controlled lab settings and in real-life settings. **PURPOSE:** To assess the accuracy of a pedometer and 6 popular activity trackers at measuring steps while walking on a treadmill and walking outside. **METHODS:** Twenty-three college students (Mean±SD: 22.2±3.9yrs; 24.9±4.1kg/m², 11 male) walked 500 steps at 3mph on a treadmill while wearing 7 different activity trackers (Pedometer (PED), Blaze (BLA), Charge HR (CHR), Alta (ALT), Flex (FLE), Zip (ZIP), One (ONE)). During a second visit, participants wore the devices while walking 400 meters at 3mph outside. Steps were counted by a trained researcher using a hand tally counter. Mean Absolute Percent Error (MAPE) values were calculated for each device relative to the tally counter and were correlated between each of the devices and the tally counter using Pearson correlations. Significance was set at p<0.05. Mean bias scores were calculated between the step counts for each device and the tally counter. **RESULTS:** MAPE values were significantly correlated between the treadmill and outdoor protocol for the PED (r=0.634, p<0.001). The remaining devices were not correlated between protocols (p>0.05). The treadmill protocol produced underestimations in step counts for 5 devices (mean bias±SD: PED = -1.4±41.5steps; BLA = -35.3±70.8; CHR = -3.9±51.9; ALT = -86.5±74.4; FLE = -16.9±71.6) and slight overestimations for 2 devices (mean bias±SD: ZIP = 2.1±3.5; ONE = 0.3±2.2). The outdoor protocol produced step count overestimations for all devices. MAPE values were approximately twice as large

or greater for all devices in the outdoor protocol compared to the treadmill protocol except for the PED (MAPE±SD: 4.0±7.2 treadmill vs. 3.5±5.2 outdoor). Besides the PED, the ONE was the most accurate during the treadmill protocol (MAPE±SD: 0.3±0.3) and the ZIP was the most accurate during the outdoor protocol (MAPE±SD: 14.7±6.6). **CONCLUSION:** The step counting devices in this study performed better in the controlled laboratory setting compared to the outdoor setting with a device worn on the waist producing the best results in each trial. These findings indicate that step counts in real-life settings from commercial activity devices may produce significant error.

1385 Board #147 May 30 9:30 AM - 11:00 AM
The Accuracy Of A Smartphone To Measure Laboratory And Free-living Physical ActivityNicola K. Thomson¹, Lauren McMichan², Eilidh Macrae¹, Julien Baker¹, David Muggeridge³, Chris Easton¹. ¹*University of the West of Scotland, South Lanarkshire, United Kingdom.*²*University of Strathclyde, Glasgow, United Kingdom.*³*University of the Highlands and Islands, Inverness, United Kingdom.* (Sponsor: Professor Jason Allen, FACSM)

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Accelerometers worn on the wrist or hip can be used to measure physical activity (PA) levels in free-living populations. Most modern smartphones also contain an inbuilt accelerometer but the capacity of this technology to accurately measure parameters of PA needs to be further established. **PURPOSE:** The primary objective of this study was to assess the validity of a popular smartphone to count steps and estimate energy expenditure (EE) during laboratory-based PA. A second objective was to compare free-living daily step counts measurements from the smartphone with a waist-worn accelerometer commonly used in research studies. **METHODS:** Healthy adults (n=20, 28 ± 5 yrs) took part in a single laboratory trial and a free-living trial (n=16, 42 ± 17 yrs). Participants wore the smartphone and accelerometer in a waist-mounted pouch continuously during both trials. Laboratory trials comprised 5 min bouts of treadmill walking and jogging. Step counts were manually counted (MC) and EE was measured using indirect calorimetry (IC). The estimates of PA parameters from the smartphone and accelerometer were compared to each other and to the gold standard measures (MC and IC) using the concordance correlation coefficient (CCC) with the thresholds: almost perfect >0.90; substantial >0.8 - 0.9; moderate 0.65 - 0.8; poor <0.65. Levels of agreement are expressed as mean bias with 95% limits of agreement (LOA). **RESULTS:** Compared to MC (700 ± 98 steps), the smartphone (703 ± 97 steps; CCC 0.992; mean bias 3 steps, LOA -19 to 25 steps) and accelerometer (675 ± 133 steps; CCC 0.76; mean bias -25 steps, LOA -179 to 129 steps) provided accurate measurements of step count. Compared to IC (8 ± 3 kcal·min⁻¹), the smartphone (6 ± 1 kcal·min⁻¹) underestimated EE with poor agreement between methods (CCC = 0.48; mean bias -1.9 kcal·min⁻¹, LOA -5.6 to 1.8 kcal·min⁻¹). During free-living, the smartphone (7990 ± 4673 steps·day⁻¹) substantially underestimated step count compared to the accelerometer (9085 ± 4647 steps·day⁻¹; mean bias -1095 steps·day⁻¹, LOA -4780 to 2591 steps·day⁻¹). **CONCLUSION:** The smartphone provided accurate measurements of step count during a controlled laboratory walking trial but substantially underestimated PA in comparison to an accelerometer during a period of free living. Supported by a grant from the Digital Health and Care Institute.

1386 Board #148 May 30 9:30 AM - 11:00 AM
Temporal Relationships Between The Act24 And A Monitor-based Method For Estimating Energy Expenditure Over A 24 Hour PeriodNicholas R. Lamoureux¹, Paul R. Hibbing², Charles E. Matthews³, Gregory J. Welk, FACSM¹. ¹*Iowa State University, Ames, IA.* ²*University of Tennessee, Knoxville, TN.* ³*National Cancer Institute, Bethesda, MD.* (Sponsor: Greg Welk, FACSM)

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(No relevant relationships reported)

The ability to quantify physical activity (PA) behavior and energy expenditure (EE) remains an important metric in public health and fitness research. While monitor-based methods remain popular, they cannot provide the context needed to understand relationships between PA, sedentary behavior, and sleep. The ACT24 is a promising online, self-guided recall survey that enables activities to be summarized and processed by day, activity or time.

PURPOSE: To compare EE estimates from the ACT24 with estimates from the established Sensewear armband (SWA) across full days as well as at the minute-by-minute level.

METHODS: 91 adults (36% male, mean±SD age 26.0±10.2 years) wore a SWA for 24 hours and completed the ACT24 the following morning. The compendium of physical activities was used to quantify self-reported activity levels based on ACT24 responses. To compare overall relationships, estimates of total daily EE from the

SWA and ACT24 were correlated, and the mean absolute percent error (MAPE) of the ACT24 estimate was calculated relative to the SWA values. To assess the potential for contextualizing monitor data, data from Act24 were temporally matched with the SWA files and similar correlation and descriptive analyses were performed and averaged across individuals.

RESULTS: The daily estimates were highly correlated $r = 0.88$, $p < 0.0001$ and similar in magnitude for total daily EE (SWA: 2929 ± 1106 kcal; ACT24: 2902 ± 950 kcal) with a group level MAPE of 13.6%. The associations of temporally matched estimates revealed individual correlations ranging from $r = 0.08$ to $r = 0.93$ (mean of $r = 0.54 \pm 0.15$). The individual MAPE values for the temporally matched data ranged from 0.02% to 56.1% (mean MAPE = $14\% \pm 11.6\%$).

CONCLUSION: Previous-day recalls such as ACT24 may be useful alternatives to questionnaires or wearable devices for assessment of daily activities over 24-h periods. The robust export options also enable data to be temporally matched with other data sources to provide contextual information to be merged with monitor data. The results reveal good overall agreement between the two methods at both the group and individual level and provides a promising way to investigate PA context; however, additional research is needed to understand the factors influencing error between report-based and monitor-based methods.

1387 Board #149 May 30 9:30 AM - 11:00 AM

The Comparison of Using the Preferred or Non-Preferred Wrist When Measuring Physical Activity

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(No relevant relationships reported)

People who participate in regular physical activity (PA) have a decreased risk of chronic diseases and premature death. A dramatic decrease of PA occurs from adolescence to young adulthood. With serious implications on health, PA is a critical behavior to measure. However, inconsistencies exist on how to measure PA. When using accelerometers, differences between the preferred (arm most commonly used to perform daily tasks of living, P) or non-preferred (NP) wrist may result in different estimates of PA. **PURPOSE:** The purpose of this study was to compare the P and NP wrist measured PA using commonly used research accelerometers during structured daily college activities and free-living (FL) conditions of college students. **METHODS:** 30 college students (15 females and 15 males) completed 7 lab tasks including shooting a basketball (BB), relaxing on a couch (Relax), hitting a racquetball (RB), walking up and down stairs (WUS), walking on an inclined surface (WUI), walking while using a smart phone (WSP), and using a laptop (COM). An accelerometer was placed on each wrist and the right hip. After the tasks, the students completed one week of FL conditions wearing an accelerometer on each wrist. Accelerometer counts from the P and NP wrists were compared using Wilcoxon signed-rank tests for the lab activities and a paired t tests for the FL conditions with α at 0.05. **RESULTS:** P and NP total counts per minute (tCPM) from the respective accelerometer were significantly different for BB, COM, RB, Relax, WSP, and WUS. The FL conditions showed no significant differences between the P and NP wrist. All means, standard deviations, and p -values are displayed in Table 1. **CONCLUSION:** Researchers should be aware of differences between the P and NP wrist in PA measurements during structured activities. Though for FL conditions, less concern should be placed on the P or NP wrist. Findings suggest that future studies should further investigate wrist placement and tightness of the device on the wrist.

Table 1

Condition	P tCPM	NP tCPM	p-value
BB	37,624.1 (5,194.6)	35,078.9 (5,420)	0.010
COM	1,183.4 (1,077.2)	1,522.0 (884.7)	0.004
RB	25,719.0 (4,318.3)	20,715.8 (5,405.3)	<0.001
Relax	1,276.0 (1,065.6)	1,783.1 (1,385.6)	0.037
WSP	7,895.4 (2,457.4)	10,450.9 (2,736.5)	<0.001
WUI	10,290.8 (6,522.5)	10,304.4 (7,472.6)	0.894
WUS	12,477.6 (2,820.7)	13,225.2 (3,050.1)	0.009
FL	3,015.2 (665.5)	2,897.2 (671.2)	0.092

1388 Board #150

May 30 9:30 AM - 11:00 AM

Device-specific Cadence (steps/min) Thresholds For Metabolic Intensities of Walking

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(No relevant relationships reported)

In studies where steps are directly observed, walking cadences of 100 steps/min and 130 steps/min have emerged as thresholds for absolutely-defined moderate (MOD; 3 metabolic equivalents [METs]) and vigorous (VIG; 6 METs) intensities, respectively. However, there is limited information regarding device-specific cadence thresholds provided for guidance.

PURPOSE: To estimate device-specific cadence thresholds for MOD and VIG in 61-85 year old adults.

METHODS: Thirty-seven healthy older adults (62.3% women; age=68.5±4.6 years; BMI=26.3±3.8 kg/m²) walked on a treadmill for 5-min bouts. The first bout was conducted at 0.5 mph. Speed increased in 0.5 mph increments until participants reached 75% of their age-predicted maximum heart rate, started to run, or reported a Borg Rating of Perceived Exertion > 13. Cadence (steps/min) was measured across all speeds with multiple devices: ActiGraph GT9x (hip and wrist), activPAL (thigh), StepWatch (ankle), Fitbit Zip (waist), and Garmin vivoactive® 3 (wrist). Oxygen uptake was measured with indirect calorimetry and converted to METs. Receiver Operator Characteristic (ROC) analysis was used to determine optimal cadence thresholds associated with MOD and VIG intensity using Youden's index.

RESULTS: Device-specific cadence thresholds for MOD and VIG intensity are presented in Table 1. The optimal device-specific cadence thresholds were associated with very good to excellent classification accuracy for both intensities (AUC > 0.8). Except for the wrist-worn ActiGraph, which had relatively lower specificity for identifying thresholds, optimal cadence thresholds for all devices ranged from 86-104 steps/min for MOD and 125-140 steps/min for VIG intensity.

CONCLUSION: Device-specific cadence thresholds appear to be acceptable indicators of MOD and VIG walking intensities.

FUNDING: NIH-NIA-5R01AG049024

Table 1: Device-specific cadence thresholds by intensity

Device	Absolutely-defined Intensity	Cadence (steps/min)	Specificity (%)	Sensitivity (%)	AUC	AUC 95% CI
ActiGraph (Waist)						
	MOD	86	86	83	0.90	0.86-0.94
	VIG	140	100	75	0.89	0.68-1.00
Fitbit Zip (Waist)						
	MOD	93	77	93	0.91	0.87-0.95
	VIG	136	97	100	0.98	0.96-1.00
ActiGraph (Wrist)						
	MOD	39	77	82	0.83	0.78-0.89
	VIG	63	86	100	0.94	0.88-1.00
vivoactive® 3 (Wrist)						
	MOD	96	82	90	0.92	0.88-0.96
	VIG	133	97	100	0.97	0.95-0.99
StepWatch (Ankle)						
	MOD	104	93	79	0.92	0.89-0.96
	VIG	125	91	75	0.87	0.70-1.00
ActivPAL (Thigh)						
	MOD	101	85	85	0.92	0.89-0.96
	VIG	138	99	75	0.90	0.72-1.00

AUC = Area Under the Curve

CI = Confidence interval

- 1389** Board #151 May 30 9:30 AM - 11:00 AM
The Accuracy of Activity Trackers Measuring Energy Expenditure while Walking
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 (No relevant relationships reported)

PURPOSE: Activity trackers are becoming increasingly popular worldwide. As a result, the market has expanded with different brands that produce a variety of activity trackers varying in function and ability. Consumers who purchase these devices rely on the functions that are advertised, especially when cost, exercise, and lifestyle choices are considered. The purpose of this study was to assess the accuracy of the energy expenditure function of three popular activity trackers (1, 2, and 3).

METHODS: A sample was drawn from students attending Indiana Wesleyan University. Of those eligible, a total of 35 participants completed the study. Each participant wore the three devices and walked on a treadmill for 10 minutes at 3.0 mph with no incline. To assess accuracy, a t-test was used to compare the total energy expenditure measurement obtained from each device to the indirect calorimetry measurement obtained, which is considered the gold standard of energy expenditure. Correlations were calculated to analyze the relationships between the activity trackers.

RESULTS: All three activity trackers overestimated energy expenditure ($p < .05$) when compared to the indirect calorimetry measurement. Activity tracker 1, 2, and 3 overestimated by 37, 22, and 4 kcalories, respectively. Activity tracker 1 ($r = 0.667$), 2 ($r = 0.570$), and 3 ($r = 0.568$) had a moderate correlation to the indirect calorimetry measurement.

CONCLUSIONS: Based on the findings of this study, consumers who purchase one of these devices will read an overestimated energy expenditure. Purchasing activity trackers can be expensive so doing research on which one is the most accurate is essential for consumers.

C-37 Free Communication/Poster - Carbohydrate Metabolism

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

- 1390** Board #152 May 30 10:30 AM - 12:00 PM
Muscle Glycogen Depletion And Body Water Status Assessed With Segmental Bioimpedance Spectroscopy
 Keisuke Shiose¹, Yosuke Yamada², Keiko Motonaga³, Hideyuki Takahashi³. ¹Fukuoka University, Fukuoka, Japan. ²National Institutes of Biomedical Innovation, Health and Nutrition, Tokyo, Japan. ³Japan Institute of Sports Sciences, Tokyo, Japan.
 (No relevant relationships reported)

Glycogen is stored in combination with 3-5 g/g of water in muscle tissue, and carbohydrate (CHO) loading is accompanied by an increase in body water content, especially intracellular water. Therefore, body water status may be useful as an indicator of muscle glycogen level. However, body water status under conditions of glycogen depletion has not been investigated.

PURPOSE: To determine the effect of muscle glycogen depletion on body water distribution using segmental bioimpedance spectroscopy (S-BIS).

METHODS: Twelve healthy men performed cycling exercise aimed at muscle glycogen depletion, and 24 hours later consumed a high- (HIGH group; CHO, 7 g/kg/day) or low- (LOW group; CHO, <1 g/kg/day) CHO diet. Thigh muscle glycogen content was measured at baseline, immediately after, and 24 hours after exercise using ¹³C-magnetic resonance spectroscopy. Intra- and extracellular water content (ICW and ECW) in the leg was assessed using S-BIS; measurement was performed at baseline and 24 hours after exercise to avoid the effect of exercise-induced acute changes in blood flow and metabolite concentration, but not glycogen, on body electrical properties.

RESULTS: Muscle glycogen content decreased after exercise in both groups (HIGH, 76.2 ± 16.4 to 28.1 ± 16.8 mmol/kg w.w.; LOW, 71.6 ± 12.1 to 25.5 ± 10.1 mmol/kg w.w.; both $p < 0.05$ vs. baseline). At 24 hours after exercise, muscle glycogen content recovered in the HIGH group, but not in the LOW group (HIGH, 72.7 ± 21.2 mmol/kg w.w.; LOW, 33.2 ± 12.6 mmol/kg w.w.; $p < 0.05$ between groups). ICW and ECW in the leg were unchanged from baseline in both groups (ICW; HIGH, 7.70 ± 1.43 to 7.59 ± 1.37; LOW, 7.53 ± 1.24 to 7.58 ± 1.35; ECW; HIGH, 4.73 ± 0.50 to 4.69 ± 0.54; LOW, 4.66 ± 0.67 to 4.49 ± 0.53).

CONCLUSION: Muscle glycogen was obviously decreased in thigh muscles, but ICW and ECW in the leg were unchanged. We conclude that muscle glycogen depletion per se does not alter body water status assessed with S-BIS.

- 1391** Board #153 May 30 10:30 AM - 12:00 PM
Comparison Of High-Intensity Exercise And Continuous Moderate-Intensity Exercise On Postprandial Metabolism: Pilot Analysis
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 (No relevant relationships reported)

PURPOSE: Examine the effects of low-volume high-intensity interval exercise (HIIE) and moderate-intensity continuous exercise (MICE) on postprandial glucose, insulin, and triglyceride (TG) concentration following a mixed meal (MM). **METHODS:** Recreationally active men ($n = 7$; age = 22.2 ± 2.1 yrs; body mass = 93.7 ± 18.0 kg; BMI = 28.3 ± 4.6; body fat% = 29.2 ± 8.1; WC = 91.3 ± 16.5) completed a 1) rest bout, 2) MICE bout, and 3) HIIE bout in a randomized order. Rest consisted of sitting quietly for 20 minutes. MICE required 20 minutes of continuous cycling at 60% maximal work rate (WR_{max}). HIIE consisted of performing 20 (15-second) cycling sprints (@ 130% WR_{max}) followed with 45 seconds of passive cycling. Thirty minutes following the completion of each trial, participants consumed a MM in the form of a milkshake providing 5.3 ± 0.7 kcal/kg BM (body mass) with a macronutrient composition of 50% carbohydrate (CHO), 15% protein, and 35% fat. Blood samples were acquired prior to each trial and at 0, 0.5, 1, and 2 hours post-MM. Blood samples were analyzed for glucose, insulin, and TG concentration. Postprandial responses were quantified via the incremental area under the curve (AUC_i) using the trapezoidal method. Significant differences ($p < .05$) between trials were determined using a one-way, repeated measures ANOVA and Bonferroni post-hoc test. **RESULTS:** The average work performed over 20 minutes was similar between MICE (120.8 ± 30.8 W) and HIIE (115.6 ± 15.7 W) ($p = .63$, ES = .17). Glucose AUC_i was reduced following HIIE (26.4 ± 38.2 mg·dL⁻¹·2hr⁻¹) when compared to MICE (44.8 ± 35.9 mg·dL⁻¹·2hr⁻¹) ($p = .018$, ES = .51). HIIE was not different from rest (42.6 ± 66.4 mg·dL⁻¹·2hr⁻¹) ($p = .13$, ES = .30). Insulin AUC_i was unchanged between trials, however HIIE did elicit the lowest AUC_i (32.8 ± 31.8 μIU·mL⁻¹·2hr⁻¹) compared to rest (51.6 ± 31.7 μIU·mL⁻¹·2hr⁻¹) ($p = .17$, ES = .59) and MICE (52.4 ± 30.2 μIU·mL⁻¹·2hr⁻¹) ($p = .15$, ES = .63). TG AUC_i was unchanged between trials. **CONCLUSION:** Low-volume HIIE may reduce the postprandial glucose and insulin concentration. While there was no statistical significance with insulin AUC_i , there was a moderate effect size with HIIE. The lack of change in TG AUC_i was anticipated as previous studies have reported that exercise completed immediately prior to a mixed meal does not influence postprandial TG concentration.

- 1392** Board #154 May 30 10:30 AM - 12:00 PM
Circulating Lactate Is Elevated in Prediabetes Phenotypes Compared with Normal Glucose Tolerant Counterparts
 Brielle L. Dotson, Emily M. Heiston, Stephanie L. Miller, Natalie Z.M. Eichner, Nicole M. Gilbertson, Steven K. Malin, FACSM. *University of Virginia, Charlottesville, VA.* (Sponsor: Steven K. Malin, FACSM)
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 (No relevant relationships reported)

Purpose: Prediabetes can be characterized as impaired fasting glucose (IFG) with or without impaired glucose tolerance (IGT; 2-hr blood glucose). IFG is depicted by impaired liver insulin sensitivity, while IFG+IGT is related to reduced liver and muscle insulin sensitivity. Lactate is a byproduct of non-oxidative glycolysis that may mediate altered glucose regulation. However, whether people with IFG and/or IFG+IGT have elevated lactate concentrations compared to normal glucose tolerant (NGT) controls is unclear. We hypothesized that individuals with IFG and IFG+IGT would have higher lactate levels than NGT controls in relation to glucose metabolism.

Methods: Forty-one obese adults (Age: 54.8 ± 2.0 yrs; BMI: 36.0 ± 1.0 kg/m²; 34F/7M) were screened for NGT, IFG, or IFG+IGT (75g OGTT, ADA criteria) following an overnight fast. Plasma lactate, glucose, and insulin were measured during a 120min 75g OGTT. The oral minimal model was used as an estimate for insulin sensitivity. Aerobic fitness (VO_{2peak}), fasting substrate oxidation (respiratory exchange ratio (RER), indirect calorimetry) and body composition (bioelectrical impedance) were also tested. **Results:** There were no differences in VO_{2peak} , body fat or fasting RER across groups. Individuals with IFG+IGT had lower insulin sensitivity compared with IFG and NGT ($P < 0.01$). However, both IFG and IFG+IGT had increased lactate tAUC compared to NGT ($P < 0.01$ and $P = 0.01$, respectively). Increased lactate tAUC correlated with fasting glucose ($r = 0.33$, $P = 0.03$) and reduced VO_{2peak} ($r = -0.34$, $P = 0.03$). Fasting lactate also related to fasting RER ($r = 0.31$, $P = 0.04$). **Conclusion:** Despite no differences between prediabetes phenotypes, adults with IFG and IFG+IGT have elevated lactates compared to NGT controls. Lactate tAUC directly associates with fasting glucose and fitness, but not insulin sensitivity. These data suggest that fitness may mediate lactate metabolism via the liver. Future work is warranted to determine the mechanism by which lactate influences type 2 diabetes risk.

- 1393** Board #155 May 30 10:30 AM - 12:00 PM
Effects of Breaking-up Prolonged Sitting with Three Different Walking Break Conditions on Glucose Metabolism
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 (No relevant relationships reported)

PURPOSE: To compare the metabolic effects of interrupting prolonged sitting with three different walking break conditions in healthy adults.

METHODS: In a randomized crossover trial, 16 inactive healthy adults (male: $n = 7$) aged 21-30 years (body mass index: $22.2 \pm 2.3 \text{ kg/m}^2$) completed four 26-h (from 8:00 AM on day 1 to 10:00 AM on day 2) laboratory conditions that included a 9-h intervention phase as follows: 9-h continuous sitting (SIT), 3-min brisk walking ($60\% \text{VO}_{2\text{max}}$) every 35 min during 9-h sitting (WALK3), 5-min brisk walking every 50 min during 9-h sitting (WALK5), and 8-min brisk walking every 70 min during 9-h sitting (WALK8). Continuous interstitial glucose monitoring (CGM) was performed during the 26-h intervention period. Four 2-h postprandial periods were also analyzed. Four meals and meal times were standardized across the conditions for all the participants.

RESULTS: Compared with that in SIT (mean \pm SD: $5.66 \pm 0.44 \text{ mmol/L}$), the 26-h mean glucose level during WALK3 ($5.42 \pm 0.42 \text{ mmol/L}$), WALK5 ($5.44 \pm 0.46 \text{ mmol/L}$), and WALK8 ($5.44 \pm 0.50 \text{ mmol/L}$) were significantly lower (all $P < 0.01$), with similar results for glucose total areas under the curve (tAUC; attenuated by 3%-4%; all $P < 0.01$), but no significant differences were found among the three intervention conditions. The 2-h breakfast postprandial glucose incremental area under the curve (iAUC) was significantly lower for WALK3 (33%) and WALK8 (25%) than for SIT (all $P < 0.05$) on day 1, whereas 2-h dinner postprandial glucose iAUC was significantly higher for WALK8 (25%) than for SIT ($P = 0.038$). No significant treatment effects on both lunch (day 1) and breakfast (day 2) postprandial glucose iAUC were found.

CONCLUSIONS: Three kinds of regular walking break conditions attenuated 26-h glucose responses. WALK8 most likely influenced the 2-h postprandial glucose metabolism of the healthy young adults in this study.

- 1394** Board #156 May 30 10:30 AM - 12:00 PM
Does Pattern of Drink Intake Affect Exogenous Carbohydrate Oxidation During Prolonged Submaximal Running?
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 (No relevant relationships reported)

Marathons and half-marathons usually position drink stations every 5 km, providing opportunity for fast runners to consume fluid and carbohydrate approximately every 15-20 min. In recent attempts to break the marathon world record, drinks have been provided at more frequent intervals, often in smaller volumes. **PURPOSE:** To determine how the pattern of carbohydrate ingestion during running affects exogenous carbohydrate oxidation rates and measures of gastrointestinal (GI) comfort.

METHODS: Twelve well-trained male runners ($27 \pm 7 \text{ y}$, $67.9 \pm 6.7 \text{ kg}$, $\dot{V}\text{O}_{2\text{peak}}$: $68 \pm 7 \text{ mL/kg/min}$) completed three exercise trials of 100 min steady state running at $70\% \text{VO}_{2\text{peak}}$. During the first trial, 200 mL water was consumed every 20 min and results were used for background correction of $^{13}\text{CO}_2$ breath enrichment. In the final two trials a 1 L volume of a 10% dextrose solution, enriched with $[\text{U}-^{13}\text{C}]$ glucose, was consumed at a rate of either 200 mL every 20 min (CHO-20) or 50 mL every 5 min (CHO-5). Expired breath and venous blood samples were collected at rest and every 20 min during exercise. Subjective scales of GI comfort were recorded at regular intervals.

RESULTS: Exogenous carbohydrate oxidation rates were higher after 80 ($0.58 \pm 0.16 \text{ v } 0.48 \pm 0.16 \text{ g/min}$; $P = 0.020$) and 100 min ($0.67 \pm 0.14 \text{ v } 0.58 \pm 0.15 \text{ g/min}$; $P = 0.016$) of running in CHO-20 compared to CHO-5. During exercise, total carbohydrate oxidation rates were similar between trials and remained within a range of 2.0 to 2.5 g/min ($P > 0.168$). Oxidation of endogenous carbohydrate was lower in CHO-20 ($1.87 \pm 0.37 \text{ v } 2.08 \pm 0.44 \text{ g/min}$; $P < 0.05$). Serum glucose concentration increased above 5 mmol/L after drink ingestion, remaining elevated throughout exercise with no difference between trials ($P = 0.095$). There were no differences in reported symptoms of GI comfort ($P > 0.05$), with no subject reporting severe symptoms (all ≤ 6) in either trial.

CONCLUSIONS: Ingestion of a larger volume of carbohydrate solution at less frequent intervals increased exogenous carbohydrate oxidation rates, resulting in similar rates of total carbohydrate oxidation but with reduced contribution from endogenous carbohydrate stores.

- 1395** Board #157 May 30 10:30 AM - 12:00 PM
Acute Effects of Rotating Shift Work Paradigm on Activity and Metabolism
 Vasavi Shabrish. *University of Texas at Austin, Austin, TX.*
 (No relevant relationships reported)

Shift work, which involves working during normal sleeping periods, results in asynchrony between central and peripheral molecular circadian clocks and is associated with increased risk for metabolic disease. Catecholamines released during physical activity act as entrainers of the circadian clock, and disruption of physical activity patterns may contribute to the negative effects of shift work.

PURPOSE: The purpose of this study was to investigate the acute effects of rotating shift work on physical activity patterns, glucose tolerance, and body composition.

METHODS: Eleven-week-old male mice on a FVB/N background were individually housed and randomly assigned to either a control group or a rotating shift work group. Control group mice were exposed to a normal 12:12 light/dark cycle, while the shift work mice were exposed to alternating 12:12 light/dark and dark/light inversions to simulate a rotating shift work pattern of 3 days "on shift"/4 days "off shift" for one week, followed by 4 days "on shift"/3 days "off shift" during the following week. Shift work conditions were maintained for two-weeks, followed by a 4-week period on normal light cycles and then another 3 weeks of alternating light cycles. Both groups received *ad-libitum* access to wireless running wheels, normal chow, and water. Glucose tolerance tests and body composition were measured at baseline, after two weeks, and the study end.

RESULTS: Acute exposure to rotating shift work resulted in the shift work group being significantly more active between zt0-zt12 (5 vs 28 km, $p < 0.001$; 11.8 vs 61 km, $p < 0.001$) and during lights on (15.9 vs 24.5 km, $p < 0.01$; 11.8 vs 51 km, $p < 0.01$) and significantly less active between zt12-zt24 (23.7 vs 49.9 km; $p < 0.01$) compared to the control group. Activity in the shift work group was more distributed throughout the 24-hour period compared to the control group. Acute exposure demonstrated significant differences between groups for fasting glucose ($p < 0.05$) indicating dysregulation in carbohydrate metabolism. No significant differences were observed in body weight and body composition between groups at any time point.

CONCLUSIONS: Acute exposure to a rotating shift work paradigm disrupts normal activity patterns and dysregulates carbohydrate metabolism.

- 1396** Board #158 May 30 10:30 AM - 12:00 PM
Acute Resistance Exercise Fails to Alter Post-Exercise Glycemic Control
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 (No relevant relationships reported)

Acute exercise has commonly been found to transiently enhance glycemic control during recovery from the exercise. This effect has more commonly been observed following aerobic exercise. **PURPOSE:** This study combined results from two recent smaller investigations to gauge the effects of resistance exercise on post-exercise blood glucose (BG) response to an oral glucose tolerance test (OGTT). **METHODS:** Data from seventeen resistance-trained volunteers were used. All subjects completed a resting control trial consisting of a 75-min OGTT following consumption of a 25% glucose solution dosed at 1 g/kg body mass. On a separate day, subjects completed either 30 repetitions of squat only exercise (at 10-RM); 30 repetitions each of squat, bench press and biceps curl (at 10-RM); or ~30 repetitions each of biceps curl and knee extension (at 10-RM). BG was assessed via fingertip sampling prior to exercise, post-exercise and during the OGTT (every 15 min). Blood lactate was collected at rest and upon completion of exercise. **RESULTS:** Resistance exercise resulted in significantly increased blood lactate vs. resting state ($8.58 \pm 0.87 \text{ vs. } 1.39 \pm 0.22 \text{ mmol/L}$). OGTT response following acute resistance exercise was not significantly different ($p > 0.05$) from the resting OGTT condition. BG area under the curve was 2% smaller ($p > 0.05$) following resistance exercise compared to resting control ($11330.6 \pm 320 \text{ vs. } 11551.3 \pm 405$ arbitrary units). **CONCLUSIONS:** Based on the results of this investigation, acute resistance exercise was not found to elicit enhanced glycemic control. The volume of working muscle, the overall energy deficit induced by exercise and the magnitude of the body's glycogen depletion may be important factors to consider when examining post-exercise blood glucose response to an OGTT challenge.

1397 Board #159 May 30 10:30 AM - 12:00 PM
The Effects of High-Versus Low-Intensity Resistance Exercise on Acute Hyperglycemia in Young Healthy Males

Brandon Beimborn, Luis Segura, Joshua Cotter, PhD, Evan Schick PhD. *California State University, Long Beach, Long Beach, CA.*

(No relevant relationships reported)

ACSM 2019

THE EFFECTS OF HIGH- VERSUS LOW- INTENSITY RESISTANCE EXERCISE ON ACUTE HYPERGLYCEMIA IN YOUNG HEALTHY MALES
Luis E. Segura, Brandon Beimborn, Shayan Emamjomeh, Josh A. Cotter, PhD, Evan E. Schick, PhD

Nearly one-third of Americans older than 18 years of age are pre-diabetic, yet much remains to be understood about this condition. Regular exercise can help control prolonged hyperglycemia, a flagship symptom of type 2 diabetes, however, the nature in which exercise can alleviate periods of acute hyperglycemia, a common symptom of pre-diabetes, is unclear. **Purpose:** The purpose of this study was to examine the effect of high-intensity (HI) versus low-intensity (LO) resistance exercise (RE) on acute hyperglycemia in resistance-trained males. **Methods:** Thirteen recreationally trained males (age, 23.43 ± 2.18 yrs.; height, 175.16 ± 10.44 cm; mass, 77.02 ± 8.91 kg) completed three randomized testing sessions separated by 96 hours: 1) no exercise control (CON), 2) HI (5x4, 90% 1-RM), and 3) LO (3x14, 65% 1-RM). Following overnight fast, all three-testing session commenced with oral ingestion of a high glucose drink (2 g glucose/kg body weight). HI and LO RE protocols began 30 mins post-glucose ingestion. Capillary blood samples obtained via finger stick occurred immediately pre- and 30, 60, 90 and 120-mins post-glucose ingestion. **Results:** A two-way ANOVA revealed a significant ($p < 0.015$) time main effect for plasma glucose and insulin concentrations throughout the 120 min testing duration, however neither glucose or insulin differed between conditions at any of the individual time points. One-way ANOVA showed that total glucose response in the HI condition, as assessed by AUC, was significantly greater ($p < 0.012$) than in both CON and LO. Strong negative correlations existed between total body mass and lean body mass ($r = -0.78$) as well as lean body mass and LO glucose AUC ($r = -0.78$). **Conclusions:** High intensity resistance exercise may exacerbate acute episodes of hyperglycemia, thus combining high intensity with lower intensity resistance exercise may optimally manage skeletal muscle health and glycemic control.

1398 Board #160 May 30 10:30 AM - 12:00 PM
Impact of Reduced Carbohydrate Intake after Exercise on Breath Acetone Levels

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(No relevant relationships reported)

PURPOSE: The purpose of the present study was to determine the impact of reduced carbohydrate (CHO) intake after sprint exercise on breath acetone levels during post-exercise.

METHODS: Nine subjects (20.8 ± 0.2 yrs, 170.1 ± 1.6 cm, 65.1 ± 1.8 kg) conducted two trials, consisting lower CHO trial (LOW) or normal CHO trial (NOR). In each trial, the subjects came to the laboratory at 7:30 to evaluate breath acetone level, blood variables and resting metabolic rate. From 17:00, they started repeated sprint exercise (4 × 30 s maximal cycle sprint exercise). After exercise, isoelectric meals (during 2-3 h after exercise) were provided with containing normal CHO (60% for CHO, 20% for protein, 20% for fat) for NOR or reduced CHO (20% for CHO, 20% for protein, 60% for fat) for LOW. Time course changes in breath acetone levels were monitored immediately before exercise, immediately after exercise, 1 h, 3h, 4h and on the following morning.

RESULTS: In the LOW, exercise markedly increased breath acetone levels during post-exercise (trial × time interaction: $p < 0.05$). At 4 h after exercise, breath acetone level was significantly higher in LOW (0.9 ± 0.02 ppm) than in NOR (0.66 ± 0.07 ppm, $p < 0.05$). However, a significant difference between the trials was not observed on the following morning. Respiratory exchange ratio (RER) on the following morning was significantly lower in the LOW (0.81 ± 0.02) than in the NOR (0.87 ± 0.02, $p < 0.05$). Moreover, LOW showed significantly lower contribution of CHO oxidation (34 ± 4.8 %) than that in NOR (50 ± 6.2 %, $p < 0.05$), whereas fat oxidation was significantly higher in LOW (66 ± 4.8 %) than in NOR (50 ± 6.2 %, $p < 0.05$).

CONCLUSIONS: Reduced CHO intake after exercise increased breath acetone level during early phase of post-exercise (4 h after exercise), suggesting augmented fat metabolism in the liver under impaired CHO availability. However, the increased breath acetone level by reduced CHO intake was not evident on the following morning. The results may suggest that breath acetone levels can be available to evaluate CHO availability following intensive exercise.

1399 Board #161 May 30 10:30 AM - 12:00 PM
Effects of Acute Swimming Exercise on Pancreatic Enzyme Activity and Intestinal Glucose Transporters in Rats

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(No relevant relationships reported)

PURPOSE: It has been reported that long-term endurance exercise training increases pancreatic amylase activity in rats, suggesting that chronic exercise training enhances the carbohydrate digestive capacity. To clarify whether an acute bout of endurance exercise can also induce the pancreatic adaptation and affect glucose transport capacity in small intestine as well, we evaluate the effects of acute swimming exercise with different duration on pancreatic amylase activity and intestinal glucose transporter contents in rats. **METHODS:** Male Sprague-Dawley rats performed acute bout of swimming exercise for 1 h (Ex-1h group) or 6 h (Ex-6h group, two 3-h bouts separated by 1h of rest). Sedentary rats were used as a control (Con group). Immediately and 24 h after the exercise, pancreas and small intestine (jejunum) were dissected out and amylase activity and glucose transporters (GLUT2 and SGLT1) content were measured, respectively. **RESULTS:** While no significant difference in total pancreatic amylase activity was observed between the Con and Ex-1h groups, the Ex-6h group had significantly lower total amylase activity compared with the Con group in both immediately (1233 ± 229 vs. 2088 ± 205 U, $p < 0.05$) and 24 h after the exercise (1295 ± 112 vs. 1954 ± 227 U, $p < 0.05$). There were no significant differences in GLUT2 and SGLT1 protein contents among the three groups. **CONCLUSIONS:** These results suggest that acute bout of prolonged exercise for longer time (~6 h) may decrease the carbohydrate digestive capacity in the rat pancreas through the diminished amylase activity, although it has little effect on intestinal glucose transporters content.

1400 Board #162 May 30 10:30 AM - 12:00 PM
cfDNA As A Metabolic Marker

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(No relevant relationships reported)

PURPOSE: We observed in previous studies that incremental running tests to exhaustion and continuous aerobic running leads to significant increases of cell-free DNA (cfDNA) in capillary blood, which showed a high positive correlation with total energy expenditure. Here we investigated the increases of cfDNA during different interval loads with a focus on metabolic rates, heart rate (HR), and TRIMP. We hypothesized that cfDNA shows a high association with carbohydrate energy expenditure.

METHODS: 14 male subjects were subjected to a stepwise incremental exercise test until exhaustion to determine the individual anaerobic threshold (IAT; as LT + 1.5 mmol/l) and subsequently participated in three different interval training sessions. cfDNA and lactate were taken after every step and metabolic data were monitored continuously after a 10min warmup phase on the treadmill (+1.5%) during 6 x 400m intervals at 18km/h with 2min pauses, 6 x 400m intervals at 18km/h with 5min pauses, and 6 x 1000m intervals at IAT with 2min pauses. The order of the first two tests that only differed in duration of pause was randomized. Heart rate and subsequent calculation of TRIMP was done based on ECG Monitoring.

RESULTS: cfDNA analysis showed a significantly higher increase in the 400m interval setting with short pause time (8.2-fold; 95% CI: 6.3-10.6; $p < 0.0001$) compared to 400m interval setting with long pause time (3.4-fold; 95% CI: 2.6-4.4; $p < 0.0001$). In contrast to cfDNA TRIMP showed a significantly higher increase in the 400m interval setting with a long pause time (long: 4.8-fold; 95% CI: 4.4-5.2; $p < 0.0001$) compared to 400m interval setting with short pause time (4.3-fold; 95% CI: 4.0-4.7; $p < 0.0001$). In a global analysis across all interval tests and points in time cfDNA increased 7.0-fold (95% CI: 5.4-9.1; $p < 0.0001$) and the highest correlation of this increase with all other physiological parameters was with carbohydrate energy expenditure ($r = 0.87$; $p < 0.0001$).

CONCLUSIONS: cfDNA appeared to reflect training load of the 400m interval settings more properly than TRIMP. Here we report for the first time a high correlation between cfDNA and carbohydrate energy expenditure. Further studies will have to investigate the validity of cfDNA releases during exercise as a marker for carbohydrate energy expenditure.

- 1401** Board #163 May 30 10:30 AM - 12:00 PM
Metabolic Responses of Pre-Exercise Carbohydrate Ingestion in Cycling and Running
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Several studies have examined the metabolic responses of pre-exercise carbohydrate (CHO) ingestion in cycling and running, however, none of the existing studies compared directly cycling and running on the same individuals. **PURPOSE:** To examine the metabolic responses of pre-exercise CHO ingestion in cycling and running on the same individuals. **METHODS:** Eleven males (25.5 ± 3.2 years old, 175.7 ± 2.0 cm, body fat percentage $12.4 \pm 4.2\%$, mean \pm SE), following an overnight fast, cycled or ran for 30 min at 77-83% maximal heart rate (HR_{max}) after ingestion of either 1g/kg body weight maltodextrin (CHO-Cycle and CHO-Run respectively) or placebo (PL-Cycle and PL-Run) solutions. Fluids were ingested 30min before exercise in a double-blind and random way. Data were analyzed using three-way ANOVA, whereas pre-post exercise changes were compared by two-way ANOVA. **RESULTS:** Blood glucose and serum insulin responses were higher before exercise in CHO (mean CHO-Cycle+CHO-Run) (Glucose: 7.3 ± 0.4 mmol^{L-1}; Insulin: 59 ± 10 mU^{L-1}) compared to placebo trials (mean PL-Cycle+PL-Run) (Glucose: 4.7 ± 0.1 mmol^{L-1}; Insulin: 8 ± 1 mU^{L-1}) ($p < 0.01$). No differences were observed during exercise among the 4 conditions, while blood glucose did not drop below 4.1 mmol^{L-1} in any trial. Blood lactate increased with exercise (post - pre difference) more in cycling (CHO-Cycle+PL-Cycle: 3.4 ± 0.4 mmol^{L-1}) compared to running (CHO-Run+PL-Run: 0.7 ± 0.2 mmol^{L-1}) ($p < 0.01$). At the end of exercise plasma free fatty acids (FFA) were higher in placebo compared to CHO irrespective of exercise mode (PL-Cycle+PL-Run: 0.36 ± 0.03 vs. CHO-Cycle+CHO-Run: 0.14 ± 0.03 mmol^{L-1}), while at the same time plasma glycerol was higher in PL-Run (137 ± 8 mmol^{L-1}) compared to PL-Cycle (87 ± 8 mmol^{L-1}) ($p < 0.01$). **CONCLUSIONS:** During 30min exercise at 77-83% HR_{max}, lactate was higher in cycling compared to running irrespective of fluid ingestion, whereas glycerol was increased more in running when no CHO was provided. The ingestion of CHO reduced FFA concentrations independently of the mode of exercise, while glucose and insulin responses were not affected by the exercise mode

- 1402** Board #164 May 30 10:30 AM - 12:00 PM
Electrolyte-based Carbohydrate Drink: Effect On Steady State Exercise Done Against Progressively Higher Workloads
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 (No relevant relationships reported)

Aerobic exercise with progressively higher workload stages done in succession challenges a person's cardiorespiratory system as their $\dot{V}O_{2max}$ is estimated. Higher heart rates (HR) at the end of stages lowers a person's estimated $\dot{V}O_{2max}$. Adding electrolytes to a carbohydrate-based drink may raise $\dot{V}O_{2max}$ values if ingested before exercise. **Purpose:** Compare the merits of added electrolytes, in two otherwise similar beverages, when consumed before $\dot{V}O_{2max}$ tests that entail progressively higher workload stages. **Methods:** In a randomized double-blind study subjects (13 men, 21 women) first gave written informed consent, followed by two stationary cycle ergometer workouts to estimate their $\dot{V}O_{2max}$. Workouts were preceded by intake of a 2% sucrose solution, one of which was an electrolyte-rich (500 mg of vitamin C, 1 mg of B-12, 100 mg of Mg²⁺, 400 mg of K⁺, 200 mg of Na⁺, 1 µg of Cr) beverage, while the other was devoid of added electrolytes and served as a placebo. HR were recorded before, four times during, and after workouts. Ratings of perceived exertion (RPE) were provided at the end of workouts. HR were compared with a three-way (gender, treatment, time) ANOVA, with repeated measures for treatment and time. Estimated $\dot{V}O_{2max}$ and RPE were assessed with two-way (gender, treatment) ANCOVAs, with repeated measures for treatment. Body mass and body fat percentage were examined as covariates. Scheffe's served as our post-hoc and a $\alpha = 0.05$ denoted significance. **Results:** There were significant inter-time differences for HR. RPE and $\dot{V}O_{2max}$ each had inter-gender differences. Yet there were no inter-treatment differences. **Conclusions:** Little research exists on the ergogenic effects on electrolyte formulations added to carbohydrate beverages, yet our results concur with studies that also saw a lack of inter-treatment differences.

- 1403** Board #165 May 30 10:30 AM - 12:00 PM
The Effects of a Carbohydrate Mouth Rinse on Central and Peripheral Fatigue Following High and Low Intensity Fatiguing Exercise
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 (No relevant relationships reported)

Carbohydrate (CHO) mouth rinsing has been shown to improve performance during long duration, aerobic exercise. However, the ability of a CHO mouth rinse to attenuate fatigue during shorter term exercise is not well characterized. **PURPOSE:** This study sought to determine the effects of a CHO mouth rinse on torque production and voluntary activation following high and low intensity isometric exercise. **METHODS:** Twelve, active male participants completed 6 sessions—2 familiarization and 4 testing visits. Knee extension MVC was determined (PRE), followed by performance a high (80% of MVC) or a low (20% of MVC)-intensity isometric exercise held to task failure. An 8% CHO solution or placebo was then rinsed for 20-secs. MVC was then reassessed immediately following (iPOST) the rinse and following 5-min of rest (SPOST). Voluntary activation (VA%) was determined during each MVC via twitch-interpolation and rate of torque development (RTD) and relaxation (RTR) were calculated from twitch torque (TT). **RESULTS:** There were no significant interactions ($p \geq 0.31$) between exercise intensity, time, and rinse condition on all variables. MVC was reduced compared to PRE following 20% and 80% exercise ($p < 0.01$), but greater reductions were found at iPOST following exercise at 20% of MVC (-24.1% vs. -14.2%; $p < 0.001$). VA% decreased following both exercise protocols ($p \leq 0.02$), but was reduced to a greater extent following exercise at 20% of MVC (-18.7% vs. -6.7%; $p < 0.004$). A significant main effect for time ($p = 0.01$) was found on TT with reductions observed iPOST ($p \leq 0.047$), but not at SPOST ($p > 0.05$). RTD was reduced following exercise at 80% (281 ± 65 vs. 251 ± 70 Nm·s⁻¹; $p < 0.05$), but not following exercise at 20% of MVC ($p \geq 0.06$). RTR was reduced following exercise at both 20% and 80% of MVC ($p \leq 0.01$) at iPOST. Greater reductions were observed following exercise at 80% of MVC (216 ± 55 to 144 ± 37 vs. 222 ± 54 to 184 ± 54 ; $p < 0.04$). **CONCLUSIONS:** We were successful in eliciting differing levels of central and peripheral fatigue by exercising at a low and high intensity. Despite significantly larger declines in VA% following exercise at 20% of MVC, CHO mouth rinsing had no effects compared to placebo on any measured variable.

- 1404** Board #166 May 30 10:30 AM - 12:00 PM
Influence of Chronic Carbohydrate Ingestion During High Intensity Exercise on Incidences of Gastrointestinal Distress
 Ben M. Krings¹, Hunter S. Waldman², Brandon D. Shepherd², Matthew J. McAllister³, JohnEric W. Smith². ¹University of Wisconsin- Platteville, Platteville, WI. ²Mississippi State University, Mississippi State, MS. ³Texas State University, San Marcos, TX.
 (No relevant relationships reported)

The effects of carbohydrate (CHO) ingestion during endurance exercise on gastrointestinal distress (GID) has been well researched, but there is limited research with high intensity exercise. **PURPOSE:** The purpose of this study was to examine the effects of chronic CHO ingestion on GID responses during a 4 week concurrent resistance training (RT) and high intensity interval training (HIIT) program. **METHODS:** 18 resistance trained males, aged 18-24 years old, were stratified into one of two groups: ingesting a 500 mL beverage containing a 6% CHO solution during exercise or ingesting a 500 mL artificially flavored placebo. Each group completed 4 weeks of RT and HIIT, three days per week of RT, and two days per week of HIIT, repeated all-out 30 second cycling sprints. GID was measured immediately before and after one RT session and one HIIT session per week for a total of 8 sessions. GID was measured using a 10-point Likert scale assessing feelings of nausea, regurgitation/reflux, stomach fullness, abdominal cramps, gas/flatulence, and urge to defecate. GID was analyzed using a four-way repeated measures ANOVA (exercise \times group \times time \times week). **RESULTS:** There was a main effect for time for nausea (pre-exercise 0.29 ± 0.68 , post-exercise 1.31 ± 2.24), regurgitation/reflux (pre-exercise 0.24 ± 0.75 , post-exercise 1.53 ± 2.00), and abdominal cramps (pre-exercise 0.09 ± 0.54 , post-exercise 0.83 ± 1.56) ($p < 0.05$), suggesting these symptoms of GID increased pre- to post-exercise independent of exercise type, group, or week. There were no interaction effects or main effects for gas/flatulence or urge to defecate ($p < 0.05$). **CONCLUSION:** Ingesting beverages containing CHO or artificial sweeteners both increase GID during high intensity exercise. Chronic CHO ingestion during endurance training has been suggested to train the gut to better absorb nutrients, but based on the results from this investigation, signs and symptoms of GID are not reduced following 4 weeks of chronic ingestion during high intensity exercise.

1405 Board #167 May 30 10:30 AM - 12:00 PM
Carbohydrate Effects on Post-Exercise Performance in Prepubescent Girls

C. Eric Heidorn, Brandon J. Dykstra, Cori A. Conner, Anthony D. Mahon. *Ball State University, Muncie, IN.*

(No relevant relationships reported)

Carbohydrate (CHO) consumption is a common practice during variable-intensity exercise (VIE) such as team sports. The effects of CHO on performance during VIE have been studied in adults; however, the effects are less defined in children and apparently not at all in prepubescent girls. **PURPOSE:** To investigate the effects of a 6% CHO drink on a one-minute performance test following 30-minutes of VIE in prepubescent girls. **METHODS:** Ten girls (10.4±0.7 yrs.) participated in this study. During the initial visit, maximal aerobic power was determined followed by a familiarization of the protocol used during the next two visits in which the child consumed either a CHO drink or an electrolyte-matched placebo (PL). The experimental protocol involved two 15-minute bouts of VIE (20, 55, 95% maximal aerobic power and 6-second maximal sprint); beverages were consumed prior to exercise and after each 15-minute segment. A one-minute performance trial was then completed at maximal effort. Measurements during VIE included heart rate (HR), rating of perceived exertion (RPE), sprint mean power (MP) and sprint peak power (PP). During the one-minute performance bout, HR, RPE, PP, total work (TW), and fatigue index (FI) were assessed. Data were analyzed using a 2-way ANOVA and paired t-tests. **RESULTS:** $\dot{V}O_{2\max}$ was 39.7±5.5 mL·kg⁻¹·min⁻¹ and HR_{max} was 196±11 bpm. During VIE, there were no interaction effects, no trial effects ($p>0.05$) for HR, %HR_{max}, RPE, sprint MP, sprint PP and no time effects ($p>0.05$) for HR, %HR_{max}, or MP. However, there were time effects ($p<0.05$) for RPE (VIE1<VIE2) and PP (VIE1>VIE2). No differences were found between trials (CHO vs. PL) for one-minute performance for HR (190±9 vs. 189±9 bpm), %HR_{max} (97.0±3.2 vs. 96.6±3.0 %), RPE (7.8±2.3 vs. 8.1±1.9), PP (238±70 vs. 235±60 W), FI (54.7±10.0 vs. 55.9±12.8 %), and TW (9.37±2.6 vs. 9.37±2.1 kJ). **CONCLUSION:** A 6% CHO drink is ineffective at improving one-minute performance following 30-minutes of VIE in pre-pubertal girls. Based upon the current findings, CHO supplementation does not appear to be beneficial with respect to improving performance for prepubescent children completing VIE activity lasting 30-minutes.

C-38 Free Communication/Poster - Nutrition and Energy Metabolism

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1406 Board #168 May 30 10:30 AM - 12:00 PM
Influence Of Sports And Energy Intake On BMD In Female Athletes Compared To Sedentary Controls

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(No relevant relationships reported)

Physical activity, particularly percussive activities with adequate energy intake may influence bone mineral density (BMD) in young female adults. Unfortunately, it is common to see energy deficiencies in this population that can put them at risk of health issues including lower BMD. **PURPOSE:** To determine the influence of the type of sport and energy intake on BMD in female athletes compared to sedentary students. **METHOD:** Seventy-three female students (age 20.8±1.9 y, height 167.4±8.8 cm, weight 62.3±9.2) from McGill University were evaluated (44 from McGill Varsity Teams: basketball (BB n=13), volleyball (VB n=11), figure skating (FS n=13), and synchronized swimming (SS n=7); and 29 sedentary healthy women (controls). Dietary intake (kcal/day) was assessed using a 3-day Food Log and analysed with the Food Processor™ Software. Lumbar spine (LS) (L1-L4) and femoral neck (FN) BMD were assessed by DXA scanning. A one-way ANOVA explored between-group differences and an ANCOVA examined the influence of energy intake on BMD. **RESULTS:** A significant difference in BMD at the LS and FN sites was observed between the type of sports ($F(4,68) = 8.6, p < .001, \eta^2 = .335$; $F(4,68) = 6.3, p < .001, \eta^2 = .272$, respectively). Also, BB (LS = 1.7±1.53, $p < .001$; FN = 1.7±1.13, $p = .001$) and VB (LS = 1.5±1.55, $p = .001$; FN = 1.7±1.66, $p = .002$) players had a significantly higher BMD in both sites compared to their non-athletic counterparts (LS = -0.3±1.19; FN = 0.1±1.04). The FS and SS athlete's bone densities were not different from the control group ($p = .719$; $p = .246$). No significant association was observed between BMD at both sites and total energy intake/day across all groups ($F(1,67) = .496, p = .484, \eta^2 = .007$; $F(1,67) = .035, p = .852, \eta^2 = .001$). There was a significant difference between the delta energy intake (recommended intake minus actual intake) in both BB and SS groups compared to the control group ($p = .003$ and

$p = 0.02$, respectively). **CONCLUSION:** The type of sport revealed an influence on BMD. However, no significant relationship was observed between energy intake and BMD. A significant discrepancy was found between the required versus actual energy intake in some athletes. These data suggest that female varsity athletes should work closely with sports dietitians to promote healthy eating and optimize bone health.

1407 Board #169 May 30 10:30 AM - 12:00 PM
The Role of Acute Fasting on Substrate Utilization During Submaximal Exercise

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(No relevant relationships reported)

Purportedly, performing 20 minutes of aerobic exercise following an overnight fast has a greater effect on fat loss than in the postprandial state. Theoretically, a fast may attenuate glycogen stores, thus shifting to the utilization of increased free fatty acids, and resulting in greater fat burn throughout exercise. **Purpose:** To determine if exercising at a titrated intensity, as determined by equal fat and carbohydrate fuel utilization, will elicit more fat utilization in a fasted state when compared to a fed state. **Methods:** 13 (12♂) asymptomatic (ht. 176.6±2.9 cm; wt. 79.1±17.2 kg), healthy college students (age range 19-24) who regularly engage in aerobic exercise a minimum of twice per week volunteered for the study. During familiarization, individual treadmill workloads were titrated by using a ramp protocol (speed increase of 13.4 m/min) at 1% grade to achieve a RER of .85. All trials were preceded by a 12 hr fast w 24 hr abstinence from alcohol & caffeine, and 30 minutes of rest immediately prior to the trial. The fasted trial (Fa) required 25 minutes of rest and 5 min of measured resting metabolism (RMR) prior to the treadmill exercise, while the fed trial (Fe) required ingestion of 450 kcal (74% CHO, 14% pro, & 12% fat) in 10 minutes with 15 minutes of rest immediately prior to 5 min of RMR. Single blind randomization determined trial cross over order. Blood glucose (BG) was obtained by finger stick. Statistical analysis by paired samples T-test were applied to these data ($p<0.05$). **Results:** The RER at RMR of 0.88 Fe & 0.83 Fa, was significantly different, however, exercise $\dot{V}O_2$ of 2.46±0.8 & 2.36±0.8 and RER of 0.89 & 0.87 for Fe & Fa, respectively, was NSD ($p>0.05$). BG pre and post exercise of 81.3±9.2 & 61.8±9.1 for Fe and 80.9±5.5 & 85.5±10.1 mg/dL for Fa was NSD for Fa. **Conclusion:** A 12 hr fast can alter resting fuel substrate, but exercise fuel sources are unaffected. Reductions in BG from exercise during the fed state may be attributed to fuel use, however the maintenance of BG in the fasted state may be related to glucagon release. Relative to fat expenditure, there is no advantage to exercising in an acute fasted state (12 hr) or in a fed state, however an extended fast may provide a different outcome.

1408 Board #170 May 30 10:30 AM - 12:00 PM
Effects of Concussion on Whole-Body Energy Metabolism and Caloric Intake: A Preliminary Investigation

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(No relevant relationships reported)

PURPOSE: Prior studies suggest changes in resting metabolic rate (RMR) and brain substrate use in severe traumatic brain injuries (TBI). However, no data exist in humans with concussion. The purpose of this study was to examine the effect of concussion on RMR, estimated substrate use, and diet throughout recovery in male and female athletes.

METHODS: Concussed participants ($N = 25$ [13 males, 12 females]) were recruited from a university and local high schools. RMR was determined by indirect calorimetry < 72 hours following a diagnosed concussion (T1), 7 days after T1 (T2), and 14 days after T1 (T3). Percent carbohydrate (CO) and lipid (LO) oxidation were calculated from $\dot{V}O_2$ and $\dot{V}CO_2$. Dietary intake was self-reported for the day of and two days following each time point. Total caloric intake (kcal) and percentage from carbohydrates (CI), proteins (PI) and lipids (LI) were calculated. Separate repeated measures ANOVAs were used to assess sex by time changes in RMR and CI. Descriptive statistics were used to assess macronutrient intake and use. **RESULTS:** Participant demographics, metabolic, and nutrient data are in Table 1. RMR did not change over time ($p = .49, \eta^2 = .03$) and sex did not significantly influence RMR over time ($p = .08, \eta^2 = .11$). Total kcal decreased over time ($p = .002, \eta^2 = .32$) such that intake at T1 was greater than T2 and T3, and there were no effects of sex over time ($p = .20, \eta^2 = .10$). CO appeared to increase over time.

CONCLUSION: Our preliminary data suggest that concussions may influence whole-body and carbohydrate metabolism in a sex specific manner. While not significant, there was a moderate effect of sex on RMR where males increased from T1 to T3 and females did not, and there may have been an acute decrease in CO which elevated

throughout recovery. CI was elevated acutely and decreased throughout recovery, but macronutrient intake ratios did not drastically change. Further investigations of these measures with a larger sample size is warranted given our preliminary data.

Table 1. Demographic, Substrate Utilization, and Food Preference Descriptive Statistics*

	T1			T2			T3		
	Total (n=25)	Males (n=13)	Females (n=12)	Total (n=24)	Males (n=12)	Females (n=12)	Total (n=25)	Males (n=11)	Females (n=12)
Age (years)	18.5(1.9)	18.9(1.7)	18.0(2.0)						
BMI (kg/m ²)	24.2(4.35)	26.2(5.12)	22.9(1.65)						
RMR (kcal/d)	1057.5(309)	1224.4(336)	876.8(129)	1050.7(289)	1205.7(326)	895.7(115)	1061.7(296)	1276.6(272)	864.7(139)
Average Daily Substrate Use									
CO (%)	35.8(21.0)	33.2(18.0)	38.6(24.3)	37.5(21.0)	37.7(22.9)	37.3(20.1)	43.3(23.8)	42.4(22.5)	44.2(26.0)
LO (%)	64.2(20.1)	66.8(18.0)	61.4(24.3)	62.5(21.0)	62.3(22.9)	62.7(20.1)	56.7(23.8)	57.6(22.5)	44.2(26.0)
Average Daily Dietary Intake									
Total (kcal/d)	2006.4(697)	2291.1(967)	1745.5(373)	2009.3(697)	2328.3(732)	1719.3(542)	1743.3(572)	2029.6(660)	1561.1(428)
CI (%)	44.8(4.9)	43.7(4.1)	45.7(5.5)	47.8(7.6)	44.0(7.6)	50.8(6.4)	46.1(7.6)	44.0(7.3)	47.3(7.8)
PI (%)	17.7(4.1)	17.8(4.4)	17.6(4.1)	17.3(4.0)	17.4(3.6)	17.2(4.5)	17.4(3.1)	17.7(3.4)	17.2(3.1)
LI (%)	37.5(4.3)	38.5(3.5)	36.7(4.8)	35.9(6.2)	38.6(5.5)	32.0(5.4)	36.5(7.5)	38.4(8.3)	35.5(7.3)

*Presented as Mean(SD)

1409 Board #171 May 30 10:30 AM - 12:00 PM Effects of Time Restricted Feeding on Peak VO₂ and Substrate Utilization in Healthy Adults

Corbyn R. Bendtsen, Megan M. Coyle, Megan M. Lind, Nicole L. Schweitzer, Eric A. Norman, Lauren M. Kaminski, Cassandra A. Fileccia, Marquel A. Fleischacker, Andrew L. Kezar, Emma P. Masiulewicz, Justin R. Geijer. *Winona State University, Winona, MN.*

(No relevant relationships reported)

Time Restricted Feeding (TRF) is a type of Intermittent Fasting, which refers to the finite time to intake calories during the day. TRF has become a dietary approach that is used for weight loss and overall health. Individuals that partake in TRF may experience a decrease in peak volume of oxygen uptake (VO_{2peak}) due to minimization of glycolytic stores. To date, few studies have compared the impact of TRF on VO_{2peak}. **PURPOSE:** The current study aimed to further investigate the metabolic impact of TRF. **METHODS:** Twenty one participants, ages 18-60, completed an eleven week longitudinal study to examine differences in VO_{2peak}, substrate utilization crossover, and resting substrate utilization. Participants self-reported diet, exercise, sleep, and medications over two separate four week periods. The first four weeks were without TRF and the following four were with TRF. A maximal exercise test and a resting metabolic test were performed three times, four weeks apart from each other. A repeated measures ANOVA was performed to determine within subject differences. A post-hoc analysis was performed to determine the time effect. **RESULTS:** VO_{2peak} was significantly lower after implementing TRF ($p < 0.001$). The mean pre-test VO_{2peak} was 2.95 ± 0.59 L/min and the non-TRF testing was 3.14 ± 0.68 L/min. During TRF, the mean was 2.76 ± 0.54 L/min. There was a significant difference between the pre-test and TRF ($p = 0.012$). Also, there was a significant difference between non-TRF and TRF ($p = 0.002$). Resting RQ showed a significant increase ($p < 0.004$). The pre-test mean for resting RQ was 0.716 ± 0.071 . Non-TRF resting RQ had a mean of 0.736 ± 0.082 and the TRF resting RQ was 0.802 ± 0.097 . There was a significant difference between the pre-test and TRF ($p = 0.010$). Substrate utilization crossover showed a significant decrease ($p < 0.03$) in fat usage after TRF implementation. There was a significant difference between the pre-test (123.9 ± 30.1 watts) and TRF (98.8 ± 30.1 watts; $p = 0.05$). **CONCLUSION:** An earlier crossover of substrate utilization implies a decrease in fat usage and an increase in carbohydrate usage, therefore significantly lowering fat oxidation and VO_{2peak}. Future studies are needed to examine the physiological mechanisms that may lead to shifts in substrate utilization during TRF.

1410 Board #172 May 30 10:30 AM - 12:00 PM The Impact of Energy Balance on Sleep Time and Recovery

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(No relevant relationships reported)

In female athletes, prolonged energy deficits have been demonstrated to negatively influence performance, recovery, and impair sleep. **PURPOSE:** The purpose of this study was to evaluate the relationship between energy status, sleep quality, recovery and training satisfaction in Division II female lacrosse players. **METHODS:** Twenty-two female lacrosse players (20.4 ± 1.79 years, 69.1 ± 8.7 kg, 168 ± 6.3 cm, $28.1 \pm 2.99\%$ fat) wore a physical activity monitor to assess total daily energy expenditure (TDEE) and recorded dietary intake using MyFitnessPal over a four-day period during NCAA season play. Energy balance over the four-day period was then calculated based on the sum of total energy in – TDEE. Upon returning the physical activity

monitor, players also completed a questionnaire that assessed total sleep, sleep quality, ratings of recovery, soreness and satisfaction with training using visual analog scales. **RESULTS:** Players presented with an average energy deficit of $-1,186.85$ kcal/d ($SD = 813.09$) and an average of 6.77 ($SD = 1.02$) hrs. of sleep per night. Those in a state of higher energy balance reported more hours of sleep ($r = 0.641$, $p = 0.001$), felt more rested ($r = 0.535$, $p = 0.01$) and were more satisfied with training ($r = 0.484$, $p = 0.023$). **CONCLUSION:** Our results imply that an improved energy state helps to facilitate an increase in total hours slept. An improved energy state also appears to result in athletes feeling more rested and satisfied with training during the competitive season. Female lacrosse players demonstrated that a more favorable state of energy balance appears to be associated with more total hours of sleep, feeling better rested and being more satisfied with training. Therefore maintaining a positive energy balance should be a primary focus for coaches and athletes to help promote optimal training, performance, and recovery.

1411 Board #173 May 30 10:30 AM - 12:00 PM “Train-high Sleep-low” Dietary Periodization Does Not Alter Ventilatory Strategies During Cycling Exercise

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(No relevant relationships reported)

“Train-high sleep-low” (THSL) dietary periodization elicits favorable adaptations within skeletal muscle, and improves endurance exercise performance. The effect of THSL on ventilatory patterns during exercise, however, has received little attention. If THSL alters ventilatory strategies during exercise, then exercise intensities and adaptations may unknowingly be influenced. **PURPOSE:** To investigate the effects of short-term exposure to THSL dietary periodization on ventilatory strategies during cycling exercise at submaximal and maximal intensities. **METHODS:** Eight trained men [age (mean \pm SEM) = 28 ± 1 y; $\dot{V}O_{2peak} = 56.8 \pm 2.4$ mL \cdot kg⁻¹ \cdot min⁻¹] completed a glycogen-depleting protocol on a cycle ergometer. Afterwards, participants were given a low carbohydrate (CHO) meal and beverages containing either no additional CHO (THSL) or beverages containing 1.2 g \cdot kg⁻¹ CHO [traditional CHO replacement (TRAD)]. The following morning, participants completed 4 min of cycling below (Stage 1), at (Stage 2), and above (Stage 3) gas exchange threshold, followed by a 5 km time-trial. Metabolic data were collected continuously throughout exercise. Inspiratory capacity maneuvers were performed in the last minute of each stage as well as during the time-trial, for calculation of expiratory reserve volume (ERV) and inspiratory reserve volume (IRV). **RESULTS:** Respiratory exchange ratio (RER) was significantly lower ($P < 0.01$) in THSL compared to TRAD at every exercise stage. During Stage 1, $\dot{V}O_2$ was 37.9 ± 1.5 mL \cdot kg⁻¹ \cdot min⁻¹ in the TRAD condition and 39.6 ± 1.8 mL \cdot kg⁻¹ \cdot min⁻¹ in THSL ($P = 0.05$). During Stage 2, $\dot{V}O_2$ was 44.6 ± 1.7 mL \cdot kg⁻¹ \cdot min⁻¹ in the TRAD condition and 47.0 ± 1.9 mL \cdot kg⁻¹ \cdot min⁻¹ in THSL ($P = 0.07$). No differences in \dot{V}_E , V_T , or $\dot{V}CO_2$ occurred between conditions at any exercise intensity ($P > 0.05$). No change in ERV or IRV was detected between dietary conditions at any exercise intensity ($P > 0.05$). 5 km time-trial performance was significantly faster in TRAD compared to THSL (8.7 ± 0.3 min and 9.0 ± 0.3 min, respectively; $P = 0.02$). **CONCLUSIONS:** THSL dietary periodization does not alter $\dot{V}E$, $\dot{V}CO_2$, V_T , ERV, or IRV when cycling at submaximal or maximal intensities. THSL impairs performance immediately following the dietary intervention, and may influence $\dot{V}O_2$ at submaximal intensities.

1412 Board #174 May 30 10:30 AM - 12:00 PM Low Carbohydrate Intake Is Related To Energy Deficiency And Hypometabolism In Physically Active Population

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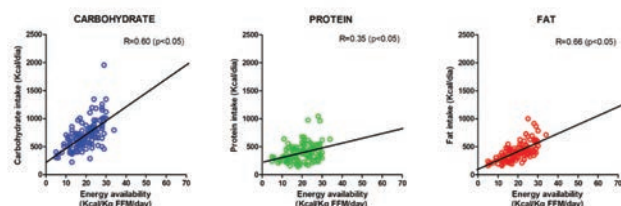
(No relevant relationships reported)

PURPOSE: The aim of this study was to analyse metabolic factors associated to energy availability deficiency (EAD) in physically active people. **METHODS:** We evaluated 147 physically active people. The free fat mass (FFM), caloric intake (CI) and energy expenditure (EE) were analysed by Petroski (1995) protocol, 3-day self-reported food journal and metabolic equivalent calculation, respectively. Energy deficiency was assumed at ≤ 30 Kcal/Kg FFM/day by the EA equation: $(CI - EE) \times FFM$ (kg)⁻¹. The hypometabolism was diagnosed when the ratio between resting metabolic rate (measured by indirect calorimetry) and Cunningham equation values was < 0.90 . The associations were analysed by Pearson correlation, Chi-squared, Odds Ratio (IC 95%) and Fisher's tests, considering $p < 0.05$. **RESULTS:** We observed 80% of EAD. The hypometabolism was presented in 37% of ED people. Also, they had carbohydrate (2.8 ± 1.1 g/kg bw) and fat (0.76 ± 0.3 g/kg bw) consumption below the recommendations. As expected, the lower macronutrients caloric intake

were related to reduced energy availability in EAD sportspeople (carb., $r=0.60$; prot., $r=0.35$ e; fat, $r=0.66$; $p<0.05$). Interestingly, the magnitude of its reductions was greater in carbohydrate, analysed by slope curves (carb., 25 ± 3 ; prot., 9 ± 2 ; fat, 16 ± 2 ; $p<0.001$). In addition, only carbohydrate intake was independently associated to hypometabolism in EAD population (OR, 2.91; IC 95%, 1.08 - 7.82; $p<0.05$).

CONCLUSION: Low carbohydrate intake is the major diet contributors to energy deficiency and hypometabolism development in physically active people. It may impair the weight loss protocols.

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Diet factors associated to hypometabolism in physically active population

	Odds ratio	95% IC	p values
Carbohydrate (g/kg bw)	2.912	1.085 to 7.815	0.031
Protein (g/kg bw)	0.6019	0.2767 to 1.309	0.244
Fat (g/Kg bw)	0.6706	0.1918 to 2.345	0.529

1413 Board #175 May 30 10:30 AM - 12:00 PM

Acute Carbohydrate Restriction During Recovery From Prolonged Exercise Enhances Intramuscular Triglyceride Resynthesis

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(No relevant relationships reported)

Intramuscular triglyceride (IMTG) is an important substrate during moderate-intensity exercise, but providing a high carbohydrate (CHO) diet following exercise impairs IMTG resynthesis. Restricting CHO intake in the post-exercise period may augment the adaptive response to exercise, but whether this strategy enhances IMTG resynthesis is not known. Furthermore, because the lipid droplet (LD)-associated perilipin (PLIN) proteins promote IMTG storage, their distribution and interaction with LD may determine their role in post-exercise IMTG resynthesis. **Purpose:** To determine the effect of acutely restricting CHO during recovery from prolonged exercise on IMTG resynthesis and PLIN protein dynamics. **Methods:** 14 male triathletes (27.1 ± 1.3 y, 66.5 ± 1.3 ml.kg⁻¹.min⁻¹) completed 4 h of cycling at $\sim 56\%$ $\dot{V}O_{2max}$. In the initial 4 h period following exercise 7 participants consumed a high CHO diet whereas 7 participants consumed only water. For the remaining recovery period (20 h) all participants received the same CHO-rich diet. Muscle samples collected pre and post-exercise, and 4 and 24 h post-exercise were analysed using confocal immunofluorescence microscopy to determine muscle fibre type-specific IMTG content and PLIN localisation to LDs. **Results:** Exercise reduced IMTG content in type I fibres ($\sim 53\%$, $P<0.05$), with LD both associated and not associated with PLIN2, PLIN3, and PLIN5 being used. During recovery, IMTG content tended to increase in type I fibres after 4 h in the water condition only ($+63\%$, $P=0.076$), and at 24 h IMTG content was similar to pre-exercise levels ($P=0.987$). Despite no change in PLIN protein content, the number of LD with PLIN2 or PLIN3 associated tended to increase during recovery in type I fibres only ($P=0.08$), and to a similar extent between conditions, whereas the number of LD with PLIN5 associated only increased in the CHO condition ($P=0.002$). **Conclusion:** Acute restriction of CHO during recovery from prolonged exercise has a tendency to initially enhance IMTG resynthesis, although a CHO-rich diet does not impair overall IMTG resynthesis 24 h later. A redistribution of PLIN proteins appears to support post-exercise IMTG resynthesis, but the predominant PLIN isoform supporting post-exercise IMTG storage may be dependent on post-exercise CHO availability.

1414 Board #176 May 30 10:30 AM - 12:00 PM

Energy Availability In Physically Active Males And Females Across A 12- Week Tactical Training Programme

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(No relevant relationships reported)

ACSM SCIENTIFIC ABSTRACT

INTRODUCTION: Tactical training personnel are exposed to frequent intense physical activity and sleep deprivation, the combination of which may compromise health. Insufficient energy availability (EA) can exacerbate these issues. **PURPOSE:** The aims of this study were to investigate in tactical training personnel, i) energy intake (EI), exercise energy expenditure (EEE) and EA, ii) reported injury and illness incidence and iii) dietary intake vs. estimated nutritional recommendations. **METHODS:** On four consecutive days during two weeks of tactical training, nine weeks apart, participants recorded all food eaten in a smartphone application (Nutritics Education v4.315, 2011). Injury and illness incidence were recorded weekly using the Oslo Sports Trauma Research Centre Questionnaire on health problems and the females completed the Low Energy Availability in Females Questionnaire (LEAF-Q) to assess risk of low energy availability (LEA). **RESULTS:** Mean daily EI was 2523 (± 469) kcal for males and 2182 (± 380) kcal for females. EEE increased significantly from W1 (Mean = 656 kcal, ± 76) to W2 (Mean = 842 kcal, ± 93) $P<0.001$. Insufficient carbohydrate (3.3g/kg BW/day vs. recommended 6g/kg BW/day, $P<0.001$) and excess fat consumption was observed (37% dietary energy (DE) vs. the recommended 20-35% DE). There were 274 reported health problems; 160 injuries and 114 illnesses. Of females, 59% were classified as at risk of LEA. **CONCLUSIONS:** These findings demonstrate the need to improve awareness of EA during training for health and performance. Implementation of adequate fueling strategies is necessary for tactical training personnel to optimise health and performance.

1415 Board #177 May 30 10:30 AM - 12:00 PM

The Effects of Endurance Training Under Low Energy Availability on Muscle Glycogen Contents

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(No relevant relationships reported)

PURPOSE: Some previous studies demonstrated that acute bout of exercise suppressed appetite and reduced energy intake among athletes. However, the accumulative effects of reduced energy intake during consecutive days of training period remains unclear. The purpose of the present study was to investigate the influences of 3 days of endurance training under low energy availability on muscle glycogen content, endocrine responses and endurance capacity. **METHODS:** Seven male long distance runners (19.9 ± 0.4 years, 175.6 ± 1.8 cm, 61.4 ± 2.0 kg, 67.5 ± 1.6 ml/kg/min) completed 3 consecutive days of endurance training under low energy availability trial (LEA, 18.9 ± 0.7 kcal/kg FFM/day) and normal energy availability trial (NEA, 52.9 ± 1.9 kcal/kg FFM/day). The order of two trials was randomized with two weeks interval between trials. The experiment consisted of 3 consecutive days of endurance training (days 1-3) and exercise performance test on the following morning (day 4). The endurance training consisted of 75 min of treadmill running at 70% of maximal oxygen uptake ($\dot{V}O_{2max}$) in both trials. Muscle glycogen contents, respiratory gas variables, subjective parameters, blood and urinal variables were evaluated in the morning during 3 days of training periods (day 1-day 3) and on the following morning after the training (day 4). As an indication of endurance capacity, time to exhaustion during submaximal running test was determined on day 4. **RESULTS:** LEA trial showed that body weight, free fat mass and skeletal muscle volume were significantly reduced during training period ($P<0.05$). Also, muscle glycogen contents were significantly decreased in LEA ($P<0.001$) with significant lower values than those in NEA trial ($P<0.001$). Blood glucose, serum free testosterone and insulin like growth factor-1 concentrations were significantly lowered with training under LEA ($P<0.05$). On the other hand, serum leptin concentration did not change significantly in LEA trial during training period ($P>0.05$). Time to exhaustion during submaximal running test evaluated on day 4 was not significantly different between LEA trial (1170 ± 127 s) and NEA trial (1361 ± 196 s, $P>0.05$). **CONCLUSION:** Three consecutive days of endurance training under Low EA reduced muscle glycogen content. However, endurance capacity was not attenuated.

1416 Board #178 May 30 10:30 AM - 12:00 PM
Acute Effects of Exercise With and Without Energy Replacement on Energy Expenditure and Substrate Utilization

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(No relevant relationships reported)

It has been well documented that exercise of sufficient energy expenditure can elicit an increase in fat oxidation that persists following exercise. However, whether and how this exercise-induced metabolic benefit would be affected by replacing the energy expended during exercise remains unclear. **Purpose:** To compare energy expenditure and substrate utilization between exercise with and without energy replacement at rest and during exercise. **Methods:** Fourteen healthy and recreationally trained subjects including 7 men and 7 women volunteered to participate in this study. Each subject underwent three 2-day experimental protocols in a random order. Each protocol consisted of no exercise (NE), exercise only (EO), or exercise with energy replacement (ER) on day 1 that was followed by metabolic assessment that took place in a fasted condition on day 2. The exercise in EO and ER was a treadmill running at 60% $\dot{V}O_{2\max}$ that induced an energy expenditure of 500 kilocalories. The replacement meal used in ER contained 500 kilocalories made up by 45% carbohydrate, 30% fat, and 25% protein. During the metabolic assessment, oxygen uptake ($\dot{V}O_2$), heart rate (HR), respiratory exchange ratio (RER), and rates of carbohydrate (COX) and fat oxidation (FOX) were determined in three successive 10-min periods that included rest, exercise at 50% $\dot{V}O_{2\max}$ and exercise at 70% $\dot{V}O_{2\max}$. **Results:** No differences in $\dot{V}O_2$ and HR were found at rest between NE, EO, and ER. However, RER was lower in EO than NE (0.840 ± 0.014 vs. 0.889 ± 0.012 , $p < 0.05$), COX ($\text{g} \cdot \text{min}^{-1}$) was lower in ER than NE (0.144 ± 0.016 vs. 0.197 ± 0.019 , $p < 0.05$), and FOX ($\text{g} \cdot \text{min}^{-1}$) was higher in either EO or ER than NE (0.054 ± 0.010 or 0.057 ± 0.009 vs. 0.034 ± 0.007 , $p < 0.05$). When these variables were compared under the exercise conditions, no treatment effects were noted for all variables at either intensity. **Conclusion:** Our results demonstrate that an acute bout of aerobic exercise can elicit an increase in fat oxidation even when the exercise-induced energy deficit is replaced by energy intake. These findings suggest that factors other than caloric deficit mediate the exercise-induced lipolytic effect.

1417 Board #179 May 30 10:30 AM - 12:00 PM
Comparing Liver And Skeletal Muscle Sensitivity In Response To Acute And Chronic Calorie Restriction

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(No relevant relationships reported)

PURPOSE: We determined the effects of acute and chronic calorie restriction on hepatic and skeletal muscle insulin sensitivity. **METHODS:** Twenty-three obese subjects (body-mass index, $36.3 \pm 0.7 \text{ kg/m}^2$) followed an energy-deficit diet (1,200kcal/day). Magnetic resonance spectroscopy, muscle biopsies, and a euglycemic-hyperinsulinemic clamp were used to determine insulin action, cellular insulin signaling and intrahepatic triglyceride content before, after 48-h, and after ~12 wks (7% weight loss) of diet therapy. **RESULTS:** Intrahepatic triglyceride content significantly decreased at both 48-h ($-16.6 \pm 2.3\%$, $p < 0.001$) and 7% weight loss ($-40.7 \pm 6.2\%$; $p < 0.001$) compared to baseline. Basal glucose production rate significantly decreased at 48-h ($-21.8 \pm 3.2\%$, $p < 0.001$) and after 7% weight loss ($-20.8 \pm 3.4\%$, $p < 0.001$). Insulin-mediated glucose uptake did not significantly change at 48-h ($-5.2 \pm 12.8\%$, $p > 0.05$) but did significantly increase at 7% weight loss ($26.1 \pm 4.3\%$, $p < 0.05$). Insulin-stimulated phosphorylation of Jun N-terminal kinase did not change at 48-h ($-0.2 \pm 16.2\%$, $p > 0.05$) but did significantly decrease at 7% weight loss (-29.9 ± 12.6 , $p < 0.05$) and phosphorylation of Akt increased by $15.2 \pm 14.6\%$ ($p > 0.05$) and $36.2 \pm 8.8\%$ ($p < 0.05$), after 48-h and 7% weight loss, respectively. **CONCLUSION:** A low calorie diet acutely reduced intrahepatic triglyceride content and improved hepatic insulin sensitivity whereas moderate weight loss is necessary to improve insulin sensitivity in the skeletal muscle.

1418 Board #180 May 30 10:30 AM - 12:00 PM
Neither Autophagy Inhibition Nor High Intensity Interval Training Alter Exercise Adaptations During High Fat Feeding

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(No relevant relationships reported)

Obesity and associated comorbidities remain a significant health crisis. Exercise mitigates many of these pathologies, however, controversy remains on optimal exercise types for favorable adaptations. More so, mechanisms underlying these adaptations are not fully understood. Evidence suggests autophagy (cellular degradation and recycling of proteins) may be an important mediator for adaptations, however, the necessity of autophagy, specifically autophagosome formation, on exercise adaptations during obesity has yet to be investigated. **PURPOSE:** To investigate the individual and combined effects of different exercise interventions and autophagy inhibition on glucose handling and exercise capacity after high fat feeding. **METHODS:** C57BL/6J male mice initiated 45% high fat diet at 8 wks of age. After 6 wks of high fat diet, animals were divided into moderate intensity (MOD) or high intensity interval training interventions (HIIT), animals were further subdivided into autophagy inhibition (AI) or control (CON) conditions. Animals exercised their respective protocols 3X/wk; work and average intensity were matched between exercise groups. Autophagy was inhibited by 3X/wk injections of NSC185058 at 100mg/kg of bodyweight, to block autophagosome formation, CON animals received vehicle injections. Animals continued interventions for 4 wks. Glucose tolerance tests (GTTs) and graded exercise tests (GXTs) were completed pre-high fat diet, pre-interventions, and post-interventions. **RESULTS:** High fat diet resulted in impaired glucose handling (~20% increase in glucose area under the curve (AUC)), while exercise interventions normalized glucose handling to pre-exercise levels, without any differences between groups. Additionally, high fat diet induced a ~20% lower aerobic capacity, which were normalized to baseline values after exercise interventions. AI animals had ~2.5g of weight loss from pre- to post- exercise interventions with no differences noted in CON animals. **CONCLUSIONS:** When exercise intensities and total work are matched, HIIT and MOD confer similar adaptations on exercise capacity and glucose tolerance in high fat fed mice. Also, late stage autophagy inhibition does not influence exercise adaptations, but does appear to influence body weight, which warrants further investigation.

1419 Board #181 May 30 10:30 AM - 12:00 PM
Effects of Time Restricted Feeding on Resting Energy Expenditure and Respiratory Quotient

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(No relevant relationships reported)

Time restricted feeding (TRF) is a form of dietary intake which limits the feeding time in a day. Researchers have observed weight loss and improved body composition as the original motivators for investigation of TRF. With a variation in energy intake during TRF, resting energy expenditure (REE) has been shown to increase with high caloric consumption. An increase in REE is also associated with an increase in fat free mass and physical activity. Respiratory quotient (RQ) demonstrates the ratio between CO_2 production and O_2 uptake, determining substrate utilization at rest. RQ has been shown to change through altered macronutrient intake. Studies indicate, a diet high in carbohydrate intake increases RQ whereas diets high in fat intake have been shown to lower RQ. RQ has also been found to decrease when subjects partake in endurance training. **Purpose:** The intent of this study was to determine the impact TRF may have on REE and RQ. **Methods:** Thirty-four apparently healthy adults ages 19-51 participated in 4 weeks non-TRF and 4 weeks of TRF. The feeding window for the TRF was a nine-hour period. Participants were provided journals over the course of the study to self-record caloric intake, exercise type, and duration. REE and RQ were measured using a metabolic cart initially, after 4 weeks of non-TRF, and 4 weeks after TRF. Data was analyzed using IBM SPSS statistics. **Results:** RQ increased significantly between pretest (0.721 ± 0.015) and TRF testing (0.808 ± 0.02) ($p = 0.01$). No significance was found between non-TRF and TRF. REE had no significant difference between any of the three testing periods ($p = 0.233$). There was no significant change in caloric intake throughout the testing ($p = 0.94$). A significant decrease was found in total exercise days between non-TRF and TRF periods ($p = 0.023$). **Conclusion:** This study did not find a significant change in REE during TRF. The increase in RQ may be attributed to increases in carbohydrate intake. Caloric intake was hypothesized to increase the first couple of days due to the time-restricted nature, but overall was not

hypothesized to have a significant impact on energy intake or REE. Future studies should investigate the impact of TRF on macronutrient intake and carbohydrate utilization at rest.

1420 Board #182 May 30 10:30 AM - 12:00 PM
Resistance Exercise-mediated Improvements In Post-prandial Metabolic Responses Are Related To Exercise Volume And Muscle Mass

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 (No relevant relationships reported)

PURPOSE: To examine the effects of full-body resistance exercise on the post-prandial metabolic response to a high-fat meal (HFM) in healthy men. **METHODS:** Ten males (mean \pm SD, age = 24 ± 3 y, BMI = 26.8 ± 2.9 kg/m²) participated in this randomized, repeated measures, crossover study. Participants visited the laboratory for familiarization, and baseline strength and body composition testing. They then returned to the laboratory and completed either a session of resistance exercise (RE), consisting of three sets of 8 exercises using a 12 repetition maximum load, or no exercise (NE) and consumed a protein shake (300 - 400 kcal; protein = 0.3/kg) as their last meal. After a 12-h overnight fast, participants consumed a HFM (12 kcal/kg, 63% fat, 34% carbohydrate). Blood draws were performed prior to, and 1-, 3-, and 5-h post-meal to determine triglyceride (TG), glucose (GLU), and total metabolic load index (MLI; sum of TG and GLU) responses. Three separate, 2 (Condition) \times 2 (Time) repeated measures ANOVAs were used to examine the TG, GLU, and MLI responses. Zero-order correlations and stepwise multiple regression analyses were used to examine the relationships and relative contributions of RE volume (VOL) and skeletal muscle mass (SMM) to the change in MLI from NE to RE (Δ MLI). **RESULTS:** There were significant condition \times time interactions for TG ($F_{3,27} = 3.5$; $p = 0.03$) and MLI ($F_{3,27} = 3.0$; $p < 0.05$). Both TG and MLI were lower at 3- (TG, 152.6 ± 74.8 vs. 182.4 ± 103.9 mg/dL; MLI, 224.2 ± 72.9 vs. 257.4 ± 106.8 au) and 5-h (TG, 132.2 ± 85.3 vs. 175.6 ± 118.0 mg/dL; MLI = 210.5 ± 86.3 vs. 260.2 ± 119.0 au) post HFM in the RE versus NE condition, respectively. There were condition ($F_{1,9} = 8.9$; $p = 0.02$) and time main effects ($F_{3,27} = 8.4$; $p < 0.01$) for GLU. GLU was lower in the RE (76.4 ± 7.1 mg/dL) than NE (82.4 ± 6.8 mg/dL) condition and decreased from baseline (88 ± 3.6 mg/dL) to 1- (74.6 ± 6.4 mg/dL), 3- (73.3 ± 2.4 mg/dL), and 5-h (81.5 ± 4.5 mg/dL). Both VOL ($r = 0.66$) and SMM ($r = 0.80$) were independently related to, and significantly contributed to the prediction ($R^2 = 0.76$; beta coefficients = VOL [-1.03] and SMM [1.79]) of Δ MLI. **CONCLUSIONS:** A session of full-body resistance exercise improves the postprandial metabolic response to a HFM in healthy men. Further, VOL and SMM explained 76% of the variance in the metabolic response improvement caused by resistance exercise.

1421 Board #183 May 30 10:30 AM - 12:00 PM
Energy Expenditure and Load Carriage Exceeded Military Recommendations in Special Operations Forces Deployed to Afghanistan

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U.S. Army Special Operations Forces (SOF) undergo difficult missions in extreme environments, oftentimes while carrying heavy loads, the combination of which results in a high energy output. Energy expenditure in excess of intake may result in weight loss and impaired performance. In a scenario where energy demands consistently exceed intake, Soldiers are at increased risk of injury and mission compromise. **PURPOSE:** To determine the energy expenditure of SOF Soldiers based on present-day missions in the Central Command (CENTCOM) region. **METHODS:** Demographics of the participants were as follows: age (yrs) 30.3 ± 3.5 , height (in) 70.65 ± 2.8 , weight (lbs) 195.2 ± 24 , enlisted (86%), officer (7%), warrant officer (7%), years in the Army 8.3 ± 3.9 , and total time deployed during career (yrs) 1.26 ± 1.2 . Surveys were collected from 46 SOF Soldiers operating in eight locations in the CENTCOM theater of operations. Information from the surveys revealed the mission energy requirements and difficulty of exertion pre-, during-, and post-mission. A physical activity factor was determined based on multiple aspects surrounding mission intensity and used to calculate estimated energy expenditure based on a SOF-specific equation. **RESULTS:** During a six-month deployment, participants underwent a multitude of missions (17.25 ± 8.66). Ninety percent of respondents reported carrying a load 40% heavier than the recommended fighting load (32.9 ± 8.62 vs. 21.8 kg, respectively) based on military doctrine. Average estimated energy expenditure (4848 ± 525 kcal-day⁻¹) far exceeded the military dietary reference intake of 3400 kcal-day⁻¹. All but three respondents reported a rate of energy expenditure exceeding the benchmark of 300 kcal-day⁻¹ necessary to maintain adequate energy reserves upon enemy contact. **CONCLUSION:** Excessive load carriage is a major contributor to

high energy expenditure. The reported loads carried by SOF Soldiers exceeded the recommendations in Army doctrine. Additionally, their high energy expenditure, if not matched by an equally high energy intake, has been shown to result in performance decrements and may compromise mission success. Special attention must be given to pack weights during pre-mission planning and nutrition strategies aimed at meeting mission demands and recovery from strenuous activity.

1422 Board #184 May 30 10:30 AM - 12:00 PM
Effects Of Menstrual Cycle On Energy Utilization And Endurance Performance In Eumenorrheic Women

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 (No relevant relationships reported)

The blood concentrations of estrogen and progesterone change during various phases of the menstrual cycle. The levels of estrogen and progesterone are lower during the menstrual period (MP) and higher during the luteal phase (LP) in eumenorrheic women. Previous studies have indicated that the menstrual cycle influences energy utilization during endurance exercises. Alterations in energy utilization that may occur during the different phases of the menstrual cycle in eumenorrheic women may also influence endurance performance.

PURPOSE: The purpose of this study was to compare energy utilization and endurance performance between the MP and LP of the menstrual cycle during exercise.

METHODS: The subjects were fifteen women (age, 22.1 ± 1.0 years) with regular menstrual cycle. Subjects exercised on a cycle ergometer at 60% $\dot{V}O_{2peak}$ for 45 min, and then exercise intensity was increased to 80% $\dot{V}O_{2peak}$ until exhaustion during the two phases of the menstrual cycle (MP and LP). Blood samples were collected at rest, 45 min during exercise, immediately after exercise, and 30 min after completion of exercise. Blood levels of estradiol, progesterone, glucose, and free fatty acid (FFA) were assessed. The duration of each menstrual cycle phase was estimated by assessing the levels of the estradiol and progesterone.

RESULTS: The menstrual cycle of the subjects was 30.9 ± 1.9 days. MP was 4.1 ± 1.4 days, and LP was 24.8 ± 2.2 days. Blood concentrations of estradiol (MP, rest, 35 ± 14.6 pg/mL; LP, rest, 164 ± 58.3 pg/mL, $p < 0.001$) and progesterone (MP, rest, 0.3 ± 0.2 ng/mL; LP, rest, 13.1 ± 5.0 ng/mL, $p < 0.001$) were significantly higher in LP than in MP. No significant differences were observed in the levels of glucose ($p = 0.36$), FFA ($p = 0.80$), and respiratory exchange ratio ($p = 0.34$) at all time points. Carbohydrate oxidation (MP, 38.5 ± 7.7 g; LP, 39.2 ± 6.4 g, $p = 0.66$), fat oxidation (MP, 11.6 ± 2.9 g; LP, 11.2 ± 3.4 g, $p = 0.64$), and exercise time to exhaustion were not different between MP and LP (MP, 7.4 ± 7.9 min; LP, 6.8 ± 6.0 min, $p = 0.55$).

CONCLUSION: Our results reveal no effect of the menstrual cycle phase on substrate oxidation and prolonged endurance exercise performance during cycle ergometer exercise in eumenorrheic women.

1423 Board #185 May 30 10:30 AM - 12:00 PM
A Short-term Calorie Restricted Diet with High-fat on Inflammatory Biomarkers and Plasma Lipids

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A high-fat (HF) diet may play a positive role in weight management and body composition, yet its role in inflammation and blood lipids is not clearly understood.

PURPOSE: To examine the effects of a short-term calorie restricted diet with HF or high-carbohydrate (HC) and an acute bout of exercise on plasma lipids and inflammatory biomarkers. **METHODS:** In a randomized, cross-over design, 9 physically inactive college-aged individuals were assigned to a calorie restricted diet (20% reduction of total calorie intake from their typical diet) with either HF or HC for 2 weeks. The HF diet consisted of 70% fat (mostly mono- and poly-unsaturated fatty acids) and 30% carbohydrate and protein, whereas the HC diet consisted of 70% carbohydrate and 30% fat and protein. There was a one-week wash-out period between the two diet interventions. At the end of each diet intervention, a single bout of aerobic exercise was performed at 70% heart rate reserve for 40 minutes. Overnight fasting blood samples were collected at pre- and 24-hours post-exercise at the end of each diet intervention (pre-intervention, HF, and HC) to analyze changes in the key biomarkers of inflammation and plasma lipids, including glucose and triglycerides.

RESULTS: Either HF or HC diet did not change any inflammatory biomarkers or plasma lipids. However, a single bout of exercise significantly decreased B-cell activating factor (BAFF, 1619.37 ± 446.57 to 1520.94 ± 476.05 pg/mL, $p = 0.019$), matrix metalloproteinase-3 (MMP-3, 1700.82 ± 1090.16 to 1227.33 ± 976.38 pg/mL, $p = 0.021$), thymic stromal lymphopoietin (TSLP, 2.38 ± 1.4 to 1.88 ± 1.0 pg/mL, $p = 0.048$), and TNF-related weak inducer of apoptosis (TWEAK, 26.26 ± 10.36 to 22.53 ± 3.0 pg/mL, $p = 0.048$). **CONCLUSION:** A short-term calorie restricted diet with either HF or HC may not significantly influence soluble inflammatory markers or plasma lipids. However, a single bout of aerobic exercise, independent of dietary modification, can

improve inflammatory responses in healthy, sedentary young adults. Future studies need to further examine the effects of a long-term diet intervention on the responses of inflammatory markers in a variety of subject populations, including obese and patients with metabolic diseases in order to better understand the role of high-fat diet in inflammation.

1424 Board #186 May 30 10:30 AM - 12:00 PM
Impact of Time Restricted Feeding on Muscular Strength Within a Healthy Adult Population.

Eric A. Norman, Nicole L. Schweitzer, Corby R. Bendtsen, Megan M. Coyle, Cassie A. Fileccia, Marquel A. Fleischacker, Lauren M. Kaminski, Andrew L. Kezar, Megan M. Lind, Emma P. Masiulewicz, Justin R. Geijer. *Winona State University, Winona, MN.*

(No relevant relationships reported)

Time restricted feeding (TRF) is a feeding habit that restricts the amount of time during the day in which individuals consume calories. TRF has been shown to produce several health benefits, one of which may be an increase in force production. Muscular strength and nutritional intake have been strongly researched prior to this study. Though little research exists investigating the impacts of TRF on muscular strength in human subjects. **PURPOSE:** The purpose of this study was to identify the potential impacts of TRF on muscular strength. **METHODS:** Participants participated in two, four-week periods during which caloric intake, sleep duration, sleep quality, exercise, and medications were all documented. The first period, participants partook in non-TRF eating behavior. The second period participants were exposed to a nine-hour window of TRF. To measure muscular strength, participants were tested using an isokinetic dynamometer. Resting metabolism was also measured. Statistical analyses quantifying within subject effects were performed with a repeated measures ANOVA. Post-hoc analyses were performed to elicit differences between testing periods. **RESULTS:** Both mean torque flexion at 60 degrees/second (MTF 60) ($83.92 \text{ Nm} \pm 29.53 \text{ Nm}$ vs. $95.63 \text{ Nm} \pm 28.95 \text{ Nm}$) and mean torque flexion at 180 degrees/second (MTF 180) ($66.75 \text{ Nm} \pm 25.9 \text{ Nm}$ vs. $69.01 \text{ Nm} \pm 21.29 \text{ Nm}$ vs. $75.55 \text{ Nm} \pm 23.9 \text{ Nm}$; $F = 7.920 \text{ Nm}$) had a significant increase from pre-test to TRF, as well as non-TRF to TRF. Post-hoc testing revealed significant differences between pre-test and TRF MTF 60 increased ($p\text{-value}=0.001$). Similar results were found for MTF 180 as well ($p\text{-value}=0.037$). When observing respiratory quotient (RQ) at rest (0.716 ± 0.077 vs. 0.73 ± 0.077 vs. 0.08 ± 0.79 ; $F = 8.352$) there was a significant increase from pre-test to TRF ($p\text{-value}=0.008$), as well as non-TRF to TRF ($p\text{-value}=0.034$). Lastly, after analyzing total strength training days from non-TRF to TRF ($8.11 \text{ days} \pm 1.18$ vs. $5.22 \text{ days} \pm 1.48$), a significant decrease was found ($p\text{-value}=0.003$). **CONCLUSION:** Post TRF, participants showed an increase in muscular strength and resting RQ despite a decrease in strength training. Increased glucose utilization may be linked to short bouts of increased muscular strength activity. Future studies are needed to identify physiological mechanisms behind these findings.

1425 Board #187 May 30 10:30 AM - 12:00 PM
Effects Of Whole30 Dietary Programa On Resting Energy Expenditure, Oxygen Consumption And Heart Rate In Crossfit Athletes

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VClínica de Nutrição Research Institute

Purpose: To evaluate whether the Whole 30 dietary program alters resting energy expenditure, oxygen consumption, and heart rate in CrossFit trained individuals. **Methods:** Sixty four subjects (age range: 21-54 years) attended to nutrition education class to learn food items and recommended volumes comprising the Whole 30 program for 30 days (allowed foods: meats, seafood/ fish, eggs, fruit, vegetables and mono and polyunsaturated fats; forbidden foods: sugar, sweeteners, alcohol, flour, oat, quinoa, corn, rice, starch, beans, soy, milk and dairy products) and underwent a training protocol (4 days/week) during the program period. Resting energy expenditure and oxygen consumption were evaluated before the beginning and one day after the end of protocol by indirect calorimetry (CardioCoach, Korr™), and the resting heart rate by oximeter finger. Samples were tested for normal distribution and groups were compared by Student's t-test. The type I error was set at $p < 0.05$. **Results:** Of the 64 initial participants, 38 participants who had no follow-up information were excluded and final analysis was performed in 26 (40.63%) participants. There was a significant reduction in resting energy expenditure (1402 ± 255.7 vs 1087 ± 303.3 , pre

and post, respectively, $p=0.00001$), resting oxygen consumption (203.6 ± 36.91 vs 154.3 ± 35.58 , pre and post, respectively, $p=0.0001$) and resting heart rate (59.58 ± 15.32 vs 51.46 ± 13.73 , pre and post, respectively, $p=0.0001$). **Conclusion:** The Whole 30 dietary program promoted resting energy expenditure, oxygen consumption and heart rate reduction in trained Crossfit individuals, which may be related to the lower carbohydrate consumption proposed by the program.

1426 Board #188 May 30 10:30 AM - 12:00 PM
A Short Term Paleolithic Dietary Intervention Does Not Alter Adipokines Implicated In Obesity

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(No relevant relationships reported)

Adipokines, including adiponectin, omentin, nesfatin, and vaspin, are dysregulated with obesity and may respond favorably to diet-induced fat loss. The Paleolithic (Paleo) diet, characterized by an emphasis on hunter-gatherer type foods accompanied by an exclusion of grains, dairy products, and highly processed food items, is often promoted for weight loss and a reduction in cardiometabolic disease risk factors. The **PURPOSE** of this study was to evaluate the effects of an 8-week Paleo dietary intervention on serum adiponectin, omentin, nesfatin, and vaspin levels in a cohort of physically inactive but otherwise healthy adults. **METHODS:** Seven physically inactive adults participated in 8 weeks of a Paleo diet intervention. Anthropometric measures, body composition data, and fasting blood samples were collected from each participant pre- and post-intervention. Serum adiponectin, omentin, nesfatin, and vaspin were measured with commercially available ELISA kits. **RESULTS:** The Paleo dietary intervention elicited reductions ($p < 0.05$) in mean relative body fat (-4.4%), waist circumference (-5.9 cm), and sum of seven-site skinfolds (-36.8 mm). No changes were observed in waist to hip ratio (WHR) or any of the measured adipokines ($p > 0.05$). **CONCLUSIONS:** It is possible that short-term modest fat loss will not induce changes in adiponectin, omentin, nesfatin, or vaspin in apparently healthy but physically inactive adults. Longer-term studies that examine Paleo diet-induced changes across sex, body composition, and in populations with metabolic dysregulation are warranted in order to determine whether the Paleo diet is effective in improving biomarkers related to obesity, metabolism and overall health.

C-39 Free Communication/Poster - Pain, RPE, and Fatigue

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1427 Board #189 May 30 9:30 AM - 11:00 AM
Narrow Cuffs Decrease The Perceptual Of Discomfort With Blood Flow Restricted Exercise

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(No relevant relationships reported)

Wide cuffs cause arterial occlusion at lower pressures but may produce greater discomfort during blood flow restricted exercise compared to more narrow cuffs when applied to the same absolute pressure. Whether this is true at the same relative pressure or if this differs by sex is currently unknown. **PURPOSE:** To examine how cuff size and sex affect perceptual discomfort following blood flow restricted exercise. **METHODS:** Forty-nine participants (25 males and 24 females) completed two conditions in a random order with 10 minutes of rest prior to each condition (one on each arm). Participants performed 4 sets of unilateral elbow flexion to failure. Pressure was applied with either a narrow (5 cm) or a wide cuff (12 cm) with each cuff set to the same relative arterial occlusion pressure (40%). Discomfort was rated following the 4th set (0: no discomfort, 100: maximal discomfort). Following exercise the participants were asked to choose which condition they would prefer to use regularly. A repeated measures analysis with a between subject factor of sex was used to assess differences in discomfort. Default priors were used for fixed effects ($r=0.5$) and random effects ($r=1$). A contingency table with a default prior concentration of 1 was used to determine if cuff preference differed by sex. Bayes Factors (BF_{10}) were used to quantify evidence for the null and alternative hypothesis. Data are presented as mean (SD) unless otherwise stated. **RESULTS:** There was evidence for an effect of cuff size ($BF_{10}: 6.752$) but no evidence for an interaction or an effect of sex ($BF_{10}: .699$). The narrow [42 (17) AU] cuff had less discomfort than the wide [47 (18) AU] cuff [median δ (95% credible interval) -.53 (-.928, -.145)]. When participants rated which cuff they would prefer to exercise with, participants preferred the narrow cuff

and this did not differ by sex (BF_{10} joint multinomial: .262). The lower discomfort and greater preference for the narrow cuff was found despite completing more repetitions with the narrow cuff [Narrow: 70 (25) vs. Wide: 59 (16) repetitions; BF_{10} of 67.2].

CONCLUSIONS: A narrow cuff appear to cause less discomfort than a wider cuff when inflated to the same relative pressure with no difference between sexes. The use of a narrow cuff was preferred and may help increase the palatability of blood flow restricted exercise.

1428 Board #190 May 30 9:30 AM - 11:00 AM

Session RPE Following a Six-minute Bout of Cardiopulmonary Resuscitation Training

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Ratings of perceived exertion (RPE) are used to monitor intensity during exercise. A session RPE (S-RPE) provides an estimate of exercise intensity of a completed exercise session. S-RPE has demonstrated adequate validity and reliability for quantifying exercise intensity in traditional aerobic and anaerobic modalities. However, the efficacy of S-RPE during the physically demanding task of cardiopulmonary resuscitation (CPR) has yet to be explored. **PURPOSE:** The purpose of this investigation is to explore the relationship between RPE and S-RPE assessed during and after a 6-minute bout of CPR training. **METHODS:** Thirty healthy young adults (age 24.3 ± 6.0 y; BMI 26.1 ± 3.5 kg/m²) completed a 6-minute bout of CPR on a CPR manikin. RPE values were recorded during the last 15 seconds of each minute of exercise, and S-RPE was recorded 2 min post exercise using the Adult OMNI-RPE scale. Heart rate (HR) was recorded during each minute of activity. A repeated measures ANOVA was used to compare RPE values from minute 1-6 and S-RPE recorded during the CPR bout. A paired samples t-test compared the average RPE for the 6-minute bout to S-RPE. Statistical significance was accepted at $p < 0.05$. **RESULTS:** RPE values recorded during the CPR bout are reported in table 1. Participants obtained a peak HR of 132.3 ± 25.7 bpm during the 6-minute bout of CPR. A paired samples t-test shows S-RPE was significantly higher than the average RPE for the 6-minute bout (4.7 ± 1.9 vs. 4.1 ± 1.7 , $p < 0.0001$). However, S-RPE did not differ from the RPE obtained from minutes 3-6 of the CPR bout. **CONCLUSION:** Current findings suggest that S-RPE for a bout of CPR may not represent the average RPE, but reflects the RPE reported during the later stages of exercise. In this case, S-RPE represented exertion levels reported during the final two-thirds of the exercise session. Similar findings have been reported during aerobic and resistance training studies, where S-RPE represents exertion of the later stages of activity.

Table 1. S-RPE and RPE values for each minute of CPR

Min 1	Min 2	Min 3	Min 4	Min 5	Min 6	Session
$2.8 \pm 1.4^*$	$3.4 \pm 1.7^*$	4.1 ± 1.7	4.6 ± 1.9	4.8 ± 2.0	5.0 ± 2.1	4.7 ± 1.9

*significantly less than S-RPE, $p < 0.05$

1429 Board #191 May 30 9:30 AM - 11:00 AM

Enjoyment In Low Intensity Continuous Training Versus High Intensity Interval Training In An Iso-caloric Design

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(No relevant relationships reported)

Purpose: To examine the enjoyment during and after one exercise session of continuous aerobic exercise (CE) versus one session of high intensity aerobic interval training (HIIT) in an iso-caloric design.

Methods: Seven young healthy participants (3 males, 4 females, age: 23.4 ± 2 years, maximal oxygen uptake: 52 ± 8.7 ml·kg⁻¹·min⁻¹) were recruited to undergo two different exercise sessions of similar total caloric expenditure in randomized order: 1) one CE session at 70% of heart rate maximum (HRmax) and 2) one HIIT session of 4x4 minutes intervals at $> 90\%$ of HRmax with 3 minutes rest between interval sets. Maximal oxygen uptake (VO₂max) and HRmax were tested prior to the experiment. During and after both exercise session, the participants reported perceived exercise enjoyment using an 8-item short form of the Physical Activity Enjoyment Scale (PACES) (Raedeke, 2007, *J Appl Sport Psychol*). This is a reduced scale of the original 18-item scale from Kendzierski & DeCarlo (1991, *J. Sport Exerc Psychol*). Additionally, the participants also reported rating of perceived exertion (RPE) (Borg, 1981, *Med Sci Sport Exerc*), during and after both exercise sessions.

Results: There were no difference in PACES score between HIIT and CE during (HIIT:

94.4 ± 12.9 , CE: 91.1 ± 16.3 , $p = 0.61$) and after the two exercise sessions (HIIT: 96.6 ± 13.2 , CE: 94.4 ± 15.4 , $P = 0.75$). The participants reported higher RPE both during and after the HIIT session compared with the CE session (During HIIT: 15.4 ± 1.3 , CE: 9.8 ± 1.2 , $p < 0.01$, after HIIT: 17.0 ± 1.3 , CE: 10.0 ± 1.3 , $p < 0.001$). When pooling the reported PACES scores, there were no difference in perceived enjoyment between the HIIT and CE session (95.5 ± 12.4 vs 92.4 ± 15.4 , respectively, $p = 0.68$). The participants reported higher RPE for the HIIT session compared with the CE session in the pooled analysis (16.2 ± 1.0 vs 9.9 ± 1.3 , $p < 0.001$).

Conclusion: Although a higher perceived exertion was reported following high intensity exercise, participants reported similar enjoyment following exercise independent of exercise intensity in this iso-caloric design. Thus, if enjoyment is the depending factor for engaging in exercise, one should expect similar exercise adherence probability following HIIT and CE when prescribing aerobic exercise as preventive medicine.

1430 Board #192 May 30 9:30 AM - 11:00 AM

Comparison Of Two Cold Water Immersions Protocols On Psychological Variables Of Recovery

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In sport, recovery is a multifactorial process and one modality commonly recommended for athletes is cold water immersion (CWI). Few studies, have analyzed the psychological effects of CWI protocols, specifically with regards to pain and perceived recovery. **Purpose:** Compare the effects of two CWI protocols on psychological variables of recovery. **Methods:** Forty healthy male participants (age 21.8 ± 2.76 years, weight 73.15 ± 8.15 kg, height 176.6 ± 5.3 cm, and $13.5 \pm 3.4\%$ body fat). Participants performed a fatigue protocol (8 sets of 30-second countermovement jumps with 90-second of rest between sets). Were randomized to one of three recovery conditions: control group (CG) (12-min sitting in a 23 °C room), continuous cold water immersion (CnCW) (12-min in water at 12 ± 0.4 °C), and intermittent cold water immersion (InCW) (12-min in water at 12 ± 0.4 °C as follows: 2-min in cold water, 1-min in a controlled environment at 23 °C, until the 12-min of immersions were completed). Delayed onset muscle soreness (DOMS) was assessed through a Visual Analog Scale (VAS-Pain) and perceived recovery were used. Both were evaluated at pre, post-CWI, 24 and 48 hours post. A mixed ANOVA was used. Significance was accepted at $p < 0.05$. **Results:** Statistically significant differences were found in DOMS ($F_{(8,148)} = 5.15$, $p < .001$, $\omega^2 = .174$) in post immersion CnCW vs. CG (2.7 ± 2.28 vs. 6.42 ± 1.9 , $p < 0.001$) and InCW vs. CG (2.7 ± 2.1 vs. 6.42 ± 1.9 , $p < 0.001$), in the post 24h CnCW vs. CG (3.07 ± 2.3 vs. 5.1 ± 1.7 , $p < 0.011$) and InCW vs. CG (3.2 ± 1.8 vs. 5.1 ± 1.7 , $p < 0.01$). In the post 48h testing, results showed CnCW vs. CG (3.3 ± 2.3 vs. 6.1 ± 2.2 , $p < 0.002$) and InCW vs. CG (3 ± 1.9 vs. 6.1 ± 2.2 , $p < 0.001$). In terms of perceived recovery ($F_{(6,111)} = 2.49$, $p = .027$, $\omega^2 = .070$), results included post immersion CnCW vs. CG (15.92 ± 1.7 vs. 14 ± 1.2 , $p < 0.001$) and InCW vs. CG (16.3 ± 1.6 vs. 14 ± 1.2 , $p < 0.001$), in the post 24h CnCW vs. CG (16.3 ± 2.4 vs. 12.8 ± 1.12 , $p < 0.001$) and InCW vs. CG (14.9 ± 2 vs. 12.8 ± 1.12 , $p < 0.001$). In the case of post 48h, results were CnCW vs. CG (15.9 ± 2.6 vs. 12 ± 3.3 , $p < 0.001$) and InCW vs. CG (15.3 ± 2.6 vs. 12 ± 3.3 , $p < 0.001$). **Conclusion:** CWI protocols are effective in reducing DOMS and improving perceived recovery all post fatigue measurements. Either the CnCW or InCW protocol could be used as both had similar effects on psychological variables of recovery.

1431 Board #193 May 30 9:30 AM - 11:00 AM

Time Courses of Changes In Perceptual, Respiratory, and Neuromuscular Responses in the Severe Intensity Domain

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(No relevant relationships reported)

The severe intensity domain zone 1 (SIZ₁) includes intensities between critical velocity (CV) and 50%Δ (Δ = difference between CV and VO_{2peak}), where exhaustion may occur below VO_{2peak}. The severe intensity domain zone 2 (SIZ₂) includes intensities

> 50%Δ but < 175% CV, where $\dot{V}O_{2peak}$ is reached at exhaustion. **PURPOSE:** This study examined the time course of changes in ratings of perceived exertion (RPE), breathing frequency (f_b), electromyographic amplitude (EMG AMP) and EMG mean power frequency (MPF) during exhaustive treadmill runs within the SIZ_1 and SIZ_2 . **METHODS:** Ten runners (Age: 23 ± 3 yrs) performed an incremental treadmill test to determine the velocity at $\dot{V}O_{2peak}$ (vVO_{2p}). The CV was determined from 4 constant velocity runs. The RPE, f_b , EMG AMP, EMG MPF (from the vastus lateralis) and times to exhaustion (T_{lim}) were examined during SIZ_1 and SIZ_2 runs. Polynomial regression was used to examine the normalized (% change from the initial values) RPE, f_b , EMG AMP, and EMG MPF versus % T_{lim} (10-100%) relationships for the SIZ_1 and SIZ_2 runs. Repeated measures ANOVAs and Student Newman-Keuls tests were used to determine the time course of changes from the initial 10% of T_{lim} . **RESULTS:** During the SIZ_1 ($86 \pm 5\%$ vVO_{2p} , $\sim 33\%$ Δ, $T_{lim} = 17.7 \pm 2.6$ min) run, there was a quadratic increase for RPE ($R^2 = 0.99$, $p < 0.001$), significant from 30 to 100% of T_{lim} , a cubic increase for f_b ($R^2 = 0.99$, $p < 0.001$), significant from 30 to 100% of T_{lim} , a linear increase for EMG AMP ($r^2 = 0.85$, $p < 0.001$), significant at 100% of T_{lim} , and a linear decrease for EMG MPF ($r^2 = 0.66$, $p = 0.004$), but no differences among time points. During the SIZ_2 ($98 \pm 4\%$ vVO_{2p} , 93% Δ, $T_{lim} = 6.6 \pm 0.8$ min) run, there was a linear increase for RPE ($r^2 = 0.99$, $p < 0.001$), significant from 30 to 100% of T_{lim} , a quadratic increase for f_b ($R^2 = 0.99$, $p = 0.03$), significant from 20 to 100% of T_{lim} , a quadratic increase for EMG AMP ($R^2 = 0.68$, $p = 0.02$), but no differences among time points, and a cubic decrease for EMG MPF ($R^2 = 0.84$, $p = 0.01$), significant at 100% of T_{lim} . **CONCLUSIONS:** These findings indicated RPE was more closely related to increases in f_b , than to neuromuscular fatigue in both the SIZ_1 and SIZ_2 . It is possible feedback from group III and IV afferents in the respiratory muscles contributed to increased perceptions of effort to a greater degree than those in the leg muscles during severe exercise intensities.

1432 Board #194 May 30 9:30 AM - 11:00 AM
Mood Changes In Runners During An Ultra-marathon
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PURPOSE: There is currently very little data available in literature on the effects of ultra-marathon training and competition regarding mood. Ultra-marathons are races with distances greater than the standard marathon distance of 26.2 miles. The purpose of this experiment was to examine differences in mood during an ultramarathon competition. We speculated that perceived exertion (RPE) and pain would be the predominant determinates of mood during the race. **METHODS:** Pain, RPE, and mood were assessed using Visual Analog Scales (VAS) prior to the race, at predetermined ten-mile marker points, and immediately at the completion of the race. The support teams that would accompany each runner throughout the race were given instructions prior to the start on how to collect the data. They were instructed not to "coach" responses from the runners and not to assume their runner's responses or answer for them. The mood scale started at 10 representing best mood and decreased to 0 as mood declined. Pain and RPE scales started at 0 for no pain and no exertion respectively, increasing to a maximum of 10 for maximum pain or maximum exertion. Data were analyzed using regression analyses with $p < 0.05$ as our accepted level of significance. **RESULTS:** The regression analysis revealed a ($R^2 = 0.89$). Mood steadily decreased from 9.6 one hour before the race to 9.4 ten miles into the race. At 90 miles, mood was 5.2, then 6.2 at the completion of the race. RPE and pain steadily increased throughout the race. Pain was 0 before the start, 0.6 at ten miles and 7 at 100 miles. RPE was 1.4 one hour before the race and 2.6 at ten miles increasing to 6.8 at the end of the race. Subjective pain assessment was significantly correlated to mood throughout the race ($p < .05$), and RPE had no significant associations ($P > .05$). **CONCLUSION:** These data suggest that the increase in subjective pain assessment with runners completing a 100-mile ultra-marathon is directly related to a decrease in mood throughout the race. RPE was also correlated and is surely an important factor impacting mood throughout the race, but it did not reach statistical significance. This suggests that pain has greater association with mood compared to RPE during an ultra-marathon. Further analysis is needed to fully identify the primary factors impacting mood in ultra-endurance activities.

1433 Board #195 May 30 9:30 AM - 11:00 AM
Physical Aspects of Fatigue Throughout a Season
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 (No relevant relationships reported)

High school athletes experience changes in performance throughout sport seasons. It's important to discover if an athlete is fatigued in order to make modifications to their practice and training regimen.

PURPOSE: The purpose of this investigation is to use the jump squat measurement to determine athlete fatigue throughout a season. **METHODS:** 58 male varsity students that attend a private college preparatory school volunteered to participate in the

study ($N = 21$ football; $N = 11$ lacrosse; $N = 6$ track; $N = 12$ basketball; $N = 9$ wrestling). The average grade level for the participants was 10.91 (0.89). Students completed a modified Borg scale of rate of perceived exertion (RPE) to determine physical RPE. Students self-reported practice time and sleep. A jump squat using "Just Jump" with a flight time calculator was used to measure the level of fatigue. Data was recorded by the strength and conditioning coaches. Each athlete recorded a jump squat each week throughout the season; however, due to missing data, data was analyzed through a repeated measures analysis at times corresponding to the beginning of the season, the one-third mark, the two-third mark, and at the end of the season.

RESULTS:

Average Physical RPE	5.19; 1.75	5.19; 1.44	5.00; 1.87	4.93; 1.69
Average Sleep	7.61; 0.90	7.55; 0.81	7.80; 1.15	7.69; 0.82
Average Practice Time	130.45; 16.08	129.30; 18.55	125.96; 19.00	122.02; 24.07
Average jump Squat	18.99; 3.07	19.22; 3.10	19.29; 2.91	19.85; 3.04

CONCLUSION: It was assumed that students who recorded lower jump squat scores experienced fatigue at that point in the season. While there were individual differences, there were no significant differences among the teams. There was a gradual increase in performance, rather than a fatigue effect, which indicates that training modalities addressed individual fatigue levels. A limitation of this study is the data collection methods; academia and strength coaches will need to work together to develop data collection methods that meet the needs of both the coaching staffs and researchers.

1434 Board #196 May 30 9:30 AM - 11:00 AM
The Interactive Effect of DOMS and Topical Analgesic on Corticospinal Excitability of the Biceps Brachii
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Delayed onset muscle soreness (DOMS) is a normal response to strenuous, unfamiliar exercise characterized by muscle swelling, tenderness and pain. Typically arising 24-72 hours following exercise, DOMS results in neuromuscular impairment such as decreased muscular strength and activation. Recently, the application of topical analgesics has been proposed as a possible means to mitigate the symptoms and negative outcomes of DOMS, though the mechanisms of action are not well-understood. It is currently unknown how the presence of DOMS with and without the application of topical analgesia influences central nervous system excitability. **PURPOSE:** The purpose of this study was to investigate the interactive effects of DOMS and the application of a menthol-based topical analgesic on corticospinal excitability (CSE) to the biceps brachii. **METHODS:** A total of 32 participants completed two separate experiments; *Experiment A* (No DOMS; $n = 16$) and *Experiment B* (DOMS; $n = 16$). For each experiment, participants were randomly assigned to two groups: 1) topical analgesic gel (Topical Analgesic, $n = 8$), or 2) placebo gel (Placebo, $n = 8$). Prior to the application of gel (pre-gel), as well as 5, 15, 30, and 45 min post-gel, motor evoked potential (MEP) area, latency, and silent period, as well as cervicomedullary MEP (CMEP) and maximal compound motor unit action potential (M_{max}) areas and latencies were measured. In addition, pressure-pain threshold (PPT) was measured pre-DOMS and at the same time points in *Experiment B*. **RESULTS:** In *Experiment A*, neither group showed a significant change for any outcome measure. In *Experiment B*, both groups exhibited a significant decrease in PPT from pre-DOMS to pre-gel ($p < .05$). Following the application of topical analgesic, but not placebo, there was a significant increase in PPT at 15, 30, and 45 min post-gel ($p < .05$), respectively compared to pre-gel and an increase in silent period at post-30 and 45 min ($p < .05$) compared to pre-gel. Participants with DOMS had reduced MEP ($p < .02$) and CMEP areas ($p < .05$), and increased MEP silent periods ($p < .05$) compared to those who did not have DOMS. **CONCLUSIONS:** These findings suggest that DOMS reduced CSE to the biceps brachii, and that the application of a menthol-based topical analgesic reduced pain, which was accompanied by an increase in corticospinal inhibition.

- 1435** Board #197 May 30 9:30 AM - 11:00 AM
The Influence of Temperature on Prefrontal Cortex Activation and Performance During a Fatiguing Task
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Evidence suggests the prefrontal cortex (PFC) may play a role in interpreting afferent feedback during fatiguing tasks. Temperature changes are known to influence fatigability. It is unknown how changing the temperature of a limb influences PFC activation during a fatiguing task. **PURPOSE:** To examine changes in PFC oxygenation, psychological ratings, and muscular function in response to a fatiguing task, following thermal alterations of the exercising arm. **METHODS:** Nineteen healthy adults completed three experimental sessions. At baseline, participants performed maximum voluntary isometric contractions (MVIC) of the elbow flexors. Next, participants submerged their right arm in a water bath for 15 min. Cold (C), neutral (N), and hot (H) water temperatures were maintained at 8°, 33° and 44°C, respectively. Following water immersion, participants performed an isometric elbow flexion contraction, at 20% of MVIC, for 5 minutes. Ratings of perceived exertion (RPE) and muscular discomfort were assessed. Functional near-infrared spectroscopy was used to measure oxygenation of the right PFC during the fatiguing task. Repeated measures ANOVAs were used to analyze changes in dependent variables. **RESULTS:** There was an increase in PFC oxygenation throughout the fatiguing task, however, the increase in oxygenation was greater for the H (14.1±4.9 μ M) and N (12.7±5.6 μ M) conditions, compared to the C condition (11.1±4.4 μ M, time x temperature, $p < 0.01$). There was an increase in RPE throughout the fatiguing task, however, the increase in RPE was greater for the H (8.7±0.9) and N (8.0±0.9) conditions, compared to the C condition (7.2±1.1, time x temperature, $p < 0.01$). Muscular discomfort at the end of the fatiguing task was lower in the C condition compared to the H condition (2.7±0.1 vs. 3.7±0.1, $p < 0.001$). There was a reduction in MVIC torque at the end of the fatiguing task, however, the reduction in MVIC torque was greater for the H (25.7±8.4 %) and N (22.2±9.6 %) conditions, compared to the C condition (17.5±8.9 %, temperature x fatigue, $p < 0.05$). **CONCLUSION:** Precooling before a fatiguing task attenuated the rise in PFC oxygenation, RPE, muscular discomfort, and muscular fatigue. These results have implications for reducing mental workload and improving performance in workers, athletes, and patients.

- 1436** Board #198 May 30 9:30 AM - 11:00 AM
Factors Affecting the Outcome of an Ultramarathon Before the Race Starts
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Purpose: Very little data is available concerning the influence of pre-race mood and pain on ultra-marathon completion. This research was designed to answer questions such as how pain, mood and exertion affect ultramarathon race performance (defined as any race greater than 26.2 miles). **Methods:** Data was collected at the 2018 Keys 100 and 2017 Saint Sebastian 100 (n=23). Each research participant was presented with visual analog scales, one each for Pain (0=low pain to 10=maximum pain), Mood (10=great mood to 0=bad mood) and exertion (RPE) (0=no exertion to 10=maximum exertion). Scores were collected pre-race. Those participants who did not finish (DNF) were recorded as such. Independent sample t-test (SPSS version 21) was used with independent variable coded post-race, Finished or DNF, dependent variables were Mood, Pain and Exertion collected Pre-Race ($p < 0.05$). **Results:** Pain pre-race for finishers (0.23±0.44) and DNF's (0.86±0.38), paired differences were $t(19)=3.18$, $p=0.005$. Mood pre-race for finishers (9.5±0.85) and DNF's (7.3±2.56) paired difference were $t(19)=-2.98$, $p=0.008$. Exertion pre-race for finishers (1.07±0.99) and DNF's (0.86±0.38), paired differences were $t(19)=-0.54$, $p=0.59$. **Conclusion:** Pre-race numerical scores that rank higher in mood and lower in pain have a positive impact on race outcome. Current research shows a greater link between psychological state and performance than previously postulated. Our research supports the hypothesis that the athlete's physical performance affects their mental state. Furthermore their mental state, in turn, effects their performance. We believe this to be the first collected data of this type to show these results on ultra-marathon performance.

- 1437** Board #199 May 30 9:30 AM - 11:00 AM
Effects of Transspinal Direct Current Stimulation on Cycling Perception of Effort and Time to Exhaustion
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 (No relevant relationships reported)

PURPOSE: In the past decade, researchers have investigated the efficacy of transspinal direct current stimulation (tsDCS) on central nervous system and afferent neuron function in humans. In the past year, data has suggested it may be possible for such tsDCS-induced changes in neuromuscular function to enhance performance. This study utilized non-invasive thoracic spine tsDCS to determine if cycling performance and perception of effort (RPE) could be modulated by tsDCS.

METHODS: In three different stimulation conditions, anodal, cathodal, and sham, participants cycled at 80% of their maximal aerobic capacity until exhaustion and reported their RPE every minute. From this period, researchers compared the RPE responses over the first three minutes and time to exhaustion.

RESULTS: There was no significant difference in time to exhaustion between anodal (408 ± 121 s), cathodal (413 ± 168 s), and sham (440 ± 189 s) conditions ($p=0.58$). There was no significant difference in RPE from minutes 1-3 (collapsed across time) between anodal (12.9 ± 2.4 AUs), cathodal (13.3 ± 2.2 AUs), and sham (12.9 ± 2.1 AUs) conditions ($p=0.51$).

CONCLUSIONS: These data suggest tsDCS condition did not influence cycling performance or perception of effort during high-intensity cycling. Therefore, thoracic spine and lower abdominal montage delivering a current density of 0.071 mA/cm² for 20 minutes likely does not affect high-intensity cycling work capacity. Therefore, more research is needed to investigate the efficacy of tsDCS and which stimulation methods may and may not enhance human performance.

- 1438** Board #200 May 30 9:30 AM - 11:00 AM
Relationship Among Site Specific Fat, Lean Mass, And Pressure Pain Sensitivity
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Chronic pain and obesity are significant public health issues. Although the association between a higher BMI and chronic pain has been established, little data exist on the relationship among more direct measures of body composition and pain sensitivity.

PURPOSE: The purpose of the study was to examine the relationship between pressure pain thresholds (PPT), total body fat and lean tissue, and fat and muscle mass at the PPT assessment site. **METHODS:** PPT of 73 participants (38 female) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer on the left (L) and right (R) sides of the body. Whole body and limb specific fat and lean tissue were assessed via DEXA scan, and muscle and fat thickness were assessed in the VL and BR using ultrasound and skinfold measures. **RESULTS:** PPT in both arms correlated with whole body lean mass (LBR: $r=0.284$; $p=0.015$; RBR: $r=0.249$; $p=0.034$), and site specific lean mass (LBR: $r=0.263$; $p=0.025$; RBR: $r=0.238$; $p=0.043$). LBR was also correlated to muscle thickness ($r=0.235$; $p=0.045$). No relationships were found between PPT and measures of fat mass in the LBR ($p > 0.05$). PPT in the RBR were inversely correlated with BF% ($r=-0.231$; $p=0.049$). PPT in both legs were correlated with whole body lean mass (LVL: $r=0.422$; $p < 0.0001$; RVL: $r=0.444$; $p < 0.0001$), site specific lean mass (LVL: $r=0.425$; $p < 0.0001$; RVL: $r=0.397$; $p=0.001$) and muscle thickness (LVL: $r=0.262$; $p=0.025$; RVL: $r=0.312$; $p=0.007$). No relationships found with any measure of fat mass in the LVL ($p > 0.05$). PPT RVL inversely correlated with BF% ($r=-0.239$; $p=0.042$) and RL fat% ($r=-0.331$; $p=0.004$) but no relationship was found with region specific fat mass measures ($p > 0.05$).

CONCLUSION: PPT and assessments of fat tissue were not related. However, lean mass tended to have a positive relationship with PPT. These findings suggest a loss of lean tissue mass, which typically occurs with aging and inactivity, may play a role in increased sensitivity to pain.

1439 Board #201 May 30 9:30 AM - 11:00 AM
Self-Efficacy for Changing Sedentary Behavior or Physical Activity: Comparisons in Healthy and Chronic Pain Populations

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(No relevant relationships reported)

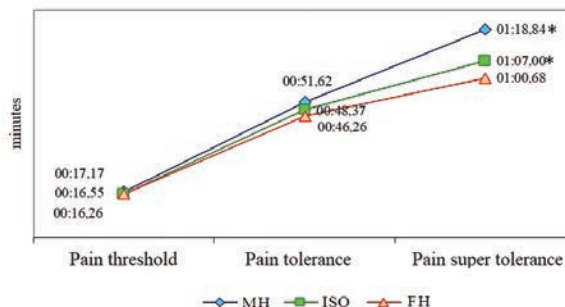
Physical activity (PA) has well known health benefits, especially for clinical populations like individuals with chronic pain (CP). However, interventions aimed at increasing PA often report low adherence, possibly due to low self-efficacy (SE). Reducing sedentary time (SED) also has health benefits and may be perceived as more achievable than increasing PA. **PURPOSE:** To compare levels of SE for reducing SED to those for increasing PA in healthy adults (HA) and individuals with CP and to explore SE for overcoming barriers for each behavior. **METHODS:** Participants completed a survey assessing SE for changing PA and SED and common barriers. Questions were rated on a Likert scale from 1 (Not at all Confident) to 10 (100% Confident). T-tests and effect sizes (Cohen's *d*) compared differences between behaviors. **RESULTS:** Participants were 1,240 HA (age = 26 ± 12 ; 61% female) and 273 individuals with CP (age = 34 ± 16 ; 70% female). Both HA and individuals with CP reported greater SE for reducing daily SED by 1 hour compared to increasing daily MVPA by 30 minutes, with moderate effects observed in both groups ($p < 0.001$, CP: $d = 0.60$; HA: $d = 0.58$). Additionally, SE was greater ($p < 0.001$) for overcoming barriers related to changing SED than PA, except social norms. In CP, the effect sizes between SE for overcoming barriers related to SED to barriers related to PA were small to moderate for fatigue ($d = 0.46$), time ($d = 0.42$), environment ($d = 0.44$), motivation ($d = 0.37$), pain ($d = 0.27$), and mood ($d = 0.24$). In HA, moderate effects for environment ($d = 0.66$) and fatigue ($d = 0.50$) and small effects for time ($d = 0.44$), motivation ($d = 0.44$), pain ($d = 0.37$) and mood ($d = 0.24$) were observed. However, SE for resisting social norms to sit was lower than SE for social norms surrounding exercise ($p < 0.001$, CP: $d = -0.32$, HA: $d = -0.59$). **CONCLUSION:** While the health effects of each behavior are not equivalent, both patients and HA may be more likely to change behavior when encouraged to sit less rather than exercise more, which may still result in substantial benefits. Individuals with CP had the lowest average SE for interrupting SED when feeling unwell or in pain, feeling sad or unhappy, or in social situations where others are sitting. Interventions targeting SED may benefit from discussing mental and physical benefits of reducing SED and strategies for overcoming social norms.

1440 Board #202 May 30 9:30 AM - 11:00 AM
Evaluation Of Perception And Tolerance To Acute Pain Thru Typological Groups Of Gender Schemas

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(No relevant relationships reported)

Pain is defined as a physiological and psychological experience, composed of an interaction between emotional, cognitive and sensorial components. The cultural aspects associated with the individual experiences of pain, tend to influence the way that individual reaction to a painful stimulus. **PURPOSE:** to evaluate if typological groups of gender schemas, generate by the Interactive Model, differs on acute pain perception and tolerance. **METHODS:** 137 athletes and 175 non-athletes, male and female (22.95 ± 4.29 yrs) were allocated into Masculine Heteroschematic (MH - Inventory of the Self-Concept's Gender Schemas - IMEGA), Isoschematic (ISO) and Feminine Heteroschematic (FH - Feminine Inventory of Self-Concept's Gender Schemas - IFEGA), groups. A scale called Factor of Acute Pain (FSAP) was developed to evaluate the sensations of acute pain. Pain threshold, pain tolerance, and pain super tolerance were evaluated during some test where the pain was induced by immersing hand on ice (0.1°C to 0.3°C). To FSAP validation and reliability were used Factorial Analysis and Cronbach's Alpha, and for acute pain perception and tolerance analysis was used inferential analysis Three-Way MANOVA and *post hoc* Least Significant Differences (LSD). **RESULTS:** Significant differences in acute pain perception and tolerance between typological groups were found ($p=0.03$). At graphic 1 is possible to observe that MH and ISO showed higher pain super tolerance than FH (00:18,16min and 00:06:32min respectively; $p=0.01$). For acute pain sensations, athlete woman FH reported more unpleasant sensation of pain ($\Delta=00:55,05\text{min}$) than MH. **CONCLUSIONS:** gender schemas at typological groups support different high levels of acute pain, as well as different sensations of unpleasant caused by the cold thermal sensations. Groups with developed masculine schema tend to have a higher tolerance to maximum pain than the other groups.



Graphic 1. Pain threshold, pain tolerance and pain super tolerance between gender schemas typological groups. * $p < 0.05$ different compared with FH.

1441 Board #203 May 30 9:30 AM - 11:00 AM
Grit, Fitness, And Goal Setting

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Grit is a measure of passion and perseverance and has been associated with academic and career success. Whether grit is associated with success in other areas such as health, fitness, or goal setting is unknown.

PURPOSE: This research attempted to examine whether grit and additional variables such as self-control and growth mindset would predict success in physical fitness goal setting and tolerance to discomfort during endurance fitness testing.

METHODS: Eligible participants ($n = 51$, 60% male, 21.45 ± 1.7 years old) were drawn from wellness classes at Slippery Rock University. Participants completed questionnaires on grit, self-control, and growth mindset at baseline and six weeks later at follow-up. Pre and post measures also included a FitnessGRAM push-up test to failure, the level of discomfort in the upper body during the push-up test, and various other upper body fitness tests. Participants set a strength goal and trained for six weeks performing a variety of upper body exercises twice per week, consisting of strength training and plyometric exercises.

RESULTS: Significant improvements were seen in push-up endurance scores (24.9 ± 10.2 vs 28.6 ± 9.0 , $p < 0.01$) and discomfort tolerance during the push-up test (7.3 ± 1.7 vs 8.0 ± 1.4 , $p < 0.01$). No significant changes were noticed in grit (3.6 ± 0.4 vs 3.7 ± 0.6 , $p = 0.86$), self-control, or growth mindset scores. A weak correlation ($r = 0.30$, $p = 0.03$) was noticed between baseline grit levels and baseline push-up scores. No other associations were found between grit and improvements in fitness.

CONCLUSIONS: Results appeared to show that improvements in endurance, strength, and tolerance to discomfort were not associated with levels of grit, growth mindset, or self-control. Although these variables have been highlighted as predictive of success, future research should continue to examine their relation to goal setting in health and fitness.

1442 Board #204 May 30 9:30 AM - 11:00 AM
Firefighter Turnout Suit Weight Influences Simulated Exercise Performance

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PURPOSE: To investigate how structural firefighter protective ensemble weight influences rate of perceived exertion (RPE) during firefighter simulated exercise (FFSE). **METHODS:** 10 active firefighters (age: 33 ± 6 years, Ht: 178.2 ± 3.1 cm, Wt: 78.6 ± 16.7 kg) were asked to wear, in random order, two ensembles: 1) a single layer (SL) outer shell (2.45 kg) and 2) a traditional turnout suit (4.57 kg). On each laboratory visit, the firefighters performed the FFSE that consisted of two rounds of a 15.24m hose advance, a 15.24m weighted (40.83 kg) carry, sledge hammer exercise, a 15.24m tire flip, a 15.24m dummy drag, rope pull, and unweighted stair climb, with a 1-minute rest period between rounds. The FFSE included a 5-minute acclimation period in the ensemble, a warm up (10 pushups, 10 squats, 20 jumping jacks). Subjects were asked to complete the FFSE as fast as possible. The traditional turnout suit consisted of an outer shell, moisture barrier, and thermal barrier typically found in most turnout suits. The Borg rating of perceived exertion scale was asked immediately at the end of each round of FFSE and ensemble weights were measured pre-FFSE.

RESULTS: The SL resulted in lower average RPE for round 1 (SL: 12.8 ± 1.7 vs. Traditional: 13.8 ± 1.7 ; $p=0.05$) and round 2 (SL: 14.2 ± 1.6 vs. Traditional: 16.2 ± 2.3 , $p=0.01$) than the traditional turnout. In addition, round 2 of the FFSE was completed significantly faster than the traditional turnout suit (SL: 262.8 ± 55.7 vs. Traditional: 293.4 ± 64.9 sec; $p=0.02$). **CONCLUSIONS:** The weight of the turnout suit increases RPE, which appears to influence performance for FFSE. Supported by Fire-Dex, LLC.

1443 Board #205 May 30 9:30 AM - 11:00 AM

Pre-Exercise Perceptions of Energy and Fatigue are Significantly Related to Performance during Sprint Interval Cycling

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Administration of ergogenic aids before exercise can increase feelings of energy and improve performance while completion of a demanding cognitive task before exercise can increase physical fatigue and decrease performance. Studies on this topic have been small (7-10 participants) and have failed to adequately measure perceptions of mental energy and fatigue. Thus, relationships between pre-exercise feelings of energy, fatigue and physical performance are not well understood.

PURPOSE: Describe relationships between anaerobic power during brief all-out cycling sprints and pre-exercise feelings of physical energy, physical fatigue, mental energy and mental fatigue.

METHODS: Ninety-four healthy men and women (18 to 29 years) completed 3 x 30-sec sprints at a high resistance. Participants were randomly assigned to cycle in an interactive or non-interactive virtual environment presented through a virtual reality setup (data presented elsewhere). Perceived feelings of energy and fatigue were measured pre-exercise using the Mental and Physical State Energy and Fatigue Scales. Compared to their capacity to perform typical mental or physical activities, participants rated their "right now" feelings of energy, vigor, pep, fatigue, exhaustion, and being worn out, on 10-cm visual analog scales. Scores were summed to yield criterion scores for physical energy, physical fatigue, mental energy and mental fatigue. Correlations between perceptions of energy, fatigue, mean power (MP) and objective performance fatigue (MP during the 1st sprint minus MP during the 3rd sprint) were used to evaluate relationships.

RESULTS: All variables were normally distributed. MP during the 1st 30-sec sprint was significantly related to pre-exercise perceptions of physical fatigue ($r = -0.300$, $p = .003$), mental fatigue ($r = -0.270$, $p = .008$) and mental energy ($r = 0.246$, $p = .017$). Performance fatigue was significantly related to pre-exercise perceptions of physical fatigue ($r = -0.237$, $p = .021$) and mental energy ($r = 0.224$, $p = .030$). Partial correlations controlling for the experimental condition and removal of outliers did not influence these relationships.

CONCLUSIONS: There are significant, small relationships between pre-exercise feelings of physical and mental fatigue, anaerobic power and performance fatigue.

1444 Board #206 May 30 9:30 AM - 11:00 AM

Assessment of Performance Fatiguability During Resistance Exercise Anchored to Ratings of Perceived Exertion

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PURPOSE: According to the critical threshold hypothesis, fatiguing single-leg exercise at intensities above the critical force should result in performance fatiguability that is unvarying. The purpose of the present study was to examine the fatigue-related decreases in maximal voluntary isometric contractions (MVIC) as an indirect measure of performance fatiguability at intensities anchored by ratings of perceived exertion (RPE).

METHODS: Ten recreationally-active men (22.9 ± 2.0 yr) performed 3 randomly ordered, sustained submaximal isometric leg extension muscle actions anchored to RPE values of 2, 5, and 8 (OMNI-RES 10-point scale) until the RPE value could no longer be maintained or a maximal time-limit of 5-min was reached. The percent decline in MVIC was defined as the difference between pretest and posttest values. A 1x3 repeated measures ANOVA was used to examine mean differences in MVIC percent decline values at RPE=2, 5, and 8.

RESULTS: The mean (\pm SD) actual time-limits for the sustained muscle actions anchored to RPE=2, RPE=5, and RPE=8 were 300.0 ± 0.0 s, 202.0 ± 95.5 s, and RPE 8 = 72.7 ± 27.6 s, respectively. The pretest to posttest decreases in MVIC values for RPE=2, 5, and 8 were 61.9 ± 14.3 to 42.8 ± 11.4 , 62.4 ± 14.3 to 47.9 ± 12.8 and 63.0 ± 12.6 to 54.0 ± 14.7 kg, respectively. There was a significant ($p=0.023$) difference in MVIC percent decline, and the pairwise comparisons indicated that the percent decline

in MVIC was significantly ($p<0.001$) greater for RPE=2 (30.4 ± 11.6 %) than RPE=8 (15.1 ± 13.6 %), but there were no differences ($p>0.05$) for RPE=5 (22.0 ± 14.0 %) versus RPE=2 or 8.

CONCLUSIONS: In general, the similar MVIC percent decline values at RPE=5 and 8, as well as the greater percent decline at RPE=2, supported the critical threshold hypothesis. Furthermore, performance fatiguability as assessed from MVIC measurements followed the expected pattern of responses as those previously described for involuntary potentiated twitch amplitude. These findings also suggested that RPE=2 was below critical intensity, but RPE=5 and RPE=8 were not.

1445 Board #207 May 30 9:30 AM - 11:00 AM

Association between Dietary Quality and Fatigability among the Elderly in the Geisinger Rural Aging Study

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Poor dietary quality contributes to impaired physical function and frailty in the elderly. Elevations in perceived fatigue, fatigability, likely exacerbate impairments in physical function and frailty. However, the association between dietary quality and fatigability is unknown. **PURPOSE:** We examined the cross-sectional association between overall diet quality and fatigability among the elderly in the Geisinger Rural Aging Study (GRAS). **METHODS:** In the present study, we included 122 (66F, 56M) elderly (≥ 80 years) participants from the GRAS who completed the Pittsburgh Fatigability Scale (PFS) and Diet Screening Tool (DST). We used multiple linear regression to measure the association between the PFS - Physical Fatigability Score (0-50, no fatigue to extreme fatigue) and the DST Score (0-100, <60 at risk, >75 low risk) adjusted for age group, sex, BMI, and number of medications used over the past two years. **RESULTS:** The mean (SD) Physical Fatigability Score, DST Score, BMI, and number of medications were 23 (10), 60 (12), 28 (5) kg/m² and 18 (8), respectively. The females reported higher Physical Fatigability Scores compared to males (26 ± 1 vs. 21 ± 1 , $p<0.01$), while those in the 90+ years old group reported higher Physical Fatigability Scores (28 ± 2 , $n=20$) compared to those in the 80-84 (20 ± 1 , $n=51$) and 85-89 (23 ± 1 , $n=51$) groups (both $p<0.05$). Low diet quality, as assessed by the DST, was associated with high Physical Fatigability Score in the crude model ($r = -0.25$, $p=0.007$). Further adjustment for age, sex, BMI and number of medications did not change the significant inverse correlation between diet quality and physical fatigability ($r = -0.31$, $p = 0.0006$). **CONCLUSION:** Our results suggest that elderly individuals with lower dietary quality may also have higher physical fatigability independent of age, sex, BMI, and number of medications. In addition, both females and the oldest-of-old reported the highest levels of physical fatigability. Further studies should examine the impact that individual macronutrients as well as micronutrients have on physical fatigability in the elderly. This study is funded by the USDA, Agricultural Research Service agreement 8050-51530-012-01A

1446 Board #208 May 30 9:30 AM - 11:00 AM

The Effects of Music Tempo on an Exerciser's Experiences During Isometric Strength Task

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PURPOSE: This study examined the effects of different music tempos on effort-related thoughts, rating of perceived exertion (RPE), affect, heart rate, and performance during isometric strength exercises. Recent research on musical stimuli during exercise supports that music has multiple physiological and psychological responses during exercise including: attention, RPE, affect, and performance (e.g., Atter et al., 2015; Connon, 2011; Crust, 2004; Dyrland & Wininger, 2008; Karageorghis, Terry, Lane, Bishop, & Priest, 2011).

METHODS: Participants were assigned randomly to one of three conditions: silent control, fast tempo music first followed by slow tempo music, and slow tempo music first followed by fast tempo music, and performed a two different isometric strength exercises in a counter-balanced order. **RESULTS:** RM ANOVAs revealed non-significant differences among conditions during any of the trials, indicating that the presence of music of either slow or fast tempo failed to influence HR, $F(2, 55) = 2.48$,

$p = .09$, $\eta^2 = .07$, RPE, $F(2, 60) = 0.75$, $p = .48$, $\eta^2 = .02$, attention, $F(2, 60) = 0.15$, $p = .86$, $\eta^2 < .01$, time to voluntary exhaustion, $F(2, 60) = .81$, $p = .45$, $\eta^2 = .02$, and affect, $F(2, 60) = 1.98$, $p = .15$, $\eta^2 = 0.07$.

CONCLUSIONS: Music of either tempo did not have an effect on exerciser's experience of an isometric strength test. However, these results are in line with Tenenbaum's (2001) social-cognitive model which postulates that as exercise intensity increases attentional flexibility decreases and attention narrows to associative, somatic cues.

1447 Board #209 May 30 9:30 AM - 11:00 AM

Association between Fatigability and Physical Function among the Elderly in the Geisinger Rural Aging Study

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Elevations in perceived fatigue, fatigability, likely contribute to impairments in physical function in the elderly. However, the independent and combined effects of physical and mental fatigability on physical function in the elderly is unknown. **PURPOSE:** We examined the cross-sectional associations between physical fatigability, mental fatigability, and physical function among the elderly in the Geisinger Rural Aging Study (GRAS). **METHODS:** Here, we included 122 (66F, 56M) elderly (≥ 80 years) participants from the GRAS who completed the Pittsburgh Fatigability Scale (PFS) and PROMIS Physical Function, Short-Form 20a [questionnaire was excluded due to missing values]. We used multiple linear regression to measure the association between the PROMIS Physical Function Score (19-95) and PFS - Physical Fatigability Score (0-50, no to extreme physical fatigue) and PFS - Mental Fatigability Score (0-50, no to extreme mental fatigue) adjusted for age, sex, BMI, and number of medications used over the past two years. **RESULTS:** The mean (SD) Physical Function Score, Physical Fatigability Score, Mental Fatigability Score, BMI, and number of medications were 80 (11), 23 (10), 12 (11), 28 (5) kg/m² and 18 (8), respectively. Low Physical Function Scores were associated with higher Physical and Mental Fatigability Scores in crude models ($r = -0.65$, $p < 0.0001$ and $r = -0.38$, $p < 0.0001$, respectively). When Physical and Mental Fatigability Scores were included in the same model, the association between the Physical Function and Physical Fatigability Scores remained significant ($r = -0.57$, $p < 0.0001$), while the association between the Physical Function and the Mental Fatigability Scores was no longer significant ($r = 0.07$, $p = 0.43$). Adjustment for age, sex, BMI and number of medications did not change the significant inverse association between the Physical Function and Physical Fatigability Scores ($r = -0.65$, $p < 0.0001$). **CONCLUSION:** Our results suggest that elderly individuals with lower physical function may also have higher physical fatigability independent of age, sex, BMI, and number of medications. Future studies should examine the impact of improving physical fatigability on physical function in the elderly. This study is funded by the USDA, Agricultural Research Service agreement 8050-51530-012-01A

1448 Board #210 May 30 9:30 AM - 11:00 AM
Longitudinal Association Between Fatigability and Executive Function: Results from the Baltimore Longitudinal Study of Aging

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Cognitive decline, specifically within the domains of executive function, has been consistently associated with diminished life satisfaction and the ability to carry out activities of daily living in older adults. As the population continues to age, identifying methods of attenuating cognitive decline is important for promoting long-term survival and quality of life. Previous research has suggested that fatigability, one's perceived exertion after a standardized walking task, is associated with declines in physical function; however, it remains unclear as to whether these effects may also extend to cognitive function. **PURPOSE:** To examine whether fatigability is associated with executive function among individuals participating in the Baltimore Longitudinal Study of Aging (BLSA). **METHODS:** The BLSA is an ongoing study of normative human aging. Participants included 1,068 older adults ($M_{age} = 67.3 \pm 12.7$ years)

seen between 2007 and 2015. At baseline and after $M = 4.5 \pm 1.8$ years of follow-up, individuals completed a physical examination, health history assessment, standardized walking task to assess fatigability, and cognitive battery assessing several domains of executive function. **RESULTS:** Multiple linear regression analyses revealed significant effects of baseline fatigability on several domains of executive function at follow-up: Digit Symbol Substitution Test ($\beta = -0.47$, $p = 0.011$), Trails Part B ($\beta = 1.85$, $p = 0.031$), and Trail Making Delta (Part B-Part A; $\beta = 1.56$, $p = 0.038$). Specifically, higher baseline fatigability was significantly associated with poorer cognitive performance at follow-up after controlling for age, sex, race, body mass index (kg/m²), years of education, years of follow-up, and number of comorbid conditions. **CONCLUSIONS:** Our findings suggest that the perception of fatigue in response to a standardized walking task may act as an indicator of future cognitive decline, at least in the short-term (e.g., 5 years). More research is warranted to examine the underlying biological mechanisms contributing to this relationship as well as how future interventions may target fatigability in mid-life to potentially attenuate age-related cognitive decline. Supported by NIH Grants R21AG053198, P30AG021334, and U01AG057545

1449 Board #211 May 30 9:30 AM - 11:00 AM

The Perceptual Responses to Continuous vs Intermittent Blood Flow Restriction Resistance Exercise

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(No relevant relationships reported)

PURPOSE: To investigate the perceptual responses (ratings of perceived exertion [RPE] and discomfort [RD]) to continuous and intermittent resistance exercise (RE) with blood flow restriction (BFR; 50% of total occlusion pressure), as well as to compare these responses to high- and low-load RE without BFR. **METHODS:** Fifteen untrained participants were randomly assigned to 4 RE conditions: 1) low-load with continuous BFR (cBFR: cuffs remain inflated between sets); 2) low-load with intermittent BFR (iBFR: cuffs are deflated between sets); 3) low-load without BFR (LI); and 4) high-load without BFR (HI). For all low-load conditions, participants performed 4 sets (30-15-15-15 reps) of bilateral leg press and knee extension at 20% of 1RM, whereas the HI condition involved 4 sets (10-10-10-10 reps) at 70% of 1RM for the same exercises. RPE was assessed after each set using the OMNI-RES scale with scores ranging from 0 to 10. RD was assessed before exercises and after each set using a visual analog pain scale with scores ranging from 0 to 10. Data were analyzed using the Friedman's and the Wilcoxon tests with Bonferroni correction and p set at 0.05. **RESULTS:** There were no significant ($p > 0.05$) differences in RPE after each set of leg press for the cBFR and iBFR conditions. HI was significantly ($p < 0.05$) greater than all low-load conditions after each set except for cBFR at sets 1 and 2. There were no significant differences ($p > 0.05$) in RD after each set of the cBFR, iBFR, and HI conditions, except after set 4, when HI was significantly ($p < 0.05$) greater than iBFR. For knee extension, similar responses were observed for RPE after each set, with no significant differences ($p > 0.05$) observed for cBFR, iBFR, and LI conditions; however, HI was significantly ($p < 0.05$) greater than the other 3 conditions. For the HI condition, RD was significantly ($p < 0.05$) greater than the iBFR condition at baseline. Similar RD values were observed for the cBFR, iBFR, and HI conditions after each set, which was significantly ($p < 0.05$) greater than the LI condition. **CONCLUSION:** Continuous and intermittent RE with BFR seem to elicit similar perceptual responses. For RPE, these responses were similar to those from low-load RE and lower than those from high-load. For RD, both BFR conditions were similar to high-load levels and greater than the low-load condition.

1450 Board #212 May 30 9:30 AM - 11:00 AM

Emotional Influence Of Music In Relation To The Effect Of Music On Exercise Performance

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(No relevant relationships reported)

PURPOSE: The purpose of this study is to examine the relationship between individuals' emotional influence of music (EIM) and the effect of listening to music during treadmill running. **METHODS:** Twenty-two recreationally-active adults (21.7 ± 1.78 yrs) completed six visits, including an initial visit to complete a questionnaire to assess EIM. During this visit, participants also created a personal playlist from a song database which utilized cadences of 180 beats per minute. Participants completed treadmill familiarization trials, running at a self-selected pace for 20 minutes, during the second and third visits. Participants then completed a VO2max test on the treadmill during the fourth visit, where running speeds and ratings

of perceived exertion (RPE) were measured. During the final two visits, participants completed time-to-exhaustion (TTE) trials while running at a speed corresponding to 80% of their $\dot{V}O_{2\max}$ on a treadmill. For these trials, two separate conditions were utilized: 1) no music (NM); and 2) self-selected music (SSM). Bivariate correlations were used to determine the relationship between EIM and physiological variables, while paired samples t-tests were used to examine differences between TTE trials. **RESULTS:** A significant difference was found between TTE with NM ($M=12.18\pm5.77$) and TTE with SSM ($M=14.36\pm5.22$) ($t=4.124$, $p<0.001$). EIM was positively correlated to RPE during the TTE without music ($r=0.457$, $p<0.05$), while $\dot{V}O_{2\max}$ was negatively correlated to the difference between TTE trials ($r=-0.481$, $p<0.05$). **CONCLUSION:** Individuals with a higher EIM perceived greater exertion during running without music compared to running while listening to music, indicating that these individuals may experience a heightened level of motivation or inspiration while using music as an external stimulus during exercise and a diminished level of motivation when music is not utilized. Additionally, individuals with a greater $\dot{V}O_{2\max}$ experienced less of a difference between TTE trials, suggesting that individuals with greater aerobic fitness may not rely on external stimuli for motivation, regardless of EIM. Utilizing music as an external stimulus to increase motivation may be a beneficial tool for certain individuals, whether it be in a personal training environment or a physical rehabilitation setting.

1451 Board #213 May 30 9:30 AM - 11:00 AM
Declines In Mental Energy Led To Decreases In Functional Balance: A Pilot Study Using Machine Learning To Detect Changes In Functional Balance

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Purpose: The purpose of this study was to determine the impact of mental task performance on fall risks and to use machine learning to predict changes in fall risk assessments.

Methods: Using a crossover-design, older adults ($N=11$) were recruited from the community and assigned to random allocation of days where they performed fall risk assessments (30 second chair stand test (CST), Timed-up-and-Go (TUG), and Berg Balance Scale (BBS) prior to and after the completion of mental tasks or days where they were told to perform non-mentally and physically taxing tasks (i.e. talk, listen to music) in between the completion of fall risk assessments. A Wilcoxon Sign Rank Test was used to assess differences in fall risks and a Friedman's rank test was used to assess changes in mood (energy, fatigue, physical and mental energy and fatigue). Using the X-box Kinect we measured variances in 25 joints. A random forest classifier was used to predict changes in functional balance. **Results:** Analysis yielded statistically significant declines in feelings of energy ($p=.003$), specifically mental energy ($p=.015$), and a decline in the BBS ($p<.001$) for participants on days when they completed mental tasks compared to days they did not. There were no significant differences ($p>.05$) between other moods and fall risk assessments. We observed a significant increase ($p=.006$) in joint variance during the "standing with eyes closed" part of the BBS after the subjects had performed mental tasks. In the post-hoc analysis our random-forest algorithms allowed us to predict with 79.0% accuracy whether the "standing with eyes closed" part of the BBS was performed after a decline in mental energy or not. The false positive rate was 40.0% and the false negative rate was 21.0%. **Conclusions:** The results of our study suggest that declines in mental energy negatively impacts postural control. Our work was able to predict with a fair degree of accuracy when someone had a decline in mental energy based on changes in functional balance however, it was unable to predict when there was no mental work performed. This suggests that when there is no decline in feelings of energy there is no change in functional balance, and mental work leads to declines in postural control.

1452 Board #214 May 30 9:30 AM - 11:00 AM
Exercise Intensity: Do Individuals Perceive It as We Physiologically Define It?

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The ACSM defines exercise intensities using physiological measures ($\% \dot{V}O_{2\max}$, $\% \dot{V}O_{2R}$, $\%HR_{\max}$, $\%HRR$). Currently, there are no studies examining if individuals perceive the exercise intensity as it is defined by the physiological ranges for each measure. **PURPOSE:** To determine if individuals perceive aerobic exercise intensities as defined by ACSM physiological criteria. **METHODS:** Sixty-three subjects (31 females, 32 males) aged 28.3 ± 11.3 years, BMI 25.0 ± 3.5 kg·m⁻², and $\dot{V}O_{2\max}$ 43.0 ± 9.0 mL·kg⁻¹·min⁻¹ participated in this study. Subjects completed a Bruce treadmill protocol to maximal exertion while rating the intensity at the end of each stage using a Perceived Intensity (PI) scale. The scale reads: Very Light, Light, Moderate, Vigorous, Near Maximal, and Maximal. Subjects were given standard instructions on how to

use the scale prior to the test. Actual Intensity (AI) was determined using $\% \dot{V}O_{2\max}$, $\% \dot{V}O_{2R}$, $\%HR_{\max}$, and $\%HRR$ attained at the end of each stage. PI rated at the end of each stage was compared against the AI for each variable. **RESULTS:** Correlation analyses showed strong relationships between PI responses and $\% \dot{V}O_{2\max}$ ($r = 0.886$, $p < 0.05$), $\% \dot{V}O_{2R}$ ($r = 0.891$, $p < 0.05$), $\%HR_{\max}$ ($r = 0.858$, $p < 0.05$), and $\%HRR$ ($r = 0.862$, $p < 0.05$). Cohen's Kappa (K) for the total sample showed fair to moderate agreements between PI and AI for $\% \dot{V}O_{2\max}$ ($K = 0.405$, $p < 0.05$), $\% \dot{V}O_{2R}$ ($K = 0.394$, $p < 0.05$), $\%HR_{\max}$ ($K = 0.386$, $p < 0.05$), and $\%HRR$ ($K = 0.392$, $p < 0.05$). The Contingency table for $\% \dot{V}O_{2\max}$ showed only 37.0% of PI ratings at a Moderate intensity were accurate with 61.1% of PI rated as less than Moderate. Vigorous intensity ratings were similar with 33.9% accuracy, and 61.3% of ratings as less than Vigorous. **CONCLUSION:** Current physical activity recommendations state that adults should participate in moderate and vigorous intensity activities for health-related benefits. Despite having strong relationships with physiological criteria, the majority of subjects under-rated moderate and vigorous intensities. The results suggest that further subjective definitions of intensity may be needed to match perceptions with physiological measures. Therefore, individuals may need additional familiarization with intensity definitions if they are going to use perceptual measures to regulate intensity.

1453 Board #215 May 30 9:30 AM - 11:00 AM
Effect of Prescribing Exercise through Verbal Commands on Psychophysiological Responses in Walkers or Runners

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Purpose: To compare the effect of prescribing exercise intensity through verbal commands on physiological, perceptual and affective responses in habitual walkers or runners. **Methods:** Fifteen walkers or runners (11 men, 4 women; age: 39.9 ± 9.9 years; height: 172.0 ± 6.1 cm; body mass: 72.6 ± 9.5 kg; BMI: 24.5 ± 2.5 kg·m⁻²; $\dot{V}O_{2\max}$: 46.3 ± 7.4 mL·kg⁻¹·min⁻¹; HR_{\max} : 177.2 ± 11.5 bpm) were submitted to four trials of walking or running at self-selected intensities corresponding to the following verbal commands: Preferred, Low, Moderate and High. All trials were performed in a randomized order. Heart rate ($\%HR_{\max}$), ratings of perceived exertion (RPE 0-10, OMNI-Walk/run scale) and feelings of pleasure/displeasure (-5 to +5, Feeling Scale) were recorded at the end of each trial. **Results:** Walking or running based on the Preferred-intensity verbal command elicited similar speed, $\%HR_{\max}$ and RPE values, and pleasant feelings compared to the Moderate trial. The High trial was the most effortful and the least pleasant one. All trials elicited $\%HR_{\max}$ values that are within the range proposed by the ACSM to promote health-related outcomes.

	Preferred	Low	Moderate	High
Speed (m.s ⁻¹)	3.3 ± 0.6	2.7 ± 0.6 ^a	3.1 ± 0.6 ^b	3.7 ± 0.6 ^{abc}
$\%HR_{\max}$	91.3 ± 6.3	81.4 ± 9.7 ^a	89.9 ± 8.4 ^b	96.2 ± 3.9 ^{abc}
RPE	4.5 ± 0.6	2.3 ± 0.4 ^a	4.5 ± 0.4 ^b	7.8 ± 0.4 ^{abc}
Feeling Scale	3.6 ± 1.0	2.4 ± 2.1	3.7 ± 1.3	0.5 ± 2.5 ^{ac}

^adifferent from Preferred; ^bdifferent from Low; ^cdifferent from Moderate. $p < .01$.

Conclusion: Prescribing walking or running through verbal commands seems highly attractive due to its effectiveness and simplicity. Walking or running at the Preferred-intensity verbal command may promote health-related outcomes and elicit a positive affective experience, which might influence exercise adherence.

1454 Board #216 May 30 9:30 AM - 11:00 AM
Relationship Among Site Specific Fat, Lean Mass, And Endogenous Pain Inhibitory Function

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 (No relevant relationships reported)

Overweight individuals experience greater functional and psychological complications of chronic pain. Dysfunction of endogenous pain-modulatory mechanisms such as conditioned pain modulation (CPM) and exercise-induced hypoalgesia (EIH) have

been found across a host of chronic pain conditions. **PURPOSE:** The purpose of the study was to assess endogenous pain inhibitory function and its relationship with whole body and site specific lean and fat mass. **METHODS:** PPT of 73 participants (38F; 35M) were assessed in the vastus lateralis (VL) and brachioradialis (BR) using a pressure algometer on both sides of the body before and after submersion of their feet in an ice bath (2°C) for 1min and an isometric knee extension, time to failure task based off of 25% of their maximal voluntary contraction. The difference between post and pre measures was defined CPM response (ice bath) and EIH response (exercise condition). Whole body and site specific fat and lean tissue were assessed via DXA scan, and muscle and fat thickness were assessed in the right (R) and left (L) VL and BR using ultrasound and skinfolds. **RESULTS:** Both CPM and EIH responses significantly increased PPTs for all of the four measured sites ($p \leq 0.001$). BF% ($r=0.256$; $p=0.029$) and fat mass ($r=-0.277$; $p=0.018$) correlated with LBR CPM but not with site specific measures ($p>0.05$). RBR, RVL, and LVL CPM did not correlate with any measures of body composition ($p>0.05$). An inverse relationship was found between dominant VL EIH and whole body lean mass ($r=-0.259$; $p=0.028$), as well as limb specific lean mass ($r=-0.262$; $p=0.026$). No relationships were found between any of the body composition measures and non-dominant VL ($p>0.05$). **CONCLUSION:** It appears that in young, healthy adults, whole body and site specific fat mass does not influence endogenous pain-inhibitory function. However, having more lean tissue may have a negative effect on the EIH response. This may be due to larger muscle mass leading to a faster rate of fatigue, reducing exercise time which may have influenced the EIH response rather than muscle mass per se.

1455 Board #217 May 30 9:30 AM - 11:00 AM
Effects Of Carbonated Sports Drink Intake After High-Intensity Exercise On Fatigue Recovery In Athletic Sprinters

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 (No relevant relationships reported)

Carbon acid bathing elevates vasodilation and blood flow due to transcutaneous absorption of carbon acid, resulting in acceleration of fatigue recovery. On the other hand, carbonated drink intake has no effect on aerobic exercise performance in endurance athletes. However, the effect of carbonated drink intake on anaerobic exercise performance remains unclear. **PURPOSE:** This study aimed to clarify whether carbonated sports drink intake after high-intensity exercise promotes fatigue recovery, leading to attenuation of performance decrement in athletes. **METHODS:** Seven male and four female athletic sprinters were enrolled in this study (20.4±0.4 years). All subjects performed wingate exercise session, as an index of anaerobic exercise capacity, (3 sets of 20-sec all-out pedaling on a cycle ergometer against a resistance equivalent to 7.5 % of body weight, with a 30-sec rest), and the same exercise session is performed once again after a 25-mins break. They orally took carbonated sports drink (CSD) containing 22g of carbon acid or non-carbonated sports drink (NCSD) (500mL) during the 25-mins break in a crossover randomized trial with 3-4days between each trial. Blood lactate concentration was measured at rest and 1, 3, 5 and 10 mins after the first exercise session. **RESULTS:** In all athletic sprinters, mean power output of the first set at the second exercise session was significantly higher in the CSD intake than the NCSD intake ($P<0.05$). Additionally, in males, mean power output of the first set at the second exercise session in the CSD intake tended to be higher compared with the NCSD intake ($P=0.07$), whereas, no significant difference was observed in females. Moreover, in males, lactic acid integrated value after 10 mins of first exercise session in males was significantly lower in the CSD intake than NCSD intake ($P<0.05$), but there was no significant difference in females. **CONCLUSIONS:** These results suggest that the carbonated sports drink intake after high-intensity exercise may promote fatigue recovery, and this effect may differ by gender. Supported by JSPS KAKENHI (#18H06423, N. Hasegawa)

C-40 Free Communication/Poster - Cold/Hyperbaric/Diving Physiology

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1456 Board #218 May 30 9:30 AM - 11:00 AM
Circulating Mcp-1 During And Following Prolonged Cycling In Cold Temperature

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 (No relevant relationships reported)

PURPOSE: The purpose of this investigation was to examine the impact of aerobic exercise in a cold condition on the recruitment of classical monocytes (CD14++CD16-). **METHODS:** Six recreationally active men (24.7±3.9 yrs; 182.3±6.9 cm; 85.7±12.8 kg; 3.7±0.3L·min⁻¹) completed three experimental conditions; a VO₂max test, and a cycling protocol in 9°C/55% Relative Humidity (RH)(LTLH), and 24°C/38%RH (MTMH). The exercise session consisted of 60-min cycling at 60% VO₂max, 15-min rest, and a time to exhaustion at 90% VO₂max (TTE). Blood samples were obtained before (PRE), after 60-min of cycling (60), after TTE (90) and after 1-hour of recovery (REC). Blood was analyzed for plasma concentration of Monocyte Chemoattractant Protein 1 (MCP-1) via ELISA, and the expression of MCP-1 receptor (CCR2) on classical monocytes and assessed by flow cytometry. Expression was determined based on fold changes over fluorescence minus one (FMO). Data were analyzed using within-subjects repeated measures ANOVA. **RESULTS:** No interaction ($F = 2.3$; $p = 0.128$; $\eta^2_p = 0.251$), main effect for time ($F = 1.9$; $p = 0.202$; $\eta^2_p = 0.209$) nor main effect of condition was observed ($F = 0.13$; $p = 0.727$; $\eta^2_p = 0.018$) for circulating MCP-1. No interaction ($F = 1.7$; $p = 0.251$; $\eta^2_p = 0.249$) was observed for CCR2 expression on classical monocytes, however, a main effect for time ($F = 31.2$; $p = 0.002$; $\eta^2_p = 0.862$) was observed. CCR2 expression was maintained from PRE (137.6 ± 37.4) to 60 (124.4 ± 91.2, $p = 0.068$), before decreasing at 90 (124.4 ± 36.8, $p = 0.001$) and REC (86.4 ± 25.2, $p < 0.001$). **CONCLUSION:** This data indicates that prolonged cycling in cold temperature may reduce the recruitment of classical monocytes, evident by reduced CCR2 expression. This may indicate a suppression of classical monocyte recruitment during exercise in moderate and cold temperatures. Further research is warranted to assess these responses at greater intensities or duration.

1457 Board #219 May 30 9:30 AM - 11:00 AM
Effects Of Cooled Compression Exercise Technology On Health, Sleep, And Quality Of Life In Veterans.

Pat Marques¹, Grove Higgins¹, Chloe Wernecke², Sara Webb¹, Lindsay Haughton¹, Liz Grimm¹, Mary Wilson¹, Aaron Black¹, Cristian Torres². ¹*Colorado Springs Center for Human Performance and Rehabilitation, Colorado Springs, CO.* ²*Vaspar Systems, Moffett Field, CA.*
 (No relevant relationships reported)

Veterans are disproportionately affected by physical and emotional functional disorders compared to their civilian counterparts, a discrepancy that is deepened by delay to care within the Veterans Health Administration. Research has supported use of compression exercise in physically limited populations and demonstrated physiological responses at lower intensities (10-20% one repetition maximum vs 70% for hypertrophy in resistance exercise). Combination of low-pressure compression exercise and cooling has shown elevated growth hormone and testosterone and depressed nighttime cortisol, indicating this may be beneficial for addressing emotional and sleep dysfunction. **PURPOSE:** To determine the safety and efficacy of an accessible cooled compression exercise system on markers of physical and emotional function in veterans. **METHODS:** 14 veterans completed 24 sessions in 12 weeks. Baseline and endpoint questionnaires validated for clinical significance were administered to determine sleep quality (Pittsburg Sleep Quality Index), quality of life (RAND Short Form 36), and respiratory dysfunction related to stress and anxiety (Nijmegen Questionnaire). **RESULTS:** Two-tailed T-tests were performed on the data. Sleep quality improved in 71% of subjects (9.15±6.87 vs 5.57±3.74, $p = 0.0232$), 57% improved quality of life (73.45±17.17 vs 84.46±9.27, $p = 0.0316$), and 71% decreased adverse respiratory symptoms (11.29±8.38 vs 7.86±6.26, $p = 0.0594$) compared to baseline. Increases were seen in all 8 sub-scores of quality of life, with statistically significant improvements in social functioning (75±28.17 vs 94.64 ±11.62, $p = 0.0058$), energy and fatigue (48.93±25.21 vs 65.63±19.26, $p = 0.0426$), emotional wellbeing (66±24.29 vs 85.14±14.16, $p = 0.0054$, and general health (72.14±15.78 vs 79.64±12.78, $p = 0.0497$). For sleep quality, those subjects with baseline scores defined as clinically disturbed sleep (n=8, 58%) all (100%) experienced sleep improvements (9.14±6.87 vs 5.57±3.74, $p = 0.00301$), with 25% resolving below clinical delineation.

CONCLUSION: These findings suggest that the combination of cooling and compression exercise may be an effective intervention method to address symptoms in veterans and other individuals living with insomnia, post-traumatic stress, chronic fatigue, and depression.

1458 Board #220 May 30 9:30 AM - 11:00 AM
Whole-body Cryotherapy: Case Series Of Sleep, Pain And Anxiety In Healthy Individuals

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(No relevant relationships reported)

BACKGROUND: Whole-body cryotherapy (WBCT) takes place in an enclosed chamber at -184 degrees Fahrenheit. WBCT is currently used to alleviate inflammation and pain in arthritis and osteoarthritis and for pain relief in fibromyalgia. However, to date, only anecdotal evidence exists on the benefits of cryotherapy to provide deep, restful sleep. **PURPOSE:** The purpose of this case series was to test the hypothesis that WBCT would have a positive impact on sleep, pain levels and anxiety of healthy individuals. **METHODS:** Surveys regarding sleep, pain levels and anxiety were administered before and after 10 WBCT sessions (max 3 minutes) to five participants (Age > 50). Sleep was assessed using the Pittsburgh Sleep Quality Assessment Index (PSQI), pain was assessed using the Borg Rate of Perceived Pain Scale, and anxiety was assessed using the Hamilton Anxiety Scale. **RESULTS:** One male (Age 74, BMI = 30.7 kg/m², Caucasian) and one female (Age 73, BMI = 24.9 kg/m², Caucasian) presented with pain from arthritis and while the WBCT had no impact on sleep or anxiety, their pain was reduced from moderate/strong pain (Borg = 4) to extremely weak pain (Borg = 0.5) and from moderate/strong pain (Borg = 4) to weak/moderate pain (Borg = 2.5), respectively. One female (Age 52, BMI = 24.0 kg/m², Caucasian) presented with stress/anxiety and sleep problems. Her pain improved from moderate (Borg = 3) to very weak (Borg = 1), her sleep quality improved by 12 points on the PSQI and her anxiety score improved by 18 points on the Hamilton anxiety scale. Finally, two females (Age 65 and 72) both had no specific reason for trying the WBCT. Both demonstrated no changes in pain, sleep, or anxiety. **CONCLUSION:** These five cases demonstrate that WBCT can improve pain if the subjects present with moderate (or greater pain) and that WBCT may be able to improve sleep and anxiety in subjects that present with problems with sleep or anxiety. Future research is needed in larger samples of people with a history pain, anxiety and/or sleep issues to continue to test the hypothesis that WBCT may have a positive impact on sleep, pain levels and anxiety.

1459 Board #221 May 30 9:30 AM - 11:00 AM
Human Physiologic Thermogenic Response to Resting Cold-Water Immersion: A Thorough Calorimetric Inquiry

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(No relevant relationships reported)

PURPOSE: Navy Diver thermal protection, a primary concern in attempting or completing cold-water tasks, remains inadequate. Optimal heat distribution with minimal energy input is sought. Therefore, heating requirements that support thermal balance (TB) in various cold-water scenarios were quantified. **METHODS:** Nine active duty Navy personnel underwent four resting immersion scenarios in a temperature-controlled 4900-gallon water tank after donning the same full-body tubsuit calorimeter (for diver heat delivery and measurement), undergarments, and a dry suit (total 1.2 Clo). Each subject achieved TB (≤ 2 hrs immersion). TB was defined as temperature equilibrium where core and mean skin temperatures varied $\leq 0.2^\circ\text{F}$ over 20 minutes time. The four scenarios were combinations of the independent variables: 1) inlet tubsuit water temperature (89 and 102°F), and 2) immersion tank temperature (35 or 50°F). **RESULTS:** Metabolic compensation continuously increased over time (Fig 1a) in the 89°F tubsuit/35°F immersion temperature water group. At the fourth quartile time point (during achievement of thermal balance, Fig 1a - Fourth), subjects in the groups of greater tubsuit heat delivery (102°F) required significantly less metabolic activity than did the coldest scenario (89°F/35°F). Distal anatomical sites showed much lower temperatures than proximal sites (data not shown). Tubsuit heat delivery (Wattage) increased significantly (Fig 1b) with both greater tubsuit temperature (102°F vs 89°F) and in colder water immersion (35°F vs 50°F). Thermal balance was achieved in all scenarios thereby allowing steady-state assessment of heat input/extraction parameters. All * indicate $p < 0.05$. **CONCLUSIONS:** Given that thermal balance was achieved over the course of each ≤ 2 -hr exposure, results suggest that using a lower tubsuit perfusion temperature (89°F vs 102°F) requires less Wattage provided a sufficient metabolic response is activated during the immersion.

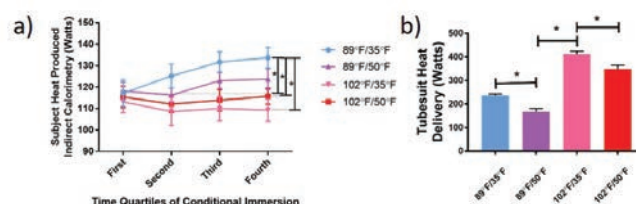


Figure 1

1460 Board #222 May 30 9:30 AM - 11:00 AM
Consecutive, Long-Duration Hyperoxic Immersions Effect on Skeletal Muscle Performance in Well Trained, Male Divers

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PURPOSE: The primary objective of this study was to investigate how resting, long-duration hyperoxic water immersions (WIs) at 1.35 atmospheres absolute (ATA) effected neuromuscular strength performance. We hypothesized that following five consecutive days of hyperoxic WIs, neuromuscular strength performance would be diminished post-WI and remain reduced longer than 72-hrs post-WI. **METHODS:** Thirteen (n=13), active male divers [31.3 \pm 1.7 (24-43) yrs., mean \pm SEM] completed five consecutive 6-hour resting WIs with 18-hour surface intervals while breathing 100% O₂ (n=13) at 1.35 ATA. Skeletal muscle performance assessments occurred immediately before and after each WI, and 24 and 72 hours after the final WI. Performance assessments included maximum voluntary isometric contraction (MVIC) and maximal isokinetic (IK) knee extensions and elbow flexions, and maximum handgrip strength (MHG). We measured neuromuscular activation of the quadriceps, biceps brachii, and brachioradialis via surface electromyography (sEMG). **RESULTS:** MHG declined by 7.8% ($p < 0.001$) by WI 5 with performance returning to baseline by 24-hr post-WI. Brachioradialis neuromuscular activation increased by 42% ($p < 0.001$) on WI 5. MVIC knee extension performance dropped by 4% ($p = 0.001$) on WI 3 with an 11% overall decrease in quadriceps neuromuscular activation. Maximal IK knee extension dropped by 3.3% ($p = 0.008$) on WI 5 with 9.3% ($p = 0.014$) drop in overall quadriceps activation dropped by 7% ($p = 0.013$) during the same period. MVIC elbow flexion performance declined by 5.1% ($p < 0.001$) with an 18% decline in neuromuscular activation by WI 5 but returned to baseline by 72-hr post-WI. Maximal IK elbow flexion performance dropped by 8.6% ($p < 0.001$) on WI 5 with a continual decline in biceps brachii neuromuscular activation by 24% ($p < 0.001$) on WI 5. **CONCLUSION:** The decreases in neuromuscular activation and strength performance coinciding with the non-load bearing muscles affected more than the load-bearing muscles. Yet, the brachioradialis had increases in neuromuscular activation with decreases in performance. These types of hyperoxic WIs caused significant changes to neuromuscular performance after three days of WI with recovery varying with each measured variable with some decrements lasting until the 72-hr post-WI recovery period.

1461 Board #223 May 30 9:30 AM - 11:00 AM
Carotid Body Chemosensitivity is Not Attenuated During Hyperbaric Hypoxia

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(No relevant relationships reported)

Water immersion causes CO₂ retention, thus increasing the risk of CO₂ toxicity. Hyperoxia reduces carotid body (CB) tonic activity, which reduces the ventilatory response to hypercapnia. However, it is not known if CB chemosensitivity is altered during the high partial pressure of oxygen associated with hyperbaria. **PURPOSE:** We tested the hypothesis that oxygen breathing would lower CB chemosensitivity more than breathing air at 6.1 msw depth. **METHODS:** Five subjects (age: 23 \pm 2 y; BMI: 28 \pm 5 kg/m²) completed two, four-hour dry dives at 6.1 msw (1.6 ATA) breathing either 100% O₂ or air. CB chemosensitivity was assessed using hypoxic ventilatory response (CB_{o2}) and brief hypercapnic ventilatory response (CB_{co2}) tests pre-dive, 75 and 155 min into the dives, immediately post-dive, and 60 min post-dive. CB_{o2} consisted of

inhaling 100% N₂ for 2-6 breaths, repeated four times, with 2 min between hypoxic exposures. CB_{CO2} consisted of inhaling 13% CO₂, 66% N₂, 21% O₂ for one breath, repeated four times, with 2 min between hypercapnic exposures. CB chemosensitivity was calculated as the slope of the linear regression line of the peak minute ventilation (MV) in three consecutive breaths vs. the nadir oxygen saturation (pulse oximetry; SpO₂) or peak end tidal CO₂ tension (capnography; PETCO₂) for CB_{O2} and CB_{CO2}, respectively. Data are reported as a change from pre-dive (mean±SD). **RESULTS:** SpO₂ was higher than pre-dive at all time points (all p<0.01), but was not different between conditions (p=0.24). The change in MV was not different over time (p=0.11) or between conditions (p=0.42). PETCO₂ increased during the dive at 75 (Air: 10±5 vs. O₂: 7±4 mmHg) and 155 min (Air: 8±5 vs. O₂: 5±3 mmHg; p<0.01), but did not differ between conditions (p=0.14). CB_{O2} and CB_{CO2} were not different at any time point (p=0.29 and p=0.48, respectively) and were not different between 100% O₂ or air conditions (p=0.64 and p=0.32, respectively). **CONCLUSIONS:** These data indicate that CB chemosensitivity to hypoxia and hypercapnia is not attenuated during hyperbaric hyperoxia. Therefore, the carotid body chemoreceptors do not appear to contribute to CO₂ retention in hyperbaria.

1462 Board #224 May 30 9:30 AM - 11:00 AM
Prolonged Hyperbaric Exposure Alters Gut Mucus, Microbiota Composition And Intestinal Antimicrobial Defense In Mice

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(No relevant relationships reported)

PURPOSE: Divers with prolonged hyperbaric exposure may suffer from digestive dysfunctions, which relate to impairment of intestinal mucosal immune system and gut microbiota homeostasis. We studied the effects of a 4-day hyperbaric exposure on gut microbiota and intestinal antimicrobial peptides (AMPs) in mice.

METHODS: 20 male C57 Mice, 8-week old, were randomly divided into hyperbaric exposure group (HE, n=10) and control group (CON, n=10). The Hyperbaric environment was established by compressed N₂/O₂ mixed gas, and sustained the ambient pressure at 500kPa for 4 days in the pressure chamber. Intestines were excised and stained with Hematoxylin and Eosin (H&E) and alcian blue-periodic acid-schiff staining (AB-PAS). Feces and intestines were collected and extract gDNA and RNA respectively. We used qPCR to assay bacterial population (*Bacteroides*, *Clostridia*, *Lactobacilli*, *Enterobacteria*, and *Akkermansia muciniphila*) of the feces, and the AMPs (*Defa5*, *Defb1*, *Retnlb*, *Reg3b* and *Reg3g*) of small intestine and colon.

RESULTS: During the hyperbaric exposure, the mice did not exhibit any behavioral abnormality, including nitrogen narcosis. According to the AB-PAS staining, the mucus was reduced in colons post hyperbaric exposure. And there was no significant morphological difference between intestines and colons from the mice of HE group and CON by H&E staining. By comparing with the 16S rRNA genes, results revealed a significant increase in the relative abundances of *A. muciniphila* (9.28±5.67) and *Clostridia* (3.45±0.63) in HE. The relative abundance of *Lactobacilli* was lower (0.40±0.24) in HE. Moreover, a distinct increase of *Enterobacteria* (23.34±8.88) was observed in HE compared with CON. Gene expressions for *Defa5* and *Defb1* in HE were decreased in small intestine, while *Defb1* and *Reg3g* in HE were significantly decreased, and *Defa5* and *Reg3b* increased in colon.

CONCLUSIONS:

In sum, the data showed that a four-day hyperbaric exposure induced changes in the mucus of colon, the mRNA level of AMPs, and the gut microbiota composition in mice.

1463 Board #225 May 30 9:30 AM - 11:00 AM
Individual Differences in Effects of Muscular Endurance Training under Hyperoxic Condition

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(No relevant relationships reported)

Hyperoxic condition causes an acute enhancement of dynamic muscular endurance. We hypothesized that muscular endurance training under hyperoxic condition increases training volume, thereby results in larger improvement in muscular endurance as compared to training under normoxic condition. We also hypothesized that there would be considerable individual differences in the effects of the training under hyperoxia, because our previous studies have shown individual differences in the acute effects of hyperoxia.

PURPOSE: To investigate the effects of muscular endurance training under hyperoxic condition and individual differences in the effects.

METHODS: Fifteen healthy young men were assigned to two groups: one group conducted muscular endurance training under hyperoxic condition (30.0% O₂; HOX group, n=7) and the other group conducted the same training under normoxic condition

(20.9% O₂; NOX group, n=8). They performed one set of one-hand preacher curl at an intensity of 30% 1RM until exhaustion, three times per week for six weeks. The number of repetition until exhaustion was recorded every training and summed up every six sessions (1st and 2nd weeks, 3rd and 4th weeks, and 5th and 6th weeks) to estimate training volume. Before and after the training period, maximal number of repetition (R_{max}) was measured under both HOX and NOX conditions.

RESULTS: R_{max} under NOX condition (R_{max}-NOX) significantly increased after 6-week training in both HOX and NOX groups (P < 0.01). Increasing ratio of R_{max}-NOX (R_{max}-NOX after training / R_{max}-NOX before training) was 683.3 ± 683.9% in HOX group and 171.2 ± 123.0% in NOX group. There was a significant correlation between the increase in R_{max}-NOX after the training and the difference between R_{max} under HOX and R_{max} under NOX measured before the training (acute effect of hyperoxia; r = 0.872, P = 0.010). Four subjects in the HOX group who showed large (more than 150%) increases in R_{max}-NOX after the training performed larger training volume than NOX group during 5th and 6th weeks of training period (P = 0.009).

CONCLUSIONS: These results indicated a large individual difference in the effects of muscular endurance training under hyperoxic condition. The difference may be related to the acute effect of hyperoxia on the training volume at the late stage of training period.

C-41 Free Communication/Poster - Hypoxia/Altitude Physiology

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1464 Board #226 May 30 9:30 AM - 11:00 AM
Vagal Withdrawal Is Not Dependent On Oxygen Availability Or Exercise Intensity During Upper-Body Exercise

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(No relevant relationships reported)

Exercise in acute normobaric hypoxia has been shown to delay parasympathetic reactivation after submaximal but not supramaximal exercise; however, the behavior of parasympathetic withdrawal at the onset of exercise has yet to be fully explored.

PURPOSE: The purpose of this study was to evaluate trends for time-domain kinematics of parasympathetic withdrawal at the onset of high-intensity upper-body ergometry exercise during normobaric hypoxia and normoxia. **METHODS:** Nine recreationally-active men (21.6±1.3 y) performed a graded exercise test to determine peak power output under normobaric hypoxia (FiO₂ = 14.0±0.1%) and normoxia (FiO₂ = 20.1±0.2%) on different days, and four time to exhaustion trials randomized over two days at 90% and 110%, and 100% and 120% of peak power output, respectively, under similar conditions. A heart rate monitor recorded R-R intervals at 1000 Hz that were later analyzed using commercially-available software. Root mean square of the standard deviation of R-R intervals (RMSSD) values were calculated using a time-varying method with 64-s moving windows and a 3-s shift. A piecewise bilinear fitting function was utilized to determine the vagal response to high-intensity steady-state arm cranking. Two-way (condition × intensity) repeated measures ANOVA was used to compare estimates of the initial RMSSD (y-intercept of the first linear function), rate of RMSSD decline (slope of the first linear function), time to parasympathetic withdrawal (x-value at the intersection of the first and second linear functions), RMSSD at the time of parasympathetic withdrawal (y-value at the intersection of the first and second linear functions). **RESULTS:** No significant interactions or main effects were noted for initial RMSSD (p>0.05; 23.42 ± 3.2 ms), rate of RMSSD decline (p>0.05; -0.45 ± -0.08 ms/s), time to vagal withdrawal (p>0.05; 46.1 ± 2 s), and RMSSD at the time of vagal withdrawal (p>0.05; 3.79 ± 0.67 ms). **CONCLUSION:** Parasympathetic withdrawal does not seem to be affected during upper-body exercise under normobaric hypoxic or normoxic conditions at exercise intensities between 90% and 120% of peak power output in male participants. Funding disclosure: This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

- 1465** Board #227 May 30 9:30 AM - 11:00 AM
The Effects Of Body Composition, Physical Fitness On Time Of Useful Consciousness In Hypobaric Hypoxia
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(No relevant relationships reported)

Abstract

PURPOSE: The purpose of this study was to investigate the effect of body composition and physical fitness of Air Force pilots on hypoxic tolerance (Time of Useful Consciousness, TUC) under hypoxic hypoxic conditions.

METHODS: At the sea level, we measured the body composition and physical fitness of 99 adults who were not exposed to hypoxic environment. In the hypoxia chamber, which can simulate high altitudes, we set the altitude to 25,000 feet and measured the TUC and the maximum heart rate (HRmax(H)). Pearson's Correlation was used to determine the relationship between TUC and other variables, and multiple regression was performed to determine the independent variables that best explain the TUC.

RESULTS: TUC is positively correlated with maximum oxygen uptake (VO2max), Stroke Volume (SV), arteriovenous oxygen difference (a-vO2 diff) and endurance (Sit-up, Push-up). The maximum heart rate on the ground (HRmax(S)), HRmax(H), body fat mass, and percent body fat were negatively correlated with TUC. A regression analysis showed that 84.5% of the TUC can be explained by body composition and physical fitness.

CONCLUSION: Our results revealed that increased cardiorespiratory fitness and decreased fat could significantly impact TUC. Therefore, for Air Force pilots who are always at high altitudes and at risk for exposure to hypoxia, aerobic exercise is essential.

- 1466** Board #228 May 30 9:30 AM - 11:00 AM
Influence Of Acetazolamide On Manual Dexterity During 30-hour Exposure To Hypobaric Hypoxia (3,500 M)
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(No relevant relationships reported)

High altitude missions pose challenges not seen during sea level expeditions. In order for missions to be successful, it is imperative for Soldiers to maintain physical and cognitive performance. Acetazolamide (AZ) is known to decrease the effects of Acute Mountain Sickness (AMS), but reported side effects (e.g., drowsiness, peripheral paresthesias) could potentially impair manual dexterity. **PURPOSE:** The purpose of the study is to evaluate whether AZ treatment (250 mg bid) alters manual dexterity during 30 hours exposure to 3,500 m simulated altitude. **METHODS:** Six volunteers (6 males, 22.2 ± 3.2 y, 77.5 ± 11.5 kg, 176.2 ± 7.1 cm) took part in two separate 30 hour exposures to 3,500 m simulated altitude in the USARIEM hypobaric chamber. Volunteers received AZ (250 mg twice daily) or a placebo, in a single-blind crossover design. Prior to exposure, volunteers were trained at sea level in all procedures. Dexterity testing included the Purdue Pegboard (sum of rows completed in 30 seconds with right hand only, left hand only and both hands), and magazine/ cartridge loading (number of cartridges loaded in 2 minutes). **RESULTS:** Both Purdue Pegboard and magazine cartridge loading performance were not different between placebo and AZ trials (Purdue Pegboard: placebo: 38 ± 6 vs. AZ: 36 ± 7 rows, P > 0.05; cartridge loading: placebo: 57 ± 12 vs. AZ: 59 ± 13 cartridges, P > 0.05). **CONCLUSION:** Our results suggest that AZ treatment and potential side effects do not impair manual dexterity during a 30 hour exposure to 3500 m altitude. Future studies could evaluate whether higher (500 mg bid) doses of AZ would demonstrate different results. *Funded by USAMRMC; author views not official US Army or DOD policy.*

- 1467** Board #229 May 30 9:30 AM - 11:00 AM
Oxygen Consumption, Heart Rate and Work Rate During Maximal Exercise in Moderate Altitude Natives: Real versus Predicted Values
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Roughly 23% of Colombian population live at moderate altitude (>2500 m above sea level) and is exposed to 28% lower inspired oxygen pressure that affects oxygen delivery and utilization systems. Maximal heart rate (HRmax), maximal oxygen

consumption (VO2max), and maximal work rate (Wmax) during cardiopulmonary exercise testing (CPET) are key parameters for diagnostic and exercise prescription purposes, the last two of them have been reported to be about 10% lower in moderate hypobaric hypoxia. Predictive equations for VO2max, HRmax and Wmax have been developed mainly from sea-level populations.

PURPOSE: To evaluate the published predictive equations for VO2max, HRmax and Wmax in healthy young residents in moderate altitude.

METHODS: VO2max, HRmax and Wmax were measured during maximal ramp cycle ergometer CPET in 136 healthy subjects (62 females) 18-25 years old, born and raised at >2,500 m and living at 2600 m. From a systematic search on Medline and Embase databases 22 studies (71 predictive equations) with similar population (healthy, age group), CPET protocols (incremental/ramp maximal cycle ergometer test) and measured parameters (VO2max, HRmax, Wmax) were selected; all studies were conducted at low altitude. Normal distribution was tested by Shapiro-Wilk test and mean differences between direct measurements and estimated values were compared by paired T-Student test (alpha error = 0.05). Estimated values with no significant mean difference from direct measurements were further assessed by Pearson product-moment correlations.

RESULTS: Most real and estimated mean values were significantly different for VO2 (male 19/21, female 16/19) and Wmax (male 7/8, female 6/9); for HRmax, significant differences were found in approximately half of them (male 3/8, female 6/9); of the remaining equations only one exhibited a strong correlation with direct values for VO2max in females (r=0.89, p<0.005).

CONCLUSIONS: In general, available predictive equations do not accurately estimate VO2max, Wmax or HRmax in a young, healthy Colombian population born and raised at moderate altitude. Differences in population characteristics (adaptation to hypobaric hypoxia, anthropometric differences, training level) can partially explain these results. Supported by COLCIENCIAS grant number 120356934972, 713-2013.

- 1468** Board #230 May 30 9:30 AM - 11:00 AM
Accumulated Oxygen Deficit During Arm Cranking: Effects Of Hypoxia And Methodological Considerations
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Under normobaric hypoxia, aerobic capacity is inherently limited, possibly leading to changes in energy system contribution. While most of the research has focused on lower body cycling or full-body exercise, upper body differences in muscle fiber type distribution and diffusion distance may require greater anaerobic energy provisions as reflected by accumulated oxygen deficit (AOD). **PURPOSE:** To observe the effects of normobaric hypoxia on AOD and energy system contribution during different intensities of upper-body arm cranking exercise. **METHODS:** Twenty-one recreationally active men (21.4 ± 1.4 yr.; 175.5 ± 5.7 cm; 84.8 ± 11.7 kg) performed a graded exercise test (GXT) in normobaric normoxia (N; FiO2~20%) and normobaric hypoxia (H; FiO2~14%) to determine peak power output (PPO). Time to exhaustion (TTE) trials were later conducted at 110% and 120% PPO under both N and H. AOD (in L·min⁻¹) was calculated as the difference between predicted O2 consumption (extrapolated from a regression equation calculated from GXT) and measured O2 consumption during the TTEs, standardized to time. Anaerobic energy system contribution (%AN) was calculated as [1-(actual O2 consumed/predicted O2)] × 100. AOD and %AN were calculated in three conditions: N, H, and H using the N regression equation (H_N). Two-way (condition × intensity) repeated measures ANOVAs were conducted for AOD and %AN. **RESULTS:** There was a significant condition × intensity interaction for %AN (p=.009) and AOD (p=.007). At 110% PPO, %AN was significantly greater (p=.013) in H_N compared to N (14% vs. 6.8%, respectively), but not H compared to N. At 120% PPO there were no differences in %AN between conditions. At 110% PPO, AOD was significantly greater (p=.029) in H_N compared to N (0.33 vs. 0.19 L·min⁻¹, respectively) but not H compared to N. At 120% PPO there were no differences in AOD between conditions. **CONCLUSION:** Calculating AOD for hypoxic exercise using a regression equation derived from normoxic conditions reveals a greater anaerobic contribution relative to normoxic exercise. The greater AOD and %AN in hypoxia compared to normoxia that was present at 110% PPO was not reproduced at 120% PPO. This may suggest a possible threshold at which hypoxia has no further effect on energy system contribution in this exercise modality.

1469 Board #231 May 30 9:30 AM - 11:00 AM

The Effects of Altitude Training Masks Worn During Low-Intensity Bouts on Performance

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(No relevant relationships reported)

Altitude training masks (ATMs) are frequently used during exercise to enhance physiologic adaptations, yet few studies have examined the effects of ATMS when used during recovery periods.

PURPOSE: To examine the effects of ATMs used only during low-intensity recovery intervals in a high-intensity interval training (HIIT) program in healthy young adults. **METHODS:** Participants engaged in 18 HIIT over a 6-week period using a treadmill. HIIT sessions were comprised of 6-8, 60-second high-intensity bouts at a relative work rate corresponding to 95% of participants' maximal heart rates, alternating with 90-second low-intensity recovery bouts at a relative work rate corresponding to 20% VO₂max. Participants were randomly assigned to an experimental group (EXP) which wore an ATM only during the low-intensity bouts or to a control group (CON) which did not use an ATM. Cardiopulmonary exercise tests (CPET) were performed before and after the HIIT.

RESULTS: 10 participants completed the study in the EXP group (6 females; 26±4.1 years; BMI: 24.2±1.6 kg/m²) and 10 in the CON group (7 females; 24.3±3.5 years; BMI: 22.8±2.1 kg/m²). Both groups experienced improvements in VO₂max (EXP: 39.9±4.6 vs. 42.8±6.0 ml/kg/min, p=0.02; CON: 39.7±6.1 vs. 43.9±8.3 ml/kg/min, p=0.01; baseline vs. follow-up, mean±SD). The EXP group alone saw improvements after training in time to anaerobic threshold (169±31.2 vs. 213±56.2 sec, p=0.04), increased peak work rate during CPET (44±26.9 vs. 88±54.3 Watts, p=0.03), and increased minute ventilation during peak exercise (108±15.5 to 113.64±19.6 L/min, p=0.04). No other changes were observed in the CON group.

CONCLUSIONS: Using ATMs only during the low-intensity bouts of HIIT appears to have afforded participants with unique training adaptations not observed in standard HIIT. Conventional use of ATMs employs the masks during exertional portions of exercise training, not solely during recovery periods. These findings suggest that ATMs may serve as a valuable training adjunct even if used only during recovery periods in HIIT. Supported by: GWU SMHS Emerging Scholars Award 2016-2018

1470 Board #232 May 30 9:30 AM - 11:00 AM

Effect Of Intermittent Hypoxic Exercise Training On Improving Altitude Acclimatization

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to evaluate the effect of hypoxic exercise training towards altitude acclimatization through systematic literature synthesis, and establish a potential strategy to improve altitude acclimatization.

METHODS: A selective PubMed, CNKI and Google Scholar search on intermittent hypoxic exercise training and altitude acclimatization was conducted. By search and screening, 11 articles of PubMed/Google Scholar and 4 articles of CNKI were included for final analysis and assessment.

RESULTS: Moderate-intensity intermittent hypoxic exercise training could blunt oxidative stress and decrease Acute Mountain Sickness (AMS) at elevations of ~3200m, but it has little effect on physical performance compared to intermittent hypoxic exposure. Vigorous-intensity intermittent hypoxic exercise training can improve human endurance performance. None moderate exercise is performed to increase AMS or worsen AMS severity, while exceed health bearing can worsen symptoms of AMS.

CONCLUSIONS: 1) intermittent hypoxic exercise training can improve altitude acclimatization to AMS and physical health status. 2) A proper hypoxic exercise training intensity may be a crucial factor to maintain and raise human physical performance at high altitude.

Author	Effect	Altitude	Training method
H. Mairiaux et al. 1984	A positive effect of adaptation to altitude on exercise performance.	2300m	13days, altitude training
Reusch RC et al. 2000	Exercise masks reduce stroke mortality risk.	4800m	14days, exercised at 50% altitude specific maximal workload four times for 30 min
Balchunas BA et al. 2009	A positive effect was observed to affect muscular performance significant, but the difference was not significant between exercise and rest.	4300m	7weeks, cycled for 45-60 min/day at 60%-70% of maximal O2 uptake
Balchunas BA et al. 2009	Intermittent hypoxic exposure did not improve endurance performance.	4300m	7days exercise at approximately 80% of peak HR
Balchunas BA et al. 2009	A positive effect was observed to affect time trial cycle exercise performance, but the effect of exercise or rest does not have a significant difference.	4300m	7 days two consecutive 15 min constant-work rate exercise bouts
Hoop T et al. 2012	Altitude masks did not differ significantly between exercise and rest.	F020+120/4800m	4 h cycling at 45% F020/30 specific maximal power output
Wester M et al. 2013	The influence of moderate exercise on AMS is minor.	F020+11.0/4500-500 m	Moderate intensity
Edel M et al. 2014	High-intensity exercise in hypoxia led to an increase in the development of pulmonary interstitial edema after subacute exposure but not during acute exposure.	4000 m	High-intensity interval exercise (HIIE) test
Muller A et al. 2014	AMS rates were higher after training days with higher levels of perceived exertion.	3833-4510-5120 m	10days, trekking
Hoop T et al. 2014	Exercise attenuated the effect of hypoxia by increasing total brain volume, but did not correlated with AMS symptoms.	F020+120/4800m	11 hours
Hoop T et al. 2014	Exercise training attenuated the oxidative stress.	F020 + 13.0% (4800m)	10days, two training sessions per day at 50% of hypoxic maximal aerobic power
Chen Gezhou et al. 2012	Wearing the 10miners improved headache symptoms and tended to decrease AMS.	3200m	2days
MAN Wang, 2002	Intermittent hypoxic exercise enhanced the adaptation of organisms to hypoxia.	4800m	3 weeks, intermittent hypoxic training(2100-3500-4800m), 20 min constant load exercise of machine pedaling with 80rpm and 80W
DIJOU Wenzheng et al. 2010	Training in intermittent altitude exposure had remarkable effect for the hypoxia acclimation to AMS.	4800m	2 weeks, intermittent hypoxic training(2100-3500-4800m) with 20min cycling (30% of V _{max} at 40% w _{max})
MA Jiang et al. 2014	Hypoxic training contributed to high altitude acclimatization, but fails to improve physical fitness.	4000m	2 months, low and moderate intensity physical fitness training

1471 Board #233 May 30 9:30 AM - 11:00 AM

Lipolysis Mechanism By Down-regulating Mir-92a Activating Wnt/β-catenin Signaling Pathway In Hypoxic training Rats

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Lipolysis mechanism by down-regulating miR-92a activating Wnt/β-catenin signaling pathway in hypoxic training rats

Studies showed that the loss of body weight in high altitude or hypoxic training conditions was more significant than that in normoxic training conditions. Wnt/β-catenin signaling is a molecular switch that governs adipogenesis. Some studies showed that hypoxia can induce lipolysis and inhibit fat synthesis and influence Wnt/β-catenin signaling.

PURPOSE: This study investigates the role of miR-92a via Wnt/β-catenin signaling in lipid metabolism of hypoxic training rats.

METHODS: Microarray and real-time polymerase chain reaction (RT-PCR) were used to detect the mRNA change of miR-92a in the perirenal fat and epididymis fat of hypoxic training and normoxic training rats. The downstream target mRNA of miR-92a was predicted using bioinformatics and further identified with dual luciferase assay. The Fzd10 and c-myc expression change was detected in the perirenal fat and epididymis fat by using RT-PCR and Western blot.

RESULTS: The microarray and RT-PCR results showed a significantly decreased expression of miR-92a in the fat tissues of hypoxic training rats more than that of normoxic training rats. Result of dual luciferase assay showed that the target gene of miR-92a is Fzd10, which is an acceptor in the Wnt pathway. Fzd10 expression was upregulated in hypoxic training rats. The mRNA expression of the c-myc located at downstream of Wnt pathway increased significantly.

The significantly increased mRNA and protein levels of Fzd10 and c-myc may be related to miR-92a downregulation, leading to lipolysis through Wnt/β-catenin signaling pathway regulation and subsequently causing rat's body weight loss of hypoxic training rats.

1472 Board #234 May 30 9:30 AM - 11:00 AM

Effects Of Acute Intermittent Hypoxia (AIH) On Metabolism, Substrate Partitioning, And Dysglycemia In Obese Individuals With Spinal Cord Injury: A Case Series

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(No relevant relationships reported)

Innovative approaches are essential for achieving clinically meaningful improvements in cardiometabolic health in individuals with spinal cord injury (SCI).

PURPOSE: Examine changes in glycemic control and metabolism while at rest and during exercise after 4 days of resting exposure to AIH compared with a time-matched normoxic (SHAM) treatment.

METHODS: Participants were 4 males aged 34-57 with chronic (3-18 yrs) SCI at C6-T8. Participants reported to the laboratory after an 8-10 hour fast. After 30 minutes

of rest, participants performed a graded arm exercise test (GXT) to establish peak O_2 consumption. Substrate oxidation rates were derived from cardiorespiratory data averaged over the last minute of each 3-minute stage where RER was < 1.0 . On a non-consecutive day, participants underwent a baseline (BL) 75-gram oral glucose tolerance test (OGTT). Participants were exposed to AIH for 4 consecutive days involving hour long intervals of alternating 6-minute hypoxia ($\text{F}_{\text{I}}\text{O}_2 = 0.09\text{--}0.12$) and 3-minute normoxia ($\text{F}_{\text{I}}\text{O}_2 = 0.21$). The SHAM protocol was the same except with continuous normoxia. Following the final exposure of each intervention, participants performed a follow-up OGTT, and a GXT 24 hours later.

RESULTS: All participants were obese by population-specific criteria ($\text{BMI} = 23.0\text{--}44.7 \text{ kg/m}^2$) and two were insulin resistance per the Homeostatic Model-2 (HOMA2-IR) Assessment ($\text{HOMA-IR} = 3.8\text{--}4.2$). No changes were seen in HOMA-IR after intervention, however, post-AIH OGTT showed fasted insulin concentrations 31% lower than observed at BL, while glucose remained similar across both trials (2% Δ). Insulin area under the curve was 26% lower after AIH compared to BL with little change (11%) in glucose. There were no differences in metabolism and substrate utilization at rest or exercise across trials.

CONCLUSION: Lower pre-load insulin concentration and lower peak insulin values observed following AIH suggests an insulin-sensitizing effect of treatment. However, the duration of this benefit requires testing. No differences were reported in metabolism and substrate partitioning in four participants, however this needs to be investigated in a larger population. This case series demonstrates that in these individuals with SCI, AIH exposure was well tolerated and can be administered without adverse events.

1473 Board #235 May 30 9:30 AM - 11:00 AM
Short-term Altitude Training Effects on Aerobic Performance Parameters in Collegiate Cross-country Runners

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Endurance athletes have been using altitude training for over half a century to improve sea-level performance. Live High-Train Low (LHTL), a contemporary form of altitude training, was proven best for long-distance (5000m) athletes. However, while athletes continue to use this training technique in an acute fashion (< 2 weeks), no study has shown the effects of such a short-term use on aerobic performance. **PURPOSE:**

To evaluate aerobic performance parameters, i.e., aerobic capacity ($\text{VO}_{2\text{Peak}}$) and ventilatory threshold (VT), after 6 days of LHTL altitude training in collegiate cross-country runners. **METHODS:** Fourteen male NCAA cross-country runners (age: 19.07 ± 0.92 y.o.) with initial $\text{VO}_{2\text{Peak}}$ of $73.13 \pm 5.65 \text{ ml/kg/min}$ participated in the study. $\text{VO}_{2\text{Peak}}$ and VT were evaluated using a metabolic cart at sea-level, pre- and post-training. Runners from sea level traveled to high altitude where they lived at 1322m above sea-level for 6 days. Six training sessions were performed at altitudes ranging from $881.25 \pm 148.87 \text{ m}$ to $1047.70 \pm 237.29 \text{ m}$ above sea-level with training sessions averaging a duration of 75.25 ± 7.04 mins, speed of $13.02 \pm 1.60 \text{ kmph}$ and distance of $16.42 \pm 2.95 \text{ km}$. **RESULTS:** There was no significant effect on either absolute ($p=0.325$) or relative $\text{VO}_{2\text{Peak}}$ ($p=0.643$). A significant main effect of time was found for absolute VT ($p<0.001$), which changed from $3.35 \pm 0.52 \text{ L/min}$ to $3.89 \pm 0.55 \text{ L/min}$, and VT relative to $\text{VO}_{2\text{Peak}}$ ($p<0.001$), which changed from $74.29 \pm 8.54\%$ of $\text{VO}_{2\text{Peak}}$ to $87.57 \pm 3.48\%$ of $\text{VO}_{2\text{Peak}}$. Consequently, there was a significant main-effect of time for heart rate at VT ($p=0.025$), which changed from $168.50 \pm 14.87 \text{ bpm}$ to $176.07 \pm 11.02 \text{ bpm}$. **CONCLUSION:** Although there was no significant change in $\text{VO}_{2\text{Peak}}$, short-term LHTL training had a positive effect on VT in trained cross-country runners. This is possibly due to the hemodilution resulting from return to sea level combined with the preserved ventilatory adaptations from altitude training.

1474 Board #236 May 30 9:30 AM - 11:00 AM
Exogenous Glucose Oxidation During Endurance Exercise in Hypoxia

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(No relevant relationships reported)

The exercise under hypoxic condition augmented carbohydrate (CHO) metabolism during exercise (Sumi et al. 2018). However, detailed CHO oxidation pattern during exercise under hypoxic condition remain unclear.

PURPOSE: The purpose of the present study was to evaluate the effect of endurance exercise under moderate hypoxic condition at the same energy expenditure or exercise intensity on exogenous glucose oxidation.

METHODS: Nine active healthy males completed three trials on different days, consisting of 30-min running at each exercise intensity of the following: 1) 65% of normoxic $\text{VO}_{2\text{max}}$ under the normoxic condition ($\text{F}_{\text{I}}\text{O}_2 = 20.9\%$; NOR), 2) 65% of

hypoxic $\text{VO}_{2\text{max}}$ under the hypoxic condition ($\text{F}_{\text{I}}\text{O}_2 = 14.5\%$; HYPOR), 3) 65% of normoxic $\text{VO}_{2\text{max}}$ under the hypoxic condition ($\text{F}_{\text{I}}\text{O}_2 = 14.5\%$; HYPOA). Venous blood samples were collected before and after exercise. The subjects consumed ^{13}C -labeled glucose immediately before exercise, and we collected expired gas during exercise to determine ^{13}C -excretion (calculated by $^{13}\text{CO}_2/^{12}\text{CO}_2$).

RESULTS: Running velocity were significantly lower in the HYPOR ($9.4 \pm 0.3 \text{ km}$) than in the NOR ($10.6 \pm 0.3 \text{ km}$) and HYPOA ($10.6 \pm 0.3 \text{ km}$). Exercise-induced blood lactate elevation was significantly augmented in the HYPOA than in the NOR and HYPOR ($P = 0.001$). The HYPOA showed significantly higher CHO oxidation (evaluated by VO_2 and VCO_2) during exercise compared with other two trials ($P = 0.01$). In contrast, exogenous glucose oxidation (^{13}C -excretion) during exercise was significantly lower in the HYPOA than in the NOR ($P = 0.01$).

CONCLUSIONS: Endurance exercise under moderate hypoxic conditions promoted whole body CHO metabolism during exercise. However, exogenous glucose oxidation during exercise was attenuated compared with the same exercise under normoxic condition.

1475 Board #237 May 30 9:30 AM - 11:00 AM
Effect of Sprint Exercise in Hypoxia on Muscle Glycogen Utilization

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The influence of maximal sprint exercise in hypoxia on muscle glycogen content muscle has not been directly evaluated.

PURPOSE: The purpose of the present study was to determine the effect of a single bout of maximal sprint exercise in hypoxia on muscle glycogen content among competitive athletes.

METHODS: Ten sprinters (height; $176.9 \pm 1.9 \text{ cm}$, body weight; $66.9 \pm 2.0 \text{ kg}$, BMI; $21.4 \pm 0.5 \text{ kg/m}^2$, athletic career, 10.3 ± 2.9 years) performed two exercise trials under either hypoxic [HYP, fraction of inspired oxygen ($\text{F}_{\text{I}}\text{O}_2$): 14.5%, a simulated altitude of 3,000m] or normoxic (NOR, $\text{F}_{\text{I}}\text{O}_2$: 20.9%) conditions with a randomized, a single-blind and crossover design. The exercise in each trial consisted of three sets of 30-s maximal sprint. Muscle glycogen content was measured using carbon magnetic resonance spectroscopy (^{13}C -MRS) in the vastus lateralis and vastus intermedius muscles before and after the exercise. Moreover, time-course changes in power output, percutaneous oxygen saturation (SpO_2), blood lactate, metabolic responses and muscle oxygenation were evaluated.

RESULTS: The average SpO_2 value was significantly lower in the HYP trial ($91.0 \pm 0.3\%$) than in the NOR trial [$95.9 \pm 0.3\%$, $P < 0.01$, effect size (ES) = 5.08]. Mean power output did not differ significantly between the two trials ($P = 0.80$, ES = 0.01). There was a significant main effect for time ($P < 0.01$, ES = 0.97) for blood lactate concentration, but no significant difference between the two trials was observed ($P = 0.31$, ES = 0.12). Change in muscle glycogen content showed significant interaction ($P = 0.03$, ES = 0.40) and main effect for time ($P < 0.01$, ES = 0.89). Relative change in muscle glycogen content between before and after the exercise was significantly greater in the HYP trial ($-43.5 \pm 0.4\%$) than in the NOR trial ($-34.0 \pm 0.3\%$, $P < 0.01$, ES = 0.83).

CONCLUSION: Maximal sprint exercise in hypoxia caused further decrement of muscle glycogen content compared with the same exercise under normoxia.

1476 Board #238 May 30 9:30 AM - 11:00 AM
Effects Of Systemic Hypoxia-hyperoxia Preconditioning On Acute Heavy Resistance Exercise-induced Muscle Damage In Athletes

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PURPOSE: Local ischemic preconditioning was shown to improve exercise performance in previous studies, but it also causes pain. The aim of the present study is to investigate the effects of systemic hypoxia-hyperoxia preconditioning on muscle damage caused by a bout of acute heavy resistance exercise (RE).

METHODS: In this double-blind, randomized-controlled crossover study design, 11 voluntary male athletes (20-24 years old) were recruited as participants. Subjects were randomly divided into normoxia and hypoxia-hyperoxia groups. For a duration of 50 min, the hypoxia-hyperoxia group was alternately supplied with 10% or 100% oxygen in 5 min intervals. The normoxia group was supplied with 20.9% oxygen for 50 min during the same period. 30 min after preconditioning, all subjects performed a bout of acute heavy RE. After a 14-day washout time, subjects swapped groups.

RESULTS: The results showed that the high intensity RE decreased peak torque and increased muscle pain in both groups. Circulating creatine kinase (CK), myoglobin and interleukin 6 (IL-6) also increased immediately after RE in normoxia subjects. CK, myoglobin and testosterone/cortisol ratio (T/C ratio) of hypoxia-hyperoxia group were lower than those of normoxia group 24 and 48 h after RE. However, IL-6 of hypoxia-hyperoxia group was higher than that of normoxia group 24 and 48 h after RE. No differences were found in thiobarbituric acid reacting substance (TBARS) levels or peak torque levels between normoxia and hypoxia-hyperoxia groups.

CONCLUSIONS: Systemic hypoxia-hyperoxia preconditioning could reduce muscle damage induced by high intensity RE. These effects may be due to increased anti-inflammatory cytokine secretion.

1477 Board #239 May 30 9:30 AM - 11:00 AM
The Integrative Physiological and Neuromuscular Effects of High Altitude Cycling in World Class Endurance Athletes

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PURPOSE: Six pro endurance athletes (3 men, 3 female) participated in a study investigating the effects of cycling at high altitude on physiological & neuro-muscular systems.

METHODS: Athletes were tested in three locations using identical procedures and equipment. Baseline testing took place in Santa Monica, CA. Then, the entire lab's equipment was transported to two additional study locations (Death Valley and Mammoth Mountain, CA). Each athlete completed a 5-stage, 3-min/stage ramp exercise trial. Athletes performed the ramp test in duplicate at each test site (morning and afternoon). Respiratory-metabolic measurements, regional oxygen saturation (SMO2), substrate oxidation rates, and EMG activity were recorded continuously. Blood samples were taken the last 15-sec of each stage. Data were analyzed using repeated-measures ANOVA models and Turkey Post-Hoc test to identify specific areas of significance when appropriate.

RESULTS: The mean workload across all 5 stages was 227 ± 60 watts (Stage 1 = 117 watts; Stage 5 = 287 watts). Compared to sea level, the over-all mean SMO2 saturation at the 227 watts mean was 24.5% lower at altitude ($p = 0.04$) while deoxy hemoglobin was 18.5% higher ($p=0.04$). Correspondingly, lactate concentrations were 27.2% greater, but this difference did not reach significance. However, lactate concentrations during stage 5 were 34% greater at altitude compared to sea level ($p = 0.035$). At sea level, quadricep (Quad) muscle activation accounted for 58% of the total force produced while cycling at altitude quad work was reduced to 51%. Lactate concentrations had an inverse relationship with EMG Quad activity ($p=0.03$) and direct relationship with hamstring force activation ($p = 0.03$). RER values indicated greater CHO oxidation rates at altitude across all stages combined (Sea level: 2.127 gm/min; Altitude: 2.954 gm/min, $p = 0.01$). For stages 4 & 5, despite greater respiration rates, over-all ventilation volumes declined cycling at altitude lowering oxygen uptake by 10.2% and 19.4% respectively despite being at the same workload compared to sea level.

CONCLUSIONS: These results indicate cycling at altitude requires greater physiological-metabolic response to maintain neuro-muscular function cycling at work rates up to 80% of max effort.

1478 Board #240 May 30 9:30 AM - 11:00 AM
Effect of Acetazolamide on Hand and Finger Strength During 30 Hours Exposure to 3500m Altitude

Beau R. Yurkevicius, Adam C. Nixon, Karleigh E. Bradbury, Katherine M. Mitchell, Billie K. Alba, Kirsten E. Coffman, Robert W. Kenefick, FACSM, Nisha Charkoudian, FACSM, USARIEM, Natick, MA. (Sponsor: Nisha Charkoudian, FACSM)

(No relevant relationships reported)

Activities that require rapid ascent to altitude, such as those that commonly occur in military, mountain rescue, and recreational settings, often require substantial hand and finger strength in order to complete tasks. Many who deploy quickly to altitude experience symptoms of acute mountain sickness (AMS), which have been shown to be decreased by acetazolamide (AZ). Although AZ may cause peripheral paresthesia, potential influences on hand and finger strength are currently unclear. **PURPOSE:** The purpose of this study was to test the hypothesis that AZ treatment during an acute, 30-hour exposure to 3500 m simulated altitude would decrease hand and finger strength relative to placebo treatment.

METHODS: Six male volunteers (22.2 ± 3.2 yrs, 77.5 ± 11.5 kg, 176.2 ± 7.1 cm) participated in two separate 30 hour altitude exposures (3500 m, 20°C, 20% RH) in the USARIEM hypobaric chamber. Participants were given either a placebo or 250 mg AZ twice a day for 3.5 days (2 sea-level days + the 30 hour altitude exposure) in

a randomized, single-blind crossover design. During each altitude exposure, strength tests were performed which comprised of maximal hand grip and finger pinch (palmar, key, tip) strength tests.

RESULTS: No volunteers reported sensations of peripheral paresthesia. There was no difference between altitude exposures in any of the measures of hand and finger strength (placebo vs. AZ; hand grip: 43 ± 7 vs. 43 ± 8 kg; palmar pinch: 11 ± 2 vs. 12 ± 2 kg; key pinch: 11 ± 1 vs. 11 ± 1 kg; tip pinch: 8 ± 1 vs. 8 ± 1 kg; $p > 0.05$ for all).

CONCLUSIONS: Our results suggest that 500 mg/day AZ treatment does not influence hand and finger strength during a 30 hour exposure to 3500 m altitude. Future studies could evaluate if higher doses of AZ, that may induce more paresthesia, would influence hand and finger strength differently.

Funded by USAMRMC; author views not official US Army or DOD policy.

1479 Board #241 May 30 9:30 AM - 11:00 AM
The Effect Of Moderate Hypoxia On Skeletal Muscle Cell Growth And Related Protein Expression

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(No relevant relationships reported)

PURPOSE: Skeletal muscle atrophy is one of the adaptations of hypoxic environment. However, previous study showed resistance training under hypoxic environment (16% oxygen concentration) causes greater muscle hypertrophy than normoxic environment (Nishimura et al., 2010). Because direct effect of hypoxia on skeletal muscle cell growth remains unknown, in Vitro studies to investigate cell responses to hypoxia are needed. Although some studies reported that severe hypoxia (i.e., 1% to 5% oxygen concentration) attenuated cell growth (Marie Csete et al., 2001; Gustafsson et al., 2005), we hypothesized that moderate hypoxia (e.g., 10% oxygen concentration) might ameliorate muscle cell growth. The purpose of this study was to examine the effect of 10% oxygen environment on skeletal muscle cell growth and related protein expressions.

METHODS: C2C12 skeletal muscle cells were divided into two groups: control group cultured in 20.9% oxygen environment (CON) while hypoxia group cultured in 10% oxygen environment (HYP) during differentiation. We analyzed expressions of myogenesis-related proteins Myogenin, using Western blotting. As well, we analyzed mTOR signaling. We also conducted immunocytochemical analyses to assess myotube diameter and Differentiation Index (DI), an indicator of muscle differentiation (Oishi et al., 2015). The lactate concentration in the medium was measured every day.

RESULTS: The myotube diameter in the HYP was significantly greater than that in the CON ($p < 0.05$). The DI was significantly higher in the HYP than in the CON ($p < 0.05$). The protein expression of myogenin was significantly higher in the HYP than in the CON ($p < 0.05$). The expression level of phosphorylated mTOR was significantly higher in the HYP than in the CON ($p < 0.05$). The lactate concentration was higher in the HYP than in the CON ($p < 0.05$). Myotube atrophy was observed 8 days after the differentiation in the CON, while moderate hypoxia maintained myotube thickness.

CONCLUSIONS: The findings suggest that 10% hypoxic environment may promote skeletal muscle cell growth and hypertrophy. Supported by Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, Culture, Sports, Science, and Technology (Grants 26702029, 18K19762).

1480 Board #242 May 30 9:30 AM - 11:00 AM
Effects of Chronic Continuous Exposure to Low Dose Carbon Monoxide on Hemoglobin Mass and Performance

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Reported Relationships: W.F. Schmidt: Receipt of Intellectual Property Rights/Patent Holder; Walter Schmidt is a managing partner of the company 'Blood tec GmbH', but he is unaware of any direct or indirect conflict of interest with the contents of this abstract..

Inhalation of carbon monoxide (CO) blocks the oxygen binding sites of the hemoglobin molecule and may produce similar effects as exposure to altitude. While single CO-doses and short-term application which are used in medicine and science do not exert measurable effects on erythropoiesis and performance, no data exists about chronic administration.

PURPOSE: To determine the effect of chronic low dose CO-application on hemoglobin mass and performance. **METHODS:** For three weeks, eleven male healthy and moderately trained subjects inhaled a CO-bolus five times the day to increase their HbCO concentration in blood by approx. 5%. Eleven matched subjects

received a placebo. Hemoglobin mass (Hbmass), serum erythropoietin concentration [EPO], ferritin, and basic hematological parameters were determined before and weekly during and until three weeks after the CO-inhalation period. An incremental step test until exhaustion on a cycle ergometer was performed before, at the end and one week after the CO administration period. **RESULTS:** During and after the intervention period, there were significant interactions between time and groups for Hbmass ($p<0.001$), ferritin ($p<0.05$), [EPO] ($p<0.001$), percentage (%) and immature reticulocytes (IRF) (both $p<0.05$). A tendency for an interaction was found for max. power and VO_{2max} ($p=0.1$). In the CO-group, Hbmass continuously increased from 919 ± 69 g to 962 ± 78 g in week 3, ($p<0.001$) and persisted for the following three weeks. Whole blood and plasma volume did not change. Reticulocytes (%) and IRF increased after one week (ret% from $1.21 \pm 0.31\%$ to $1.40 \pm 0.29\%$, $p<0.01$; IRF from $5.1 \pm 1.7\%$ to $7.0 \pm 2.7\%$, $p<0.05$). [EPO] tended to increase after one week ($p=0.07$) and was suppressed in the post period ($p<0.01$). Ferritin markedly decreased during the inhalation period (from 106 ± 37 ng/ml to 72 ± 37 ng/ml, $p<0.001$). VO_{2max} tended to increase from 4230 ± 280 ml/min to 4350 ± 350 ml/min ($p<0.1$) immediately after the inhalation period and showed a significant relationship to the change in Hbmass ($y=2.9x + 29$, $r=0.55$, $p<0.05$). In the placebo group no effect was observed. **CONCLUSIONS:** Chronic continuous exposure to low dose carbon monoxide increasing HbCO by ~5% significantly increased erythropoietic activity and showed a positive effect on performance.

1481 Board #243 May 30 9:30 AM - 11:00 AM
High Intensity Interval Training And Acute Altitude Exposure In A Masters Athlete: A Case Study

Katherine Woolley, Thomas Martin. *Quinnipiac University, Hamden, CT.*

(No relevant relationships reported)

This study involved an experienced, 64 year-old male mountaineer who trained at sea-level and climbed Mount Kilimanjaro (5,895 m). High Intensity Interval Training (HIIT) is a time-saving mode of exercise consisting of bursts of all-out effort and active recovery which has shown to improve cardiovascular fitness and strength. Hypoxia induces Acute Mountain Sickness (AMS) which poses many health risks to individuals of all age. **PURPOSE:** To assess the effects of a HIIT protocol on a Masters climber and investigate physiologic changes due to altitude exposure and incidence of AMS. **METHODS:** The six-week training program consisted of six alternating rounds of 85-90% max HR progressing from 90-120 seconds followed by 3 minutes active recovery. Subject was tested at: baseline, post-training/pre-climb, and post-climb. For baseline and post-training body composition, pulmonary function, hematology, cognitive function, reaction time, VO_2 max, and muscle strength were measured. Post-climb all measures were repeated except VO_2 max and strength. While climbing, physiologic and GPS data were collected. At each basecamp, resting SpO_2 , HR, Lake Louise Score (LLS), reaction time, cognitive function (Stroop test), and coordination tests were performed. The LLS is the standard for diagnosing AMS. **RESULTS:** Subject summited and returned healthy. HIIT increased VO_2 max (36.4 to 47.1 ml/kg/min), muscle symmetry, and FEV1/FVC increased 0.86% , body fat increased from 7.2 to 8% . Subject experienced mild AMS on days two and three of the ascent. Reaction time increased by 1 second, and the incongruent Stroop test time increased 57 seconds at high camp compared to baseline. On average, SpO_2 and HR dropped 3.2% and 5.8 bpm respectively overnight at camps. HR, and RR increased with altitude. Upon return, serum Potassium and Creatine Kinase were elevated (5.4 , 268), and FEV1/FVC decreased 4.1% , body fat decreased to 3.6% . **CONCLUSIONS:** HIIT is a safe and effective way to train a Masters athlete for the rigor of high altitude. These findings are of clinical importance for athletes preparing for high altitude mountaineering. Masters athletes are capable of training for, experiencing, and surmounting AMS. With proper training a Masters athlete can complete a high-altitude climb.

1482 Board #244 May 30 9:30 AM - 11:00 AM
Acute Effects Of Electrical Stimulation In Hypoxia On Arterial Stiffness

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(No relevant relationships reported)

PURPOSE: This study aimed to examine acute effects of electrical stimulation in hypoxia on arterial stiffness.

METHODS: Seven healthy male adults (21 ± 1) participated in experiments of four different protocols (i.e., rest in normoxia (NR), rest in hypoxia (HR), electrical stimulation in normoxia (NES), and electrical stimulation in hypoxia (HES)) in random order on separate days. Throughout a 40-min trial, the subjects breathed normoxic ($20.9\% O_2$) or hypoxic ($15.3 - 15.5\% O_2$) gas via a facemask connected to the oxygen generator. Also, in NES and HES, a 20-minute electrical stimulation of 4 Hz was conducted

in a lower limb in the latter 20-min of the trial. Before (baseline) and after (Post) each trial, arterial stiffness was assessed by cardio-ankle vascular index (CAVI), which is theoretically adjusted by blood pressure.

RESULTS: During electrical stimulation, heart rate and oxygen uptake in NES and HES increased, compared with each baseline. However, no significant difference was observed in the mean heart rate between NES and HES. Conversely, oxygen uptake during electrical stimulation was significantly lower in HES than in NES. There was no significant change in CAVI of NR and HR. However, CAVI of HES and NES significantly reduced (HES, Baseline: 5.9 ± 0.1 , Post: 4.9 ± 0.2 vs. NES, Baseline: 5.6 ± 0.2 , Post: 5.1 ± 0.2 , both $P < 0.05$), and the reduction in CAVI was significantly greater in HES than that in NES (%change, HES vs. NES: $-16.4 \pm 8.9\%$ vs. $-9.9 \pm 5.4\%$; $P < 0.05$). In addition, lactate concentrations and respiratory exchange ratio were significantly higher in HES than the other three trials.

CONCLUSIONS: These findings suggest that electrical stimulation in hypoxia can induce greater reduction in arterial stiffness than those in normoxia.

1483 Board #245 May 30 9:30 AM - 11:00 AM
Functional Inspiratory Muscle Training Improves The Strength of Inspiratory Muscles During Load Carriage In Cold-hypoxia

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(No relevant relationships reported)

PURPOSE: Load carriage (LC) exceeding 20kg elicits respiratory muscle fatigue (RMF) in sea level thermo-neutral conditions. Sub-maximal physical activity in cold-hypoxia has shown to elicit RMF. Inspiratory muscle training (IMT) combined with LC has failed to reduce RMF. Functional IMT (FIMT) may activate non-respiratory roles of the diaphragm and respiratory muscles resulting in adaptations beyond that of static IMT. **METHODS:** Loaded (18.2kg) walking trials were completed pre, mid and post training (trial 1, 2 and 3, respectively). Participants ($n=15$) performed a 6km loaded walk at $50\% VO_{2max}$ over 4 stages 0 - 6km in 0.5 increments at 0, 5, and 10% gradient in cold-hypoxia ($4300m$ in $-10^\circ C$). Following trial 1, participants were randomly assigned to control (Con=7) or experimental (Exp=8) to undertake 4 weeks of IMT using a pressure threshold training device. The Exp performed 2 x 30 breaths daily at 50% maximal inspiratory pressure (P_{imax}) and Con performed 60 daily breaths at $15\% P_{imax}$. FIMT (5 exercises designed to engage core muscles, 3 involved LC) was then performed 3 times weekly at the same intensities as IMT. **RESULTS:** Inspiratory muscle fatigue was prevalent following trial 1 ($p < .001$). Relative to baseline (126.9 ± 15.7 cmH₂O) trends were identified for greater P_{imax} in Exp post-IMT (145.5 ± 20.5 cmH₂O, $p=.066$) with no changes in Con. FIMT showed no further significant increase in P_{imax} ($p=.104$). P_{imax} values post-6km in Exp were significantly greater than Con and higher than pre-6km pre-intervention values ($p=.007$). However, ΔP_{imax} was unchanged in Exp ($p \geq .214$). No significant relationships were observed between ΔP_{imax} vs baseline P_{imax} and VO_{2max} vs ΔP_{imax} . **CONCLUSION:** Four weeks of IMT and FIMT strengthened inspiratory muscles by 23%. Despite no reduction in RMF, P_{imax} values were significantly greater post-6km in Exp and higher than pre-6km pre-intervention values. Protocols employing more progressive training loads may reduce RMF. Due to the low intensity and prolonged nature of LC in cold-hypoxia, respiratory muscle endurance may be more dominant than strength. Thus, requiring further investigation.

1484 Board #246 May 30 9:30 AM - 11:00 AM
Comparing Physiological Responses to Single and Double Leg Submaximal Cycling in Normoxia and Hypoxia

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(No relevant relationships reported)

INTRODUCTION: It has been well established that exercise intensity as well as exercise performance declines at altitude. However, it has yet to be determined how femoral blood flow and muscle oxygenation kinetics (total tissue saturation, oxy- and deoxygenated hemoglobin, as well as total hemoglobin) are influenced by altitude during submaximal and maximal performances. Furthermore, it has yet to be determined if the utilization of small muscle mass exercise, which allows for greater blood flow to the active muscle, will allow an individual to generate the same muscle oxygenation kinetics in hypoxic conditions that is achieved during larger muscle mass activities in normoxia. **PURPOSE:** Thus, the purpose of this study was to determine if tissue oxygenation was compromised at altitude during submaximal bouts of exercise and whether reducing the active muscle mass exercise could be used to offset any observed decrement due to increases in blood flow.

METHODS: 10 individuals performed double leg cycling for four minutes at 50%, 60%, 70% and 80% of their maximal oxygen consumption, rested for 15 minutes and then performed single leg cycling utilizing the same protocol but at half the double leg work rate in both normoxic and hypoxic conditions (oxygen concentration of 15% which simulated an altitude of 2,740 meters).

RESULTS: The amount of blood flow during the single leg trial in hypoxia was significantly higher compared to blood flow during double leg cycling in hypoxia ($p = 0.02$). There was no significant difference between the single leg trial in hypoxia and the double leg trial in normoxia ($p = 0.36$) nor between the two double leg trials in normoxia and hypoxia ($p = 0.87$). No difference was found in the amount of oxygenated hemoglobin when comparing the single leg trial in hypoxia to the double leg trials in normoxia ($p = 0.36$) and hypoxia ($p = 0.13$).

CONCLUSIONS: The results suggest that elevated hemoglobin saturation and femoral blood flow during the single leg condition in hypoxia are similar to that observed during double leg cycling in normoxia and may prove to be a viable training modality that would offset the main disadvantage of living at altitude by enabling an individual to exercise at the same level of intensity achieved at normoxia.

C-42 Free Communication/Poster - Microgravity/Space Physiology

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1485 Board #247 May 30 9:30 AM - 11:00 AM Impact Of Long-acting Reversible Contraceptives On Bone Density During Simulated Microgravity

Heather C.M. Allaway, Sarah E. Little, Harry A. Hogan, Susan A. Bloomfield, FACSM. *Texas A&M University, College Station, TX.*

(No relevant relationships reported)

Hormonal contraception is routinely used by premenopausal women, including female astronauts, to suppress ovarian function and menstrual cycling. Combined oral contraceptive pill (COC, ethinyl estradiol and progestin) use leads to a suppression of bone turnover and reduced bone mineral density (BMD) gain with long-term exercise. Long-acting, reversible contraceptives (LARC, progestin-only) provide many practical advantages over COC. With increasing numbers of women in the US astronaut corps, we risk sending female crew members into microgravity without a clear understanding of the impact of LARC use on bone health.

Purpose: We hypothesize that LARC use will blunt decreases in BMD associated with hindlimb unloading (HU).

Methods: Virgin female Sprague-Dawley rats ($n=26$; 4-mo-old) were singly housed and randomly assigned to placebo and LARC groups, via a slow-release etonogestrel pellet (0.00ug/d vs. 0.30ug/d) implanted under the skin. Animals were further randomized into ambulatory and HU subgroups ($n=6$ -7/subgroup), with HU initiated a week following pellet insertion and lasting for 6 weeks. Pre/post HU, proximal tibia metaphysis (PTM) were scanned in vivo with peripheral quantitative computed tomography (pQCT). Univariate and repeated measures 2-way ANOVA were used. **Results:** There was a time*loading group interaction ($p<0.01$) for body weight and food consumption. HU animals weighed less over the last 4 weeks of the study but consumed more food over 6 weeks of HU vs. ambulatory animals. Soleus wet weights were significantly lower in HU compared to ambulatory animals ($p<0.001$). There was a main effect of time for ($p<0.001$) PTM total, cancellous, and cortical volumetric BMD and total and cortical areas. For marrow area at the PTM there was a time*loading group interaction ($p=0.044$), such that over time the HU animals had a decrease in marrow area compared to the ambulatory animals. No impact of LARC on these outcomes was detected.

Conclusions: Early results indicate that LARC use does not alter the PTM bone response to mechanical unloading of simulated microgravity assessed by in vivo pQCT.

This work is supported by the Translational Research Institute for Space Health through Cooperative Agreement NNX16AO69A.

1486 Board #248 May 30 9:30 AM - 11:00 AM

Can Acute Galactic Cosmic Radiation-induced Bone Loss Be Mitigated By Dietary Modulation Of Inflammatory Cytokines?

Sarah E. Little¹, Heather CM Allaway¹, Rihana S. Bokhari¹, Derek V. Seidel¹, Kimberly L. Wahl¹, Nancy D. Turner², John R. Ford¹, Larry Suva¹, Susan A. Bloomfield, FACSM¹. ¹Texas A&M University, College Station, TX. ²Michigan State University, College Station, TX.

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(No relevant relationships reported)

The space environment includes weightlessness and galactic cosmic radiation (GCR), both of which can have a negative impact on bone parameters. In particular, acute exposures to space-relevant doses (2 Gy or less) of simulated GCR lead to a rapid acceleration of bone resorption activity and suppression of bone forming osteoblasts, resulting in diminished bone mineral density (BMD), strength and altered microarchitecture. A key mechanism driving these changes may be a radiation-induced increase in pro-inflammatory cytokines, such as TNF- α . Consuming a diet rich in omega-3 fatty acids has been associated with attenuated reductions in bone parameters in astronauts, mice and elderly humans with corresponding reductions in circulating inflammatory cytokines. **PURPOSE:** To test the hypothesis that a diet high in omega-3 fatty acids will mitigate radiation-induced bone loss and reduce inflammatory cytokines in bone osteocytes and serum.

METHODS: Adult (30- to 50-week-old) female Lgr5-EGFP C57BL/6 mice ($n=4$ -6 per group) were acclimated to a corn oil/cellulose (COC) or fish oil/pectin (FOP) diet for 3 weeks. Animals were subsequently randomized to total body low dose high-energy radiation (0.1, 0.25, 0.5 Gy of 1000 MeV/n ⁵⁶Fe at 25 cGy/min at Brookhaven National Lab) or non-irradiated control (sham) and euthanized 8 weeks later. MicroCT (ScanCo, Switzerland) analyses were performed to assess bone geometry and microarchitecture at the mid-shaft and distal end of the femur. Significance was assessed using an α of 0.10.

RESULTS: There was a significant main effect of diet on mid-shaft femur periosteal diameter (Peri.Dm) ($p=0.001$) and endocortical diameter (Endo. Dm.) ($p<0.001$). The FOP diet led to larger Peri.Dm. ($p<0.051$ for all) and Endo.Dm. ($p<0.041$ for all) than did the COC diet at all doses. We could not detect an impact of ⁵⁶Fe on cortical area or cancellous bone volume at the distal femur. Irradiation with 0.25 and 0.5 Gy in the FOP mice showed significant increases in distal femur volumetric BMD ($p=0.014$, $p=0.063$) and trabecular thickness ($p=0.058$, $p=0.028$), as compared with sham FOP mice.

CONCLUSIONS: Though we did not detect a significant impact of radiation on bone parameters, these early data analyses suggest some modest benefits from a diet high in omega-3 fatty acids on cortical and cancellous bone parameters.

1487 Board #249 May 30 9:30 AM - 11:00 AM Circulating MicroRNA Expression and Serum Biomarker Changes After 30 Days of Head-Down Bed Rest

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(No relevant relationships reported)

Microgravity is known to have negative effects on bone health. Circulating microRNAs (c-miRNA) are non-coding RNA molecules assessed in blood that have potential as biomarkers of osteoporosis and may be beneficial for tracking changes in bone status. **PURPOSE:** To examine selected c-miRNAs and serum markers of inflammation and bone turnover responses to a 30 day six-degree head-down bed rest protocol at an ambient 0.5% CO₂. **METHODS:** 11 adults (6 males, 5 females), 25-50 years, participated in the study at the Institute for Aerospace Medicine in Germany. Participants had fasted blood draws collected 3 days before, and on the final day of bed rest. Serum samples were assayed for relative expression of miR-21-5p, -100-5p, -125b-5p, and -126-3p using qPCR. Bone markers (Bone ALP, PINP, TRAP 5b, sclerostin), inflammation markers (TNF α , IL-6), and Vitamin D were measured using ELISA. **RESULTS:** Only miR-21-5p increased relative expression pre to post ($p=0.02$). TNF α and calcium increased, and all bone marker concentrations increased pre to post, except Bone ALP. Baseline relative expression of miR-21-5p was correlated with pre calcium ($r_s=0.745$, $p<0.01$), miR-100-5p with sclerostin ($r_s=0.627$, $p=0.04$), pre IL-6 ($r_s=0.661$, $p=0.03$), and vitamin D ($r_s=0.645$, $p=0.03$), and miR-125b-5p with osteocalcin ($r_s=0.864$, $p<0.01$). Log2 fold changes in miR-125-5p and absolute change in TRAP 5b were negatively correlated ($r_s=-0.782$, $p<0.01$), and Log2 fold changes in miR-21 and absolute change in vitamin D were positively correlated ($r_s=0.609$, $p=0.047$). **CONCLUSION:** 30 days of 6-degree head-down bed rest significantly increased bone turnover as evidenced by increases in both PINP and TRAP5b. Baseline c-miRNAs significantly correlated with multiple measures of bone

metabolism. MiRNA fold changes were correlated with absolute changes in Vitamin D (miR-21-5p) and TRAP5b (miR-125-5p), warranting further investigation into the use of miRNAs as biomarkers of space flight.

Table 1. Serum Biomarkers Pre and Post Bed Rest (mean \pm SD).									
Variable	Pre			Post			mean change		
							Log2 Fold Change		
miR-21-5p	-0.54	\pm	0.49	-0.07*	\pm	0.36	0.29	\pm	0.60
miR-100-5p	-8.93	\pm	1.04	-8.49	\pm	1.03	0.32	\pm	0.61
miR-125b-5p -5.67 \pm 0.77 -5.34					\pm	0.62	0.43	\pm	1.36
miR-126-3p	-0.90	\pm	0.41	-0.61	\pm	0.52	0.47	\pm	0.55
							Absolute Change		
Sclerostin	0.47	\pm	0.14	0.53*	\pm	0.17	0.06	\pm	0.08
TRAP5b	2.59	\pm	0.67	3.22**	\pm	0.73	0.63	\pm	0.36
P1NP	56.25	\pm	13.29	63.59*	\pm	14.53	7.34	\pm	7.60
Bone ALP	8.83	\pm	3.67	10.18	\pm	3.74	1.34	\pm	4.46
TNF α	6.37	\pm	4.35	9.51*	\pm	8.36	3.13	\pm	4.16
IL-6	1.05	\pm	0.10	1.11	\pm	0.16	-0.06	\pm	0.22
Vitamin D	33.07	\pm	4.27	31.32	\pm	5.46	-1.74	\pm	3.93
Calcium	2.34	\pm	0.07	2.38*	\pm	0.06	0.05	\pm	0.05
Osteocalcin	12.59	\pm	2.30	11.80	\pm	1.85	-0.79	\pm	1.69

* $p < 0.05$, ** $p < 0.01$ significant vs. Pre, TRAP5b = Tartrate-resistant acid phosphatase 5b; P1NP = Procollagen type I N propeptide; Bone ALP = Bone-specific alkaline phosphatase; TNF α = Tumor necrosis factor alpha; IL-6 = Interleukin-6.

1488 Board #250 May 30 9:30 AM - 11:00 AM Relationships Between Circulating MicroRNA and Muscular Performance Responses to a 30 Day Bed Rest Protocol

Cameron Combs¹, Carl Ade², Samuel Buchanan¹, Debra Bembem, FACSM¹. ¹University of Oklahoma, Norman, OK. ²Kansas State University, Manhattan, KS. (Sponsor: Dr. Debra Bembem, FACSM)
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(No relevant relationships reported)

Microgravity is known to have detrimental effects on muscle tissue, leading to atrophy and a decline in performance. Although underlying mechanisms are not clear, microRNAs (miRNA) may play a role as they have regulatory effects on skeletal muscle gene expression. **PURPOSE:** To determine the effects of a 30 day six-degree head-down bed rest protocol at an ambient 0.5% CO₂ on lower body muscular performance. Relationships between circulating miRNAs and changes in muscle variables were also examined. **METHODS:** 11 healthy subjects, 5 males and 6 females, were recruited for this study. The intervention involved a 30 day, six-degree head-down bed rest platform to simulate International Space Station flight. Maximal muscular performance was assessed for isokinetic knee extension (IsokKE), isokinetic knee flexion (IsokKF), isometric knee extension (IsomKE), isometric knee flexion (IsomKF), jump velocity (JV), absolute jump power (AbJP), and relative jump power (RelJP) 5 days before and 2 days after bed rest. Serum miRNAs (miR-21-5p, -100-5p, -125b-5p, -126-3p) were assessed by qPCR and fold changes (FC) were correlated with muscle performance variables. **RESULTS:** All muscular performance measures decreased ($p < 0.05$) after bed rest (absolute changes: IsokKE -36 \pm 27N, IsokKF -16 \pm 17N, IsomKE -28 \pm 22N, IsomKF -12 \pm 14N, JV -0.21 \pm 0.08m/s, AbJP -0.45 \pm 0.19kW, RelJP Power -5.23 \pm 1.88W/kg). Pre bed rest miR-100-5p relative expression was positively correlated with Pre strength measures and jump power ($r = 0.603$ to 0.727 , $p < 0.05$). MiR-126-3p FC was negatively related to absolute change in relative power ($r = -0.705$, $p < 0.05$), and miR-125b-5p FC was positively correlated ($p < 0.05$) with absolute changes in IsomKE ($r = 0.627$), IsomKF ($r = 0.817$), and JV ($r = 0.700$). MiR-100-5p FC was positively correlated ($p < 0.05$) with absolute changes in IsomKE ($r = 0.652$) and IsomKF ($r = 0.759$). **CONCLUSION:** As expected, muscle performance significantly declined after 30 days of bed rest. Significant relationships were found between miRNAs and muscle variables at baseline (miR-100-5p), and miRNA fold changes (miR-100-5p, -125b-5p, -126-3p) were correlated with absolute changes in muscle strength and power. These miRNAs require further investigation to explore their possible mechanistic roles in muscle performance declines after bed rest.

1489 Board #251 May 30 9:30 AM - 11:00 AM Cerebral Blood Flow Responses To Long Term Head-down Bed Rest

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PURPOSE: The present study was designed to investigate the effect of a 60-days, -6° head-down bed rest (HDBR) on both arterial and venous cerebral blood flows. **METHODS:** Twenty male healthy volunteers were evaluated. Blood flow in right side of the neck arteries (internal carotid artery; ICA and vertebral artery; VA) and veins (internal jugular vein; IJV and vertebral vein; VV) was measured by using ultrasonography on the day before HDBR (baseline); 30th day and 57th day of HDBR. **RESULTS:** ICA blood flow decreased at 30th day of the HDBR compared with baseline ($P = 0.002$), and returned to baseline at 57th day of the HDBR. On the other hand, VA blood flow was unchanged throughout the HDBR ($P = 0.402$). At the venous side, IJV blood flow decreased at both 30th and 57th day of the HDBR ($P = 0.002$ and $P = 0.005$, respectively), in contrast, VV blood flow increased at 30th day ($P = 0.004$) and was unchanged at 57th day compared with baseline. **CONCLUSIONS:** These findings suggest that the long-term HDBR decreased anterior cerebral arterial and venous blood flows, while posterior cerebral arterial and venous blood flows were well maintained. The heterogeneous blood flow response of the cerebral arteries may be associated with cerebral venous outflow but its physiological mechanism remains unclear.

1490 Board #252 May 30 9:30 AM - 11:00 AM Sarcobol-3: Changes In Knee Flexor And Extensor Torque Generation During A Six-month Space Flight Mission

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Purpose

To examine the effects of space flight on knee extensors and flexors over six month flight missions.

Methods

Four crewmembers were tested on board the International Space Station (ISS) after 8.9 (SD 3.0), 49.1 (SD 10.1) and 131.5 (SD 27.7) days in-flight, as well as pre- and post-flight, using the Muscle Atrophy Research and Exercise System (MARES). Voluntary isometric torque during maximal knee extension and flexion was obtained at starting positions of 90, 60 and 45 degrees of flexion. Surface EMG was simultaneously measured for the biceps femoris, semitendinosus, vastus lateralis and rectus femoris. Root mean squared (RMS) EMG within a 500 ms window centered on the time of peak torque was identified, and ratios of EMG to peak torque (EMG/T) were calculated for each isometric contraction.

Results

Peak knee extension and flexion force declined immediately in-flight from pre-flight values. Knee extension decreased by 35.25%, 23.52% and 35.71% while flexion decreased by 25.55%, 27.59%, and 30.76% at 90, 60 and 45 degrees, respectively. Peak torque during knee extension progressively increased during flight such that the differences between pre-flight values and those of the third in-flight testing session were reduced to deficits of 25.65%, 11.37% and 0% for 90, 60 and 45 degrees, respectively. Knee flexion declined slightly at both 90 and 60 degrees (30.84% and 28.18%) however improved slightly at 45 degrees (25.39%) for in-flight 2 with a reciprocal change at in-flight 3 to 23.68%, 22.97% and 34.2% at 90, 60 and 45 degrees, respectively. By the second in-flight test, EMG/T ratios reflected a changing relationship between neuromuscular activation and torque production, with greater relative activation required to produce similar levels of torque when compared to pre-flight values.

Conclusions

Results suggest that space flight results in an immediate decline of peak torque production for both knee extension and flexion. Current in-flight countermeasures appear to trend towards functional restoration of knee extension while knee flexion remained relatively unchanged.

- 1491** Board #253 May 30 9:30 AM - 11:00 AM
The Hypercapnic Ventilatory Response and Cerebrovascular Reactivity to CO₂ during Waist Water Immersion with Acute Hypercapnia and Head Out Water Immersion
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 (No relevant relationships reported)

During head out water immersion (HOWI), the hypercapnic ventilatory response (HCVR) is augmented and cerebrovascular reactivity to CO₂ (CVR) is attenuated; possibly due to water pressure exerted on the chest wall, central hypervolemia, and/or hypercapnia. Waist water immersion with acute hypercapnia (WWI+CO₂) causes central hypervolemia and hypercapnia without exerting water pressure on the chest wall. However, it is unknown if HCVR and CVR are different during WWI+CO₂ vs. HOWI. **PURPOSE:** We tested the hypotheses that the HCVR is augmented and CVR is attenuated during WWI+CO₂ and HOWI. **METHODS:** Twelve subjects (age: 24±3 y, BMI: 25±3 kg/m², 6 women) completed one hour of thermoneutral (35±0°C) WWI+CO₂ and HOWI. The partial pressure of end tidal CO₂ (PETCO₂; capnograph), minute ventilation (MV; pneumotachometer), and middle cerebral artery blood velocity (MCAv; transcranial doppler) were recorded. CO₂ was added to the inspire during WWI+CO₂ to match the increase in PETCO₂ during HOWI. Subjects rebreathed 7% CO₂ and 93% O₂ from a 10 L bag for 3.5 min at baseline, 10 min, 30 min, and 60 min of water immersion. The HCVR and CVR were calculated as the slope of the linear regression line of MV vs. PETCO₂ and MCAv vs. PETCO₂ every 30 s throughout the test. Data are reported as a change from baseline (mean±SD). **RESULTS:** PETCO₂ increased from baseline during WWI+CO₂ and HOWI at every time point (p<0.01) and was matched between conditions (p≥0.26). MV increased from baseline during WWI+CO₂ at 60 min (p=0.03) but did not change during HOWI at any time point (p≥0.38). MCAv increased from baseline during WWI+CO₂ at every time point and during HOWI at 10 min and 30 min (all p<0.01). The HCVR did not change from baseline during WWI+CO₂ at any time point (all p≥0.35) but increased from baseline during HOWI at every time point (10 min: 0.59±0.34, 30 min: 0.58±0.46, 60 min: 0.63±0.45 L/min/mmHg; p<0.01). The HCVR was lower during WWI+CO₂ vs. HOWI at 10 min, 30 min, and 60 min (p<0.01). CVR decreased from baseline during WWI+CO₂ and HOWI at every time point (p<0.01) but was not different between conditions at any time point (p≥0.16). **CONCLUSIONS:** The elevated HCVR during HOWI is likely caused by water pressure exerted on the chest wall. However, reductions in CVR during HOWI are likely caused by central hypervolemia and/or hypercapnia.

C-43 Free Communication/Poster - Immunology II
 Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

- 1492** Board #254 May 30 10:30 AM - 12:00 PM
Inflamm-aging Is Associated With Impairing The Process Of Maintaining Telomere Length In LPS Stimulated PBMCs
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PURPOSE: This study examined the impact of the inflamm-aging phenotype on the capacity of isolated PBMCs to express a key mechanistic component involved in maintaining longer telomere lengths, human telomerase reverse transcriptase (hTERT), following *ex vivo* cellular stimulation with lipopolysaccharide (LPS). **METHODS:** Plasma inflammatory cytokines (i.e., IL-6, IL-10, TGF-β, and TNF-α), PBMC telomere lengths, and LPS-stimulated hTERT mRNA expression following *ex vivo* stimulation of PBMCs with LPS in 15 middle-aged (40-64 years) and 15 young adults (20-31 years) were quantified. **RESULTS:** Aging was accompanied by the accumulation of centrally located visceral adipose tissue ($p \leq 0.005$), in the absence of weight gain ($p = 0.932$) or changes in BMI ($p = 0.081$), and alterations in the systemic inflammatory milieu (decreased plasma concentrations of the anti-inflammatory cytokine TGF-β; increased plasma concentrations of the pro-inflammatory cytokine TNF-α [$p \leq 0.050$]). Likewise, shorter telomere lengths in middle-aged compared to young adults ($p = 0.011$) were associated with increased age, body fat percentages, and plasma TNF-α concentrations ($r =$

-0.404 , $p = 0.027$; $r = -0.427$, $p = 0.019$; $r = -0.323$, $p = 0.041$, respectively). Finally, the capacity of PBMCs to express hTERT mRNA following cellular stimulation was impaired in middle-aged compared to young adults ($p = 0.018$), and negatively associated with telomere lengths ($r = 0.353$, $p = 0.028$). **CONCLUSIONS:** Inflamm-aging is associated with the impaired capacity of PBMCs to express hTERT mRNA and provides a mechanistic target to counter age-related telomere attrition and disease.

- 1493** Board #255 May 30 10:30 AM - 12:00 PM
Effect Of Self control Exercise On Lymphocyte Subsets Of Lung Cancer Patients During Rehabilitation
 JIBING WANG¹, Weimo Zhu, FACSM², Renwei Wang³, Jiaying Lang¹. ¹Tongji University, Shanghai, China. ²University of Illinois at Urbana-Champaign, urbana, IL. ³Shanghai University of Sport, Shanghai, China.
 (No relevant relationships reported)

PURPOSE: Self-Control Exercise (SCE), known also as Guolin Qigong, is a mind-body exercise being used in China for cancer survival for more than 40 years. This study was to examine the effect of SCE on lymphocyte subsets of lung cancer patients and the possible mechanisms. **METHODS:** 26 lung cancer patients (8 males & 18 females; Age in yr: 60.08±5.41; Cancer survival yr: 1.69±6.72) were recruited from the Shanghai Cancer Club. All the patients were diagnosed pathologically. The patients began to learn SCE for 3 weeks and then performed 6 months SCE at their will. Cancer history was surveyed, physical activity including SCE was recorded during the intervention. The lymphocyte surface antigen CD3/CD4/CD8/CD28/CD(16+56)/CD19/CD4CD25Foxp3 were examined by direct immunofluorescence staining and flow cytometry. Paired-samples t test was performed to compare the change of lymphocyte surface antigen before and after the intervention. **RESULTS:** It was found that CD3⁺ increased significantly (50.52±13.09, 56.77±11.56 $p < 0.05$), CD4⁺ (22.54±6.70, 33.21±7.55) and CD4⁺/CD8⁺ (1.05±0.46, 1.80±0.69) increased significantly ($p < 0.01$), CD4⁺/CD25⁺Foxp3 declined significantly (18.99±8.55, 13.04±5.86, $p < 0.05$), CD16⁺/CD56⁺ increased significantly (17.58±8.35, 21.48±8.81, $p < 0.05$) after the intervention. CD8⁺, CD8⁺/CD28⁺ and CD19⁺ showed no statistical difference ($p > 0.05$) before and after intervention. **CONCLUSIONS:** SCE intervention improved the cellular immune function which mediated by T cell and NK cell, and it may be related to the suppression and down-regulation of the T regulatory cells to the cell immunity.

- 1494** Board #256 May 30 10:30 AM - 12:00 PM
Effects Of Endurance Exercise Under Heat And Hypoxia On Hepcidin Responses
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 (No relevant relationships reported)

Interleukin-6 (IL-6) promotes exercise-induced hepcidin elevation which is an iron regulating hormone, leading to increased risk of iron deficiency in athletes. **PURPOSE:** The purpose of the present study was to compare exercise-induced hepcidin elevation between "heat and hypoxic condition" or "hypoxic condition". **METHODS:** Twelve males (21.5 ± 0.3 years, 168.1 ± 1.2 cm, 63.6 ± 2.0 kg) participated in the present study. They conducted a 60 min of cycling at 60 % of $\dot{V}O_{2max}$ under either "heat and hypoxia" (HHYP; FiO₂ 14.5%, 32°C), "hypoxia" (HYP; FiO₂ 14.5%, 23°C) or "normoxia" (NOR; FiO₂ 20.9%, 23°C). Exercise intensity was relatively matched for $\dot{V}O_{2max}$ under each environment, and the respective values of $\dot{V}O_{2max}$ were 42.7 ± 1.4 (HHYP), 41.2 ± 1.3 (HYP) and 50.8 ± 2.1 (NOR) ml/kg/min. After completing exercise, subjects stayed under the prescribed conditions during 3 h of post-exercise. Blood samples were collected before exercise, immediately after and 3 h after exercise. **RESULTS:** Blood lactate levels were significantly elevated with progress of exercise ($P < 0.05$), however, there was no significant difference among the three trials ($P > 0.05$). Serum ferritin level did not differ significantly among the trials ($P > 0.05$). Serum iron level did not change after exercise and no significant difference was observed among the trials ($P > 0.05$). In NOR, plasma IL-6 levels were significantly increased immediately after exercise and 3 h after exercise ($P < 0.05$), with no significant difference among the trials ($P > 0.05$). Serum hepcidin level was increased 3 h after exercise in all trials ($P < 0.05$). However, there was no significant difference among the trials during post-exercise ($P > 0.05$). **CONCLUSIONS:** Endurance exercise under heat and hypoxia did not facilitate exercise-induced hepcidin elevation compared with the same exercise under hypoxia.

1495 Board #257 May 30 10:30 AM - 12:00 PM
Time-course Of Physiological Changes Following An Extreme Conditioning Competition

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(No relevant relationships reported)

Purpose: Extreme conditioning programs (ECPs) are characterized by utilizing a high volume of training and using a variety of high intensity exercises. The purpose of the present study was to monitor the time-course response of cytokines (IL-10 and IL-1 β), immune variables (C-reactive protein-CRP and immunoglobulin A-IgA), hormonal milieu (cortisol-C, total testosterone-TT, free testosterone-FT and testosterone/cortisol-T/C ratios), creatine kinase-CK, muscle performance (jump height) and perceived well-being (WB) following an ECP competition. The initial hypothesis is that an extreme conditioning competition increases inflammatory response as well as metabolic stress, impairing the hormonal milieu, and decreasing muscle performance. **Methods:** Nine amateur male athletes (age 27.1 \pm 4.1 years; training experience 2.2 \pm 1.3 years) completed five workouts over three consecutive days of EC-competition. All variables were measured before, 24 h, 48 h and 72 h following the last day of competition. **Results:** The EC-competition induced a decrease in IL10/IL1 β ratio approximately 5% after 24h, 21% after 48h and 31% after 72h. Delta T/C ratio remained unchanged during the post-competition period. IgA displayed a significant increase 24h and 72h post-EC-competition. The WB status score was higher 72h after the ECP as compared with pre-competition. **Conclusion:** The present findings suggest that ECP induces transient changes in some inflammatory and hormonal biomarkers, and perceived well-being seems to be efficient to detect changes in muscle performance. These data may be useful to coaches for monitoring fatigue and prescribing training (lower intensity sessions and/or resting days) in days following an EC competition. Furthermore, psychometric measurement tools seem to be an effective and easy method for assessing fatigue in participants after the competition.

1496 Board #258 May 30 10:30 AM - 12:00 PM
Impact Of Exercise Intensity And Resting Intervals During Resistance Exercise On Acute Sparc Secretion In Healthy Young Males: A Pilot Study

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(No relevant relationships reported)

PURPOSE: Recently, it is going noteworthy that an exercise-induced novel myokine, secreted protein acidic and rich in cysteine (SPARC) has the potential to prevent colon cancer. Moreover, regular resistance exercise (RE) has been known to reduce the mortality risk of cancer. From these points of view, RE might prevent colon tumorigenesis via increasing SPARC, while it is unclear whether resistance exercise can promote SPARC secretion in human. Thus, the purpose of this study was to investigate the both effects of exercise intensity and duration of rest interval between exercise sets on acute response of RE-induced SPARC secretion.

METHODS: We designed two experiments in this study. In study 1, 7 subjects completed three experiments in a random order. They performed two RE at both 70% (High) and 35% (Low) of the individual's one repetition maximum (1-RM), and stayed rest condition without RE (Rest). The RE consisted of 8 kinds of exercise (double arm curl, shoulder press, double knee extension, chest press, lat-pull down, triceps press down, parallel squat, and seated rowing), for 3 sets of 7 repetitions. We recruited different 7 subjects in study 2, and let them conduct three experiments in a random order: RE (the same 8 kinds of exercise as described in study 1, 16 repetitions \times 3 sets at 50% 1-RM) with long inter-set rest interval (LIE, 150 s), RE with short inter-set rest interval (SIE, 50 s), and rest with no-exercise (NE). Blood samples were obtained before, immediate after, and 1h after RE in both study.

RESULTS: In study 1, serum SPARC concentration immediately after RE was significantly increased from baseline in High trial ($P < 0.05$), and that level was significantly higher than those in Rest and Low trials ($P < 0.05$, in both). In study 2, serum SPARC level immediately after RE in SIE trial significantly elevated compared with baseline ($P < 0.05$), and the increase was also significantly higher than NE trial ($P < 0.05$). However, the elevated SPARC concentrations in both High and SIE trials were swiftly returned to baseline within 1 h after RE.

CONCLUSIONS: Our findings indicate that RE can induce temporally SPARC secretion. It is also conceivable that increasing exercise load and/or shortening rest intervals between exercise sets during RE might enhance SPARC production.

1497 Board #259 May 30 10:30 AM - 12:00 PM
Serum Uric Acid Levels and Cardiometabolic Risk Among Adolescents

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(No relevant relationships reported)

Uric acid (UA) is a biomarker of inflammation that has been linked to obesity, hypertension, metabolic syndrome (MetS) and other factors associated with cardiometabolic risk (CMR). UA levels are often elevated in minority populations and tend to increase in response to poor lifestyle behaviors (i.e diet, inactivity, sleep). Multiple definitions exist for MetS—some of which include UA—but it is really the clustering of CMR factors in adolescence that is crucial for identification of disease risk and prevention. However, little is known about the relation between UA across the CMR spectrum in adolescents. **PURPOSE:** To investigate the relations between CMR classification, sex, physical activity, and sleep on UA among adolescents. **METHODS:** At age 16, subjects [Caucasian=45.9%; Male: N=47, BMI=24.6 \pm 6.7; Female: N=67, BMI=23.9 \pm 9.3] came to the lab for a fasted blood draw, anthropometric measures and assessment of physical activity (PA) and sleep [Godin and Pittsburgh Sleep Quality Index (PSQI), respectively]. CMR biomarkers were assessed using multiplex assays and ELISAs. Serum UA was assessed using a commercial EIA. A linear mixed model was used to investigate UA by CMR profile (low, dyslipidemia, high) and sex, controlling for BMI, PA and sleep. **RESULTS:** Similar to previous studies in adolescents, the mean UA level was higher for males (7.11 \pm 1.19) compared to females (5.59 \pm 0.85). While men had a higher mean UA concentration, females had a higher UA after adjusting for BMI, PA, and sleep ($p=0.056$). More specifically, females in the low ($p<0.001$) and dyslipidemia risk ($p<0.001$) groups had higher UA compared to their male counterparts. Also, BMI was significantly associated with UA regardless of group or sex ($p=0.047$). **CONCLUSIONS:** These findings suggest that 1) subjects in the dyslipidemia profile had higher UA after controlling for BMI, PA and sleep compared to subjects in either the low or high CMR profiles and 2) while males may have higher mean UA concentrations on average, females have higher UA concentrations after adjusting for BMI, PA, and sleep. Future studies should track UA levels across adolescence and investigate whether or not the relation between CMR profiles and UA levels changes from adolescence in to adulthood. Funded by NIH R01HD78346

1498 Board #260 May 30 10:30 AM - 12:00 PM
Exercise-mediated Apoptotic And Autophagic Responses Are Differentially Modulated In Pbmcs Of Obese Individuals

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PURPOSE: Obesity is associated with over activation of the pro-apoptotic pathway, implicating in the development of various comorbidities, such as insulin resistance and cardiovascular disease. While autophagy has been recently discovered as a critical molecular process in promoting cell survival against apoptosis, increased autophagic activation in obese individuals may serve as a pro-survival regulator to eliminate damaged proteins, organelles, or aggregates, and/or to enhance the cellular metabolic responses associated with physical stressors. Therefore, the purpose of this study was to examine whether or not maximal aerobic exercise-mediated apoptosis in obesity might be underlying the involvement of autophagy in the peripheral blood mononuclear cells (PBMCs).

METHODS: Twelve healthy male subjects (6 obese and 6 normal-weight) were recruited to participate in a maximal graded exercise test on a treadmill. Western blot analysis was used to determine the level of apoptotic and autophagic markers (Bax/Bcl-2 and LC3-II/LC3-I; respectively) in PBMCs prior to, immediately following exercise, and one and two hours into recovery from exercise.

RESULTS: Obese subjects exhibited a significantly lower Bax ($p = 0.028$), but a higher Bcl-2 protein level ($p = 0.006$) in conjunction with a reduced Bax/Bcl-2 area-under-the-curve "with respect to increase" (AUCi) ($p = 0.024$) compared to normal-weight subjects following maximal aerobic exercise. Furthermore, a greater LC3-II/LC3-I ratio and LC3-II/LC3-I AUCi was observed in obese subjects compared to normal-weight subjects in response to exercise ($p = 0.003$ and $p = 0.005$; respectively). LC3-II/LC3-I AUCi was also positively associated with obesity-associated parameters (BMI, waist/hip circumference, and fasting insulin level), but was negatively correlated with Bax/Bcl-2 AUCi ($r = -0.835$, $p = 0.001$).

CONCLUSIONS: These findings demonstrate that maximal aerobic exercise differentially mediates the intrinsic apoptotic pathway and autophagic activity in human PBMCs isolated from obese compared to normal-weight individuals, suggesting the importance of autophagy as a critical molecular process in promoting cell survival against exercise-induced apoptosis.

1499 Board #261 May 30 10:30 AM - 12:00 PM
Exercise Training Modulates Metabolic Inflammation In Kidney Of Diabetic Db/db Mice

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(No relevant relationships reported)

PURPOSE: Chronic inflammation and metabolic dysregulation may eventually cause tissue damage in type 2 diabetes. We examined the protective effects of moderate intensity aerobic exercise on kidney function in diabetic db/db mice.

METHODS: Functional and morphological alterations and metabolic and inflammatory signaling were examined in type 2 diabetic db/db mice with or without exercise training (5.2m/min, 1h/day, and 5days/week for a total of 8weeks).

RESULTS: Exercise training prevented weight gain (-7.0%) in db/db+Ex mice, but it did not reduce glucose and insulin levels. Exercise lowered serum creatinine, urea, and triglyceride levels in db/db+Ex mice. Reduced kidney size (0.37 vs 0.4g, $P=0.036$) and morphological alterations including decreased glomerular cross-sectional area (0.0235 vs 0.0367mm², $P<0.001$) were observed in db/db+Ex mice compared with untrained db/db mice. Mechanistically, preventing loss of SIRT1 (+62%, $P=0.048$) through exercise was linked to reduced acetylation of NF- κ B (-48%, $P=0.002$) in kidney of db/db+Ex mice. Exercise increased citrate synthase (+132%, $P=0.038$) and mitochondrial complex I activity (+80%, $P=0.004$), subunits of mitochondrial complexes (I, II, and V) and PGC1 α (+24%, $P=0.039$) at protein level in kidney of db/db+Ex mice compared with non-exercise db/db mice.

CONCLUSIONS: Moderate exercise training modulates metabolic dysfunction and inflammatory process, thereby attenuating the progression of diabetic nephropathy in type 2 diabetes mellitus.

C-44 Free Communication/Poster - Concussion I

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1500 Board #262 May 30 10:30 AM - 12:00 PM
Static Cerebral Autoregulation is Not Altered in Symptomatic Concussed Athletes During Acute Central Hypervolemia

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(No relevant relationships reported)

Dynamic cerebral autoregulation is impaired in concussed individuals. However, less is known regarding static cerebral autoregulation in symptomatic concussed athletes during a central hypervolemic challenge that increases blood pressure. **PURPOSE:** We tested the hypothesis that static cerebral autoregulation during a central hypervolemic challenge is impaired in symptomatic concussed college athletes (CA) vs healthy controls (HC). **METHODS:** Seven CA (age: 19 \pm 2 y, 5 females) and ten HC (age: 21 \pm 2 y, 6 females) completed one study visit. After 5 min of resting baseline, 20 mmHg of lower body positive pressure (LBPP) was applied for 5 min using an airtight chamber. Beat to beat blood pressure (photoplethysmography) and middle cerebral artery blood velocity (MCAv; transcranial Doppler) were recorded continuously. Static cerebral autoregulation was calculated using Fourier transfer function analysis with 3 min segments at baseline and after mean arterial pressure (MAP) stabilized during LBPP. Cerebral vascular resistance (CVR) was calculated as MAP/MCAv. Pulsatility index (PI) was calculated as the difference of peak systolic MCAv and end diastolic MCAv, divided by mean MCAv. Values are reported as a change from baseline. **RESULTS:** MAP (CA: 90 \pm 6 vs HC: 92 \pm 11 mmHg; $P=0.32$), MCAv (CA: 58.7 \pm 19.4 vs HC: 62.6 \pm 11.1 cm/s; $P=0.30$), gain (CA: 0.7 \pm 0.2 vs HC: 0.8 \pm 0.2 cm/s/mmHg; $P=0.17$), coherence (CA: 0.5 \pm 0.1 vs HC: 0.5 \pm 0.1; $P=0.21$), CVR (CA: 1.7 \pm 0.6 vs HC: 1.5 \pm 0.3 mmHg/cm/s; $P=0.21$), and PI (CA: 0.9 \pm 0.1 vs HC: 0.9 \pm 0.2; $P=0.31$) were not different at baseline. The change in MAP was not different between CA (12 \pm 6 mmHg) and HC (8 \pm 6 mmHg; $P=0.12$). The change in MCAv was greater in CA (CA: 4.8 \pm 4.6 vs HC: -4.3 \pm 8.7 cm/s; $P=0.01$). There were no differences in the change from baseline for gain (CA: 0.1 \pm 0.2 vs HC: 0.1 \pm 0.5 cm/s/mmHg; $P=0.49$) or coherence (CA: -0.0 \pm 0.1 vs HC: -0.0 \pm 0.1; $P=0.40$). The increase in CVR was attenuated in CA (CA: 0.0 \pm 0.2 vs HC: 0.3 \pm 0.3 mmHg/cm/s; $P=0.04$). The decrease in PI was greater in

CA (CA: -0.1 \pm 0.0 vs HC: 0.0 \pm 0.1; $P=0.02$). **CONCLUSION:** These data indicate that indices of static cerebral autoregulation are not different between CA and HC during an acute increase in MAP. The blunted increase in CVR and greater decrease in PI appears to allow for a rise in MCAv during an acute increase in MAP in CA.

1501 Board #263 May 30 10:30 AM - 12:00 PM

Whole-Body Reactive Agility Asymmetries among Athletes with Concussion History Are Modifiable

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PURPOSE: This study assessed associations between self-reported concussion history and measures of perception-action coupling, as well as changes in reactive responses after upper extremity training that imposed both cognitive and visuomotor demands.

METHODS: A cohort of 22 elite athletes representing 6 Olympic sports (14 males & 8 females; 26.1 \pm 5.1 years) performed pre- and post-training tests of upper extremity choice reaction time (RT) and whole-body reactive agility. The choice RT test used 10 congruent and 10 incongruent Eriksen flanker 5-arrow displays to designate correct left versus right manual responses for deactivation of illuminated buttons. Whole-body tests required lateral movement responses to 20 left or right visual targets and diagonal movement responses to 12 visual targets presented in right/left and forward/backward combinations. One-minute cognitive-visuomotor training sessions were completed 2-3 times per week over 4 weeks, which involved simultaneous manual responses (button deactivations) and verbal responses (center arrow direction for 20 5-arrow displays).

RESULTS: At least 6 training sessions were completed by each athlete (7.7 \pm 0.6). Concussion history was reported by 55% (12/22; 5.0 \pm 4.9 years; range: 0.3 - 16.5 years), which was strongly associated with asymmetries in both lateral and diagonal/backward reactive agility measures of RT, speed, acceleration, and deceleration (AUC=.808). The average of the 8 asymmetry values \geq .18 discriminated with 89% PPV, 69% NPV, and OR=18.0 (90% CI Lower Limit: 2.4; χ^2 Exact 1-Sided $P=.01$). Upper extremity choice RT incongruent-congruent difference \geq 80 ms classified concussion history status with PPV=69%, NPV=67%, and OR=4.5 (90% CI Lower Limit: 1.0; χ^2 Exact 1-Sided $P=.11$). Among the athletes with concussion history, 7 of 8 reactive agility asymmetries were reduced after training. Standardized response means for reactive agility asymmetry reduction ranged from .17 to .48, and average choice RT incongruent-congruent difference improved from 103 \pm 51 ms to 54 \pm 79 ms (SRM=.53).

CONCLUSIONS: Asymmetry in reactive responses may be a manifestation of dysfunctional interhemispheric brain connectivity. Our findings suggest that cognitive-visuomotor training with the upper extremities can reduce whole-body movement asymmetries.

1502 Board #264 May 30 10:30 AM - 12:00 PM
Normative Values on the King-Devick Screening Test in Wheelchair Basketball Players

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The King-Devick (KD) test of rapid eye movement is a common instrument used to assess concussion in able-bodied (AB) sport but data are limited for disability sport athletes. **PURPOSE:** The purpose of this study was to report updated normative KD values for wheelchair basketball sport participants. **METHODS:** One-hundred twenty wheelchair basketball players (101 males, 18 females, 1 non-report) completed baseline KD assessments via an iPad application approximately 10 minutes before a scheduled practice or competition. Because some athletes had limited or impaired grip, iPads were placed on music stands or in iPad clips on a tripod at a standardized height and distance from each participant. Per KD protocol, two baseline assessments were administered with the lowest score reflecting true baseline. **RESULTS:** Mean KD baseline score was 62 \pm 24 sec. No significant difference on mean KD baseline score existed between genders or prior concussion experience. However, significant differences on baseline KD existed between age groups (adults = 55 \pm 17 sec; youth = 71 \pm 27 sec; $F=14.92$, $p=0.00$) and among impairment types (spinal cord injury = 52 \pm 13 sec, spina bifida = 71 \pm 25 sec, amputee = 53 \pm 11 sec, cerebral palsy = 88 \pm 31 sec; $F=14.92$, $p=0.00$). **CONCLUSIONS:** KD normative scores were meaningfully higher than previously reported norms in AB sport for both adults and youth. Baseline KD scores varied by impairment type which is an important consideration for normative development in wheelchair basketball athletes.

1503 Board #265 May 30 10:30 AM - 12:00 PM
Previous Concussion History Influences Health-related Quality Of Life Among Collegiate Student-athletes: Baseline Findings From The Active Rehab Study

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Prior concussion history is posited to influence many outcomes. Understanding how concussion history affects quality of life may identify student-athletes needing intervention and those predisposed to other conditions. **PURPOSE:** To examine how prior concussion history influences college athletes' pre-season baseline health-related quality of life (HRQOL). **METHODS:** Student-athletes (n = 1599) from six Canadian and US college institutions and 24 college sports, completed a comprehensive concussion baseline assessment including an HRQOL evaluation (PROMIS-29, Neuro-QOL Fatigue, and Neuro-QOL Cognition Scales). The primary predictor was concussion history and covariates included age, sex, BMI, and contact sport participation. Primary outcomes were Anxiety, Physical Function, Depression, Sleep Disturbance, Social Role/Activities, Pain Interference, Pain Intensity, Cognition, and Neuro-related Fatigue raw scores. Linear regression models clustered on study site using generalized estimating equations examined the association between concussion history and HRQOL outcomes. **RESULTS:** Analysis was limited to 1509 (94%) participants with complete outcome and covariate data [538 females (35.6%); median age = 19 years (range: 18-27); 553 (36.7%) with 1+ prior concussions]; 1154 (76.5%) played a contact sport]. Concussion history, adjusted for age, sex, BMI, and contact sport participation, were associated with greater anxiety, sleep disturbance, depressive feelings, fatigue, and worse cognition function. However, these differences were mostly minor. Clinically meaningful mean differences (MD) suggest those with multiple concussions report worse cognitive function (MD=-1.2; 95%CI: -2.4, -0.1 for 3+ vs 0 concussions; MD=-1.1, 95% CI: -2.3, 0.1 for 2 vs. 0 concussions) and greater neuro-related fatigue (MD=1.3, 95% CI: -0.1, 2.7 for 3+ vs 0 concussions; MD=0.9, 95% CI: 0.1, 1.7 for 2 vs 0 concussions). **CONCLUSIONS:** After controlling for covariates, these data suggest that following primary recovery, those with prior concussions may exhibit increased cognitive and fatigue related complaints. These residual effects may confound incident concussion assessments, particularly when pre-season baseline measures are not available.

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1504 Board #266 May 30 10:30 AM - 12:00 PM
Long Term Effects of Concussion on Eye Tracking Patterns

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 (No relevant relationships reported)

Purpose: The purpose of this study is to investigate long-term changes in eye-tracking patterns in previously concussed individuals (>1-year post-injury) compared to non-concussed controls. **Methods:** This case control study will include 40 total participants, but currently includes 12 participants with (n=5 concussed, 3.00±1.79 concussions, 4.92±2.43 years post-injury, 22.80±2.23 years, 170.18±6.62 cm, 71.49±9.19 kg) and without (n=7; 27.00±4.96 years, 177.8±9.40 cm, 77.69±12.83 kg) a concussion history were evaluated. Participants were excluded if they only had a previously undiagnosed concussion, were currently playing contact sports, did not have normal or corrected to normal vision without glasses. Participants completed two eye-tracking tasks: an anti-saccade task consisting of 5 test blocks, 40 trials each and a circle tracking task consisting of 3 trials. The anti-saccade task measured saccadic and anti-saccadic movements, while the circle tracking task measured smooth pursuit eye movements. In both groups, results were analyzed using independent T-tests. **Results:** The mean reaction and processing times in the saccade task in formerly concussed subjects was significantly different from controls (p=0.02 and p<0.01). The control group had a 7.41% slower reaction time and 12.64% slower processing time than the concussed group. Other anti-saccade task variables (i.e. movement time, number of correct saccades, number of trials where saccade ended outside of the target zone, percent of accurate saccades, distance from target block, distance from target block for correct trials) and circle tracking (i.e. horizontal root mean squared error (RMSE), vertical RMSE, horizontal delay, mean vertical delay) were not significant (p>0.05). **Conclusions:** Counter to work on the acute effects of concussion, the preliminary findings of this study indicate that concussion may not have a long-term effect on eye-tracking reaction and processing time. Additional work in this area with larger samples is warranted.

1505 Board #267 May 30 10:30 AM - 12:00 PM
Examining Differences Between Patient and Clinician Measurements of Post-Concussion Near-Point of Convergence Distance

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Near-point of convergence (NPC) is the distance an individual can view a target without diplopia. The assessment of NPC distance is an important component of the Vestibular Ocular Motor Screening (VOMS) for sport-related concussion (SRC). The VOMS requires that the NPC distance is obtained by the patient and recorded by the clinician. However, some clinicians anecdotally report obtaining a more accurate and consistent measurement than patients due to more training and experience. Measurement differences between these two administration methods are important to investigate, as a NPC distance less than 5cm is predictive of SRC. No study to date has compared patient and clinician measurements of NPC distance following concussion. **PURPOSE:** To examine differences between patient and clinician measurements of post-concussion NPC distance. **METHODS:** One hundred and two patients (17.80±7.43 years) seeking care for a medically diagnosed SRC participated in this study. For the patient measurement, the patient focused his/her eyes on a 14-point foot target (i.e., fixation stick) and slowly moved the target toward the center of the patient's eyes until the patient reported double vision. For the clinician measurement, the clinician slowly moved the target toward the patient until the patient reported double vision and recorded the NPC distance. The NPC distance was recorded as the average of three trials. Paired-samples t-tests were performed to examine differences in NPC distance between patient and clinician administration. Chi-square analyses were performed to compare the number of cases exceeding clinical cutoffs (>5cm) between the two administration methods. Statistical significance was set at p<.05.

RESULTS: There were no significant differences between patient and clinician administered NPC distance measurements (t[102]=-1.66, p=.10). The number of NPC distance measures that exceeded clinical cutoffs (>5cm) were not significantly different between patient (n=28) and clinician administrations (n=31) ($\chi^2[1,204]=.22$, p=.64). **CONCLUSIONS:** Patients can accurately administer NPC distance despite not having the training and experience of clinicians. All 28 patients that exceeded clinical cutoffs during patient administration also exceeded clinical cutoffs during clinician administration.

1506 Board #268 May 30 10:30 AM - 12:00 PM
The Effect of School Socioeconomic Status and Sport on Adolescent Athletes' Baseline Concussion Assessment

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PURPOSE: The purpose is to examine the effect of school socioeconomic status (SES) and sport on the baseline performance of adolescent athletes on the King-Devick test (KD), modified Balance Error Scoring System (mBESS), and Post Concussive Symptom Inventory (PCSI).

METHODS: A retrospective cohort study was conducted on athletes' baseline concussion assessments completed as part of a concussion surveillance program. Testing included a history and risk factor questionnaire, KD, mBESS, and PCSI. Schools and sports clubs were classified as high SES (private or <50% free/reduced lunches) vs. low SES (public, > 75% free/reduced lunches). Sports were categorized as collision, contact, and non-contact. An ANCOVA was performed for each outcome while controlling for age.

RESULTS: Analysis was conducted on 377 athletes (63% M), average age 15.9±1.5 years (range 12.1-19.2). Two schools and 1 club were classified as high SES (n=162); 5 schools (n=215) were classified as low SES. For KD score, only a significant school × sport interaction was observed (p=0.01), with age as a significant co-variate (p=0.01). Only a significant main effect of school was observed for the mBESS (p=0.02), while a significant main effect of school (p=0.001) and school × sport interaction (p=0.02) was observed for PCSI. Age was not significant for either mBESS or PCSI (p>0.47).

CONCLUSIONS: This study examines the influence of school SES and sport on baseline KD, mBESS, and PCSI. KD scores were slower in contact and non-contact athletes of high SES schools compared to low SES school athletes. Additionally, low SES school contact and non-contact athletes reported higher baseline PCSI scores

compared to their high SES school counterparts. These findings have implications for how baseline scores are considered as comparisons for concussion surveillance; however, more studies are necessary to examine other confounding factors and the utility of these measures in managing injury recovery.

Baseline Concussion Outcome by School SES and Sport Type					
School	Sport type	n	Mean KD (SD) s	Mean mBESS (SD)	Mean PCSI (SD)
High SES	Collision	29	45.76(8.15)	26.76(2.25)	4.66(6.77)
	Contact	59	50.41(10.29)	26.54(2.84)	4.73(5.93)
	Non-contact	73	48.93(9.49)	26.22(3.15)	4.15(6.94)
Low SES	Collision	125	48.30(10.40)	24.93(3.26)	4.29(7.68)
	Contact	64	44.14(8.02)	25.84(3.25)	7.83(10.52)
	Non-contact	26	44.47(7.79)	26.23(2.52)	10.65(10.87)

1507 Board #269 May 30 10:30 AM - 12:00 PM
Administering Computerized Neurocognitive Testing Does Not Increase Symptoms Following Sport-Related Concussion

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 (No relevant relationships reported)

Computerized neurocognitive testing (CNT) is an important component for the management of sport-related concussion (SRC). The cognitive demands required to complete CNT may exacerbate SRC symptoms.

PURPOSE: To prospectively examine changes in post-concussion symptom reporting after completing CNT. **METHODS:** One hundred forty-five athletes (15.72 ± 1.78 years) with a medically diagnosed SRC completed the Post-Concussion Symptom Scale (PCSS) before and after completing a CNT (e.g., The Immediate Post-Concussion Assessment and Cognitive Testing: ImPACT). Changes in total PCSS symptoms and symptom clusters (somatic, affective, and cognitive-migraine-fatigue) were examined with a series of paired samples *t*-tests. Participants were also assigned to groups based on the time elapsed from injury until their first clinical visit: 0-7, 8-14, and 15-21 days. A series of 3 (time since injury group) X 2 time (pre, post) analysis of variance were performed on symptom totals and clusters. Statistical significance was set at a Bonferroni-corrected $p < .01$.

RESULTS: There were no significant differences in total ($t(145) = -.69, p = .49$), somatic, ($t(145) = -1.02, p = .31$), or cognitive-migraine-fatigue symptoms ($t(145) = -1.75, p = .08$) before and after CNT. There was a significant difference for affective symptoms ($t(145) = 2.51, p = .01$). Affective symptoms were significantly higher before CNT ($M = 2.19, SD = 3.15$) compared to after CNT ($M = 1.80, SD = 2.89$). There were no between-subjects or within-subjects main effects for total, somatic, affective, or cognitive-migraine-fatigue symptom clusters ($p > .05$). There were also no significant group x time interactions for total symptoms ($Wilks \lambda = .99, F[1, 142] = 0.20, p = .40, \eta^2 = .01$), somatic, ($Wilks \lambda = 1.00, F[2, 142] = .30, p = .74, \eta^2 = .004$), affective ($Wilks \lambda = .99, F[2, 142] = 0.89, p = .43, \eta^2 = .01$), or cognitive-migraine-fatigue symptom clusters ($Wilks \lambda = .99, F[2, 141] = 0.41, p = .67, \eta^2 = .01$). **CONCLUSIONS:** The administration of CNT during recovery from SRC does not increase concussion symptoms. Sports medicine professionals should administer CNT to concussed athletes even when symptomatic, to more accurately identify neurocognitive impairment, which will help determine targeted treatment options.

1508 Board #270 May 30 10:30 AM - 12:00 PM
No Differences in Tandem Gait Performance between Males and Females Acutely Post-Concussion

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Postural control impairments are common following concussion and traditionally assessed using the Balance Error Scoring System (BESS). Tandem gait (TG) has

successfully identified impairments in postural control acutely post-concussion that were undetected by the BESS; thus, TG may be a more robust postural control assessment following concussion. While sex differences in BESS performance after concussion have been explored, there is no literature regarding sex differences in post-concussion TG. **PURPOSE:** To examine sex differences in TG performance among collegiate student-athletes acutely post-concussion relative to pre-injury performance.

METHODS: Forty-eight concussed collegiate student-athletes (30 females) and twenty-five healthy controls (13 females) completed TG tests during pre-season and again acutely post-concussion. Participants walked heel-to-toe down a 3-meter line, turned, and returned as quickly as possible, completing four single-task (ST) and dual-task (DT) TG trials. During DT trials, they simultaneously answered mini-mental style questions. The best ST and DT times were recorded. A 2x2 (group*sex) ANOVA was used to examine TG change between pre-injury and post-injury tests (positive value=slower/worsening; negative value=faster/improving).

RESULTS: The change in TG time from pre-injury to post-injury was significantly higher for the concussion group relative to the control group during both ST (Concussion: 1.6 ± 2.6 seconds, Controls: -1.1 ± 0.8 seconds, $p < 0.001$) and DT (Concussion: 2.0 ± 3.8 seconds, Controls: -0.9 ± 1.7 seconds, $p < 0.001$) TG. There were no significant interactions (ST: $p = 0.17$, DT: $p = 0.23$) or main effects for sex (ST: $p = 0.63$, DT: $p = 0.91$).

CONCLUSIONS: There were no sex-specific differences in TG performance acutely post-concussion. However, all concussed participants, regardless of sex, performed significantly worse on TG than male and female controls after injury relative to baseline, while controls did not demonstrate such a change. These results suggest that TG can appropriately identify postural control impairments following concussion; however, there do not appear to be differences in performance between males and females.

1509 Board #271 May 30 10:30 AM - 12:00 PM
Post-Concussion Symptom Factors in Male and Female High School and Collegiate Athletes

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Previous research suggests concussed female athletes report higher severity of total symptoms; however, sex differences for symptom factors across recovery are understudied. **PURPOSE:** To examine sex differences in post-concussion symptom factors across concussion recovery (i.e., ≤ 72 hours, return-to-play, $> \text{one-month}$). **METHODS:** Symptoms were rated from 0 (none) to 6 (severe) on the Post-Concussion Symptom Scale (PCSS), which consists of 22 total symptoms and a total symptom severity score ranging from 0-132. The PCSS was broken into two symptom factors: cognitive-migraine-fatigue (headache, dizziness, fatigue, drowsiness, sensitivity to light/noise, feeling slowed down, foggy, difficulty concentrating/remembering) and affective (sadness, nervousness, feeling more emotional). A 2 sex (male, female)*2 group (concussed, healthy)*3 time (≤ 72 hours, return-to-play, $> \text{one-month}$) repeated measures ANOVA was used to analyze sex differences in symptom factors throughout recovery between concussed and healthy athletes. **RESULTS:** There were 167 ($M = 17.46$ years, $SD = 2.2$; male=97, female=70; concussed=78, healthy=89) total athletes. There were no significant sex differences between testing sessions at ≤ 72 hours ($M = 2.03$ days, $SD = 0.8, p = .42$), return-to-play ($M = 16.09$ days, $SD = 11.7, p = .95$), and $> \text{one-month}$ ($M = 59.72$ days, $SD = 21.4, p = .65$). There was no significant within-subject interaction for sex*group*time for the cognitive-migraine-fatigue or affective symptom factors. There was a significant between-subjects sex*group interaction for the cognitive-migraine-fatigue symptom factor ($F_{(1,163)} = 5.52, p = .02, \eta^2 = .03$). Simple main effects analysis revealed concussed females ($M = 7.39, SE = 0.57$) reported significantly higher severity for the cognitive-migraine-fatigue symptom factor than concussed males ($M = 4.83, SE = 0.48; p \leq .001$), yet no sex differences were observed between healthy athletes ($p = .82$). There was no significant between-subjects sex*group interaction for the affective post-concussion symptom factor. **CONCLUSIONS:** Concussed females reported greater symptom severity for the cognitive-migraine-fatigue symptom factor compared to concussed males, which may direct targeted concussion management approaches between female and male athletes.

1510 Board #272 May 30 10:30 AM - 12:00 PM
Patient-parent Agreement On The Health And Behavior Inventory After Pediatric Concussion

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(No relevant relationships reported)

PURPOSE: The purpose of our study was to examine patient-parent agreement on measures of concussion symptom frequency after pediatric sport-related concussion, and identify differences in patient-parent agreement between child and adolescent age groups.

METHODS: We conducted an analysis of data collected from a prospective registry of patients with concussion in a sports medicine clinic. Patients and their parents completed the Health and Behavior Inventory (HBI) at each clinic visit. Wilcoxon signed rank tests were used to assess for potential differences in symptom frequency ratings. Spearman rho correlations and Fisher's r to z transformation were used to assess linear agreement for total HBI score between parents and children (ages 6-12 yrs), compared to parents and adolescents (ages 13-18 yrs). Multiple regression analyses were used to evaluate the association between parent-reported and patient-reported HBI ratings with return to play (RTP) time and symptom duration.

RESULTS: A total of 267 patients (24% children, 28% females, evaluated 8.9±5.2 days post-concussion) were included in the analysis. For total HBI score, the agreement between children and their parents was high ($r_s=0.88$; 95% CI=0.80-0.95). Adolescents also highly agreed with their parents ($r_s=0.78$; 95% CI=0.71-0.85). However, child-parent agreement was significantly higher than adolescent-parent agreement ($z=2.21$; $p=0.03$). Additionally, combined child and adolescent patient HBI ratings were significantly associated with symptom resolution time ($\beta=0.296$; 95% CI=0.091-0.501; $p=0.005$) and RTP time ($\beta=0.487$; 95% CI=0.009-0.965; $p=0.046$), whereas parent HBI ratings were not.

CONCLUSIONS: Overall, there was strong agreement between patients and their parents on the HBI, though children demonstrated significantly higher agreement with their parents compared to adolescents. Additionally, patient-reported HBI scores were more predictive of symptom duration and RTP time than parent-reported HBI scores. Clinicians may find this useful when setting expectations regarding concussion symptom duration and RTP timing for patients and their families. Significant reporting discrepancies between patients and their parents may also be a relevant factor for clinicians to consider during acute post-concussion evaluations.

1511 Board #273 May 30 10:30 AM - 12:00 PM
Three-dimensional Multiple Object Tracking's Role In Injury Incidence Reduction In Collegiate Athletics

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(No relevant relationships reported)

Three-dimensional multiple object tracking (3D-MOT) has been proposed as a training tool for processing dynamic events such as sports activities, and has been hypothesized to reduce athletic injuries through increased awareness of player movement.

PURPOSE: The purpose of this study was to determine if 3D-MOT is an effective intervention to minimize the risk of injury in collegiate ice hockey and lacrosse.

METHODS: 78 NCAA Division III ice hockey and lacrosse players volunteered for a season-long investigation. Players were assigned to a 3D-MOT training intervention (3D-MOT; $n=38$) or a control group (C; $n=40$). 3D-MOT training gains were measured by mean speed threshold (m/s) obtained from Core training sessions and were analyzed using paired t-tests. Athletic trainers (ATs) attended school-sanctioned team conditioning sessions, practices, and competitions from which injury data was collected. Repeated measures analysis of variance (RM-ANOVA) were performed to compare total number of injuries over time and between groups (3D MOT and C). Two additional RM-ANOVA were performed to explore if 3D-MOT training decreased the number of injuries over time based on injury mechanism (i.e., contact vs. non-contact).

RESULTS: The mean speed threshold significantly increased from the first Core session to the last Core session ($p=0.000$). The total number of injuries significantly decreased over the course of the season ($p=0.002$). When comparing the 3D-MOT to C, there was no significant difference in the total number of injuries ($p=0.293$). For those injured at baseline, the total number of injuries also significantly decreased over time ($p=.002$) though the 3D-MOT intervention had no effect on the number of injuries in athletes injured at baseline ($p=.204$). The 3D-MOT intervention did not have an effect on mechanism of injury, however both contact ($p=.016$) and non-contact injuries ($p=.013$) significantly decreased over time (length of season). **CONCLUSIONS:** Motion perception training with 3D-MOT did not decrease injury incidence in NCAA Division III men's and women's ice hockey and lacrosse athletes compared to controls. NCAA Division III men's and women's ice hockey and lacrosse athletes experience fewer injuries, both contact and non-contact, as their seasons' progress.

1512 Board #274 May 30 10:30 AM - 12:00 PM
Head Motion Predicts Transient Loss of Consciousness in Human Head Trauma: Insights From Mixed Martial Arts

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Transient loss of consciousness (tLOC) is commonly observed in athletes with concussion. Despite evidence that tLOC has long-term clinical implications, the mechanism by which it occurs is not well characterized in human models. **Purpose:** To investigate the strike patterns that produce concussion with tLOC using professional mixed martial arts (MMA) competitors. **Methods:** An online database was screened for Ultimate Fighting Championship (UFC) fights ending with knockouts (KO). Inclusion criteria for analysis were classification as KO, dated from January 2013 to December 2015. Videos were excluded if a strike leading to tLOC could not be definitively identified and characterized. Demographic information of athletes was compiled into fight profiles. Two blinded, independent reviewers generated impact profiles, which included timing of strike, striking implement, strike location, and head motion. This was performed for all KO strikes (cases) and for a group of non-KO (NKO) strikes (controls). Winner and loser characteristics were compared using 2-tailed t-tests. Multivariate logistic regression analyses were used to compute odds ratios for the strike characteristics associated with tLOC. The Kaplan-Meier estimate was used to describe the temporal distribution of KOs. **Results:** A total of 130 fights were identified for review and 106 fights met criteria for analysis. Analysis of impact profiles revealed that the strongest independent predictor for LOC was axial head rotation (OR, 45.3; 95% CI, 20.8 - 98.6). Other independent risk factors included non-fist striking implements (OR, 11; 95% CI, 4.58 - 26.4), strike location affecting the mandible (OR, 2.84; 95% CI, 1.26 - 6.41) or maxilla (OR, 3.74; 95% CI, 1.32 - 10.6), and strikes resulting in flexion, extension or lateral head flexion (OR, 4.94; 95% CI, 2.09 - 11.7). The Kaplan-Meier survival curve demonstrates a decreasing risk of KO through time. **Conclusion:** Our study is among the first investigations of directly observed human head trauma and the first to directly link axial head rotation as a major contributing variable for whether trauma causes LOC in humans, in line with an extensive literature in animals.

C-45 Free Communication/Poster - Clinical Populations

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1513 Board #275 May 30 10:30 AM - 12:00 PM
Agreement Between Segmental Bioimpedance Devices, Air Displacement Plethysmography, and Dual Energy X-Ray Absorptiometry in Obese Adults

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Segmental bioimpedance analysis (BIA) has emerged as a desirable technique for assessing body composition in obese populations when more sophisticated laboratory equipment is not readily available. Nonetheless, research has yet to examine the agreement of various segmental BIA devices, air displacement plethysmography (ADP) and dual energy X-ray absorptiometry (DXA). **PURPOSE:** This study examined the agreement of segmental BIA devices, ADP and DXA for estimating body composition in obese adults. **METHODS:** Fifty obese adults (25 men and 25 women; age = 34.2 ± 11.2 years; BMI = 36.1 ± 5.3 kg/m²) had their total body fat percentage (BF%) and fat-free mass (FFM) evaluated with two segmental BIA devices, ADP, and DXA. **RESULTS:** The effect size of the mean differences for all BF% and FFM comparisons (segmental BIA vs. ADP, segmental BIA vs. DXA; ADP vs. DXA) were trivial (Cohen's $d < 0.20$). The standard error of estimate (SEE), total error (TE), and 95% limits of agreement (LOAs) were similar for the segmental BIA devices (SEE < 2.26% and 2.35 kg; TE < 2.58% and 2.66 kg; 95% LOAs < ±4.94% and 4.86 kg) and ADP (SEE = 2.39% and 2.57 kg; TE = 2.34% and 2.56 kg; 95% LOAs = 4.63%

and 5.06 kg) when compared to DXA. Validity statistics were slightly higher, but considered acceptable, when comparing the segmental BIA devices against ADP (SEE < 3.37% and 3.63 kg; TE < 3.44% and 3.79 kg; 95% LOAs < $\pm 5.82\%$ and 7.19 kg). **CONCLUSION:** The main findings from the present study revealed the segmental BIA devices are interchangeable with ADP and DXA when utilized on obese adults. ADP and DXA also had good agreement with each other. These results suggest that clinicians and practitioners can employ segmental BIA devices in obese adults when the ADP or DXA are not available.

- 1514** Board #276 May 30 10:30 AM - 12:00 PM
The Effects of Swimming Training on Arterial Stiffness, Muscular Strength and Cardiorespiratory Endurance in Postmenopausal Women with Stage 2 Hypertension
 Steven Scott¹, Alexei Wong², Yi-Sub Kwak³, Won-Mok Son⁴, Jung-jun Park⁴, Elizabeth Pekas¹, Song-Young Park¹. ¹University of Nebraska at Omaha, Omaha, NE. ²Marymount University, Arlington, VA. ³Dong-eui University, Busan, Korea, Republic of. ⁴Pusan National University, Busan, Korea, Republic of.
 (No relevant relationships reported)

Purpose: Aging is associated with progressive decreases in arterial health and function as well as overall fitness. It is crucial to prevent or reduce the negative effects of aging on vasculature and fitness components by implementing appropriate lifestyle interventions, such as exercise training. We examined the effects of a swimming (SWM) regimen on arterial stiffness (pulse wave velocity, PWV), blood pressure (BP), wave reflection (AIx), muscle strength and aerobic capacity in postmenopausal women with stage 2 hypertension. **Methods:** Using a parallel experimental design, participants were randomly assigned to either a SWM (n=52) or non-exercising control group (n=48) for 20 weeks. Participants in the SWM group trained 3-4 days/week, progressing in duration from 25 to 45 min. Participants' carotid to radial PWV (crPWV), BP, AIx, muscular strength and cardiorespiratory capacity were measured at baseline and after 20 weeks of their assigned intervention. **Results:** There was a significant group x time interaction ($P < 0.05$) for crPWV, AIx, and systolic and diastolic BP, which significantly decreased ($P < 0.05$); and strength and cardiorespiratory capacity, which significantly increased ($P < 0.05$) following SWM compared to no changes in control. **Conclusion:** SWM led to reductions in arterial stiffness, wave reflection and BP while increasing strength and aerobic capacity in postmenopausal women with stage 2 hypertension. SWM may be an effective intervention in the prevention and treatment of age-related vascular complications as well as declines in muscle strength and cardiorespiratory capacity. <!--EndFragment-->

- 1515** Board #277 May 30 10:30 AM - 12:00 PM
Improvement Of Redox Balance After Isometric Exercise Involving Large Muscle Mass In Hypertensive Adults
 Rafael Reis Olher, Thiago Belarmino Ribeiro, Brande Ranter Soares, Ioranny Raquel Souza, Luiz Humberto Rodrigues Souza, Geiziane Leite Rodrigues Melo, Lysleine Alves Deus, Caio Victor Souza, Herbert Gustavo Simões, Rodrigo Vanerson Passos Neves, Thiagos Santos Rosa, Milton Rocha Moraes. Universidade Católica de Brasília, Brasília, Brazil.
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Hypertension is one of the cardiovascular diseases responsible for more deaths worldwide. Although isometric exercise (IE) has been showing promising results to treat hypertension, the physiological mechanisms underneath blood pressure (BP) responses are still warranted, being oxidative stress (OS) and nitric oxide (NO⁻), major factors involved in acute and chronic pathophysiology of this disease. **PURPOSE:** The aim of this study was to investigate the OS, NO⁻ responses to IE in normotensive (NTG) and hypertensive (HTG) individuals. **METHODS:** After body composition and muscular strength assessment, twenty-four adult men (14 hypertensive and 10 normotensive). Individuals were submitted to 3 sessions of IE in Bench and Leg press exercises. The sessions in each exercise consisted in: i) assessment of maximal voluntary isometric contraction (MVIC); ii) 8 sets x 1' contraction at 30% MVIC with 2' rest pause; iii) control session (CS). Blood samples were collected at rest, immediately after the session and 60-min post-exercise. NO⁻ were obtained through the Griess reaction method. OS parameters (uric acid, TBARS, TEAC, GSH, catalase and SOD) were analyzed using commercial kits. For the statistical analysis, a repeated-measures ANOVA with Bonferroni post-hoc was used. **RESULTS:** A significant increase in plasmatic NO-bioavailability immediately after the IE session was observed only in HTG ($\Delta = 23.9 \pm 8.45 \mu\text{L}$). Regarding OS parameters, TBARS presented a significant reduction after the IE session in both groups in comparison to CS ($\Delta = -0.94 \pm 0.9$ and $-0.63 \pm 0.53 \text{ nmol/L}$) for HTG and NTG respectively. Catalase increased in both groups against CS ($\Delta = 48.66 \pm 13.7$ and $36.92 \pm 19.18 \text{ U} \cdot \text{mL}^{-1}$ for HTG and NTG respectively). Whereas no statistical differences were identified for uric

acid, TEAC, GSH and SOD analysis within- or between-group. **CONCLUSIONS:** In conclusion, 8 minutes of isometric exercise with large muscle mass elicits an elevated pro-oxidant activity, increased antioxidant reaction, leading to a greater NO⁻ bioavailability in hypertensive individuals.

- 1516** Board #278 May 30 10:30 AM - 12:00 PM
Cardiac Rehabilitation Significantly Reduces Body Composition in Men Greater than Women
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PURPOSE: To examine body composition (BC) changes by dual energy x-ray absorptiometry (DXA) after cardiac rehabilitation (CR) participation. We hypothesized that CR would improve multiple components of body composition. **METHODS:** The Mayo Clinic CR database was reviewed; 296 had DXA at baseline and after CR completion from January 2014 to August 2018. DXA and relevant clinical metrics (e.g. age, sex, height, weight, hip and waist circumference (WC), and clinical diagnosis) were extracted from the medical record. Referral diagnoses included myocardial infarction (29%), coronary artery disease (4%), percutaneous coronary intervention (23%), coronary artery bypass grafting (14%), heart valve surgery (14%), heart transplant (4%), heart failure (6%), and other (6%). Data are presented as mean \pm SD and analyzed with ANOVA, chi-square and Fisher's exact test when appropriate. **RESULTS:** There was no difference in age between groups at enrollment. As expected, men weighed more, had more lean mass, were taller, had larger WC, and higher waist to hip ratio (WHR; $p < 0.05$) at baseline. Women had higher body fat % and gynoid fat mass % ($p < 0.05$). After CR, weight did not change significantly in men or women; however, BC changed significantly as presented in the table. Specifically, in men compared to women, CR resulted in greater reductions in fat mass and body fat %, with greater increases in lean mass ($p < 0.05$). Men also demonstrated greater reductions in android fat mass % and WHR ($p < 0.05$). Conversely, women had a significant reduction in gynoid fat mass % but no change in android fat mass % or WHR ($p < 0.05$). Fat mass index was reduced in both groups and significantly between the sexes ($p < 0.05$). **CONCLUSIONS:** CR participation significantly reduced BC in men and women; however, men demonstrate greater reductions compared to women. Additionally, the distribution of BC improvements appears to differ between sexes suggesting sex specific CR programming may be appropriate.

	Men			Women		
	Before	After	Delta Change	Before	After	Delta Change
Weight (kg)	90.48 ± 18.71	89.82 ± 18.42	(-0.62 ± 4.96)	75.52 ± 17.56	75.29 ± 19.73	(-0.23 ± 3.29)
Waist (cm)	106.23 ± 13.78	104.31 ± 13.98	(-1.91 ± 5.11 *	95.39 ± 15.81	93.62 ± 15.94	(-1.76 ± 6.29 *
Hip (cm)	106.53 ± 9.45	105.54 ± 9.42	(-0.96 ± 4.52 *	107.83 ± 13.52	107.1 ± 13.58	(-0.73 ± 4.74
Waist/Hip Ratio	0.99 ± 0.07	0.98 ± 0.07	(-0.0095 ± 0.05 *	0.88 ± 0.08	0.87 ± 0.08	(-0.012 ± 0.06
Fat mass (Kg)	31.25 ± 11.45	30.07 ± 11.29	(-1.10 ± 2.47 *	31.71 ± 13.14	30.93 ± 14.20	(-0.75 ± 2.28 *
Lean mass (Kg)	57.34 ± 8.54	57.74 ± 8.34	0.46 ± 2.24 *	41.85 ± 6.01	41.7 ± 6.29	(-0.08 ± 2.18
% Fat	34.38 ± 6.97	33.29 ± 6.91	(-1.06 ± 2.05 *	41.46 ± 9.04	40.91 ± 9.13	(-0.58 ± 2.28
Fat Mass Index (kg/m ²)	11.01 ± 2.4	9.79 ± 3.47	(-1.30 ± 2.28 [†] *	15.37 ± 3.74	11.75 ± 4.91	(-3.43 ± 3.19 [†] *
% Trunk Fat	40.29 ± 8.98	38.96 ± 8.94	(-1.31 ± 2.97 *	43.54 ± 11.88	42.93 ± 12.05	(-0.61 ± 3.19
Android Fat mass %	43.19 ± 10.29	41.93 ± 10.12	(-1.07 ± 4.51 *	44.13 ± 13.84	43.53 ± 14.03	(-0.69 ± 4.16
Gynoid Fat Mass %	33.75 ± 6.86	32.46 ± 6.83	(-1.25 ± 2.23 *	44.7 ± 7.88	43.86 ± 7.93	(-0.86 ± 2.40 *
Android/gynoid	1.28 ± 0.23	1.29 ± 0.23	0.14 ± 0.12	0.97 ± 0.23	0.97 ± 0.25	0.00026 ± 0.08
Percentile of Fat for age and sex	86.82 ± 22.98	83.67 ± 25.48	(-3.15 ± 9.48 *	67.72 ± 24.41	66.38 ± 30.44	(-1.34 ± 9.60

Data presented as mean ± SD. * P < 0.05 between delta changes between sex. † P < 0.05 between means of before and after among same sex.

1517 Board #279 May 30 10:30 AM - 12:00 PM A Novel 4 Pillar® Model Of Exercise Delivery Reduces Cardiovascular Risk Factors In Cardiac Patients

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(No relevant relationships reported)

PURPOSE: Cardiovascular disease (CVD) accounts for an estimated 31% of deaths worldwide (WHO, 2017). Current strategies to manage CVD include medical therapy and invasive procedures, with cardiac rehabilitation (CR) offered as a secondary treatment. According to the UK National Audit of CR (2017) only 51% of referred patients commence a programme, which lasts a median of 9 weeks. In addition, the current outcomes from CR are underwhelming and research has found it is not yet effective at reducing the risk of MI or revascularization and all-cause mortality (Cochrane review, 2016). The current study investigates the effectiveness of an alternative approach to CR using a novel 4 Pillar model of exercise delivery and nutritional guidance, on reducing key modifiable risk factors in a cardiac population. **METHODS:** 120 patients (4 MI, 24 MI + PCI, 7 MI + CABG, 15 CABG, 48 PCI, 27 Valve Surgery) (109M, 11F), aged 56.5 ± 10.8 years, completed a 12-week cardiac rehabilitation programme at CP+R. This involved twice-weekly supervised resistance sessions reaching overload, twice-weekly aerobic training within a prescribed heart rate zone, on-going step-count monitoring and nutritional guidance. The programme was led by a clinical exercise specialist and overseen by a clinical nurse. All patients underwent pre and post physiological and psychological measures including systolic (SBP) and diastolic (DBP) blood pressure, body mass (BM) body fat percentage (BF%), cardio-respiratory fitness (predicted VO₂ peak), hospital anxiety and depression (HAD) and exercise confidence (Ex Con). **RESULTS:** 95% of patients completed the full 12 weeks CR programme. There were significant reductions in SBP 8.6 ± 12.6 mmHg, DBP 6.3 ± 9.0 mmHg, BM 2.3 ± 3.2 kg and BF% 1.2 ± 2.3 %. A significant increase in predicted VO₂ peak 5.5 ± 7.4 ml/kg/min and significant improvements in HAD 16.6 ± 56.1 % and Ex Con 17.0 ± 16.4 % (all P < 0.01). **CONCLUSIONS:** This novel exercise and nutrition programme incorporating a 4 Pillar model significantly reduced SBP, DBP, BM, BF and increased predicted VO₂ peak in cardiac patients. This could provide a blueprint for an achievable and effective application of lifestyle intervention following primary care that should be routinely offered to individuals to reduce further risk and improve quality of life.

1518 Board #280 May 30 10:30 AM - 12:00 PM The Inorganic Nitrate For eXercise In Heart Failure (INIX-HF) Trial: Rationale, Design, And Preliminary Data

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Peak oxygen uptake (VO₂ peak) and muscle contractile function are both impaired in patients with heart failure with reduced ejection fraction (HFrEF), with these deficits significantly contributing to the diminished quality of life and possibly even early mortality of such individuals. In previous pilot studies, however, we have reported that these deleterious changes can be ameliorated by acute ingestion of nitrate (NO₃⁻), which *in vivo* can be converted to nitric oxide (NO) via the enterosalivary NO₃⁻ → nitrite (NO₂⁻) → NO pathway.

PURPOSE Based on these studies, the INIX-HF trial is a proposed multi-center (i.e., 8 site), randomized control trial of the effects of acute (i.e., single dose) and chronic (i.e., 2 wk) dietary NO₃⁻ supplementation (in the form of KNO₃) on VO₂ peak and muscle contractility in patients with HFrEF. We are presently performing the work that is necessary and sufficient to set up this trial, including determining the optimal dose of KNO₃ to utilize.

METHODS Using a double-blind, crossover design, six patients with HFrEF (5 men, 1 woman; age = 49 ± 4 y; EF = 32 ± 3%) were studied 2-3 h after acute ingestion of either 10 or 20 mmol KNO₃. On each occasion, VO₂ peak was measured during an incremental treadmill exercise test (modified Naughton protocol) and muscle function was determined using isokinetic dynamometry.

RESULTS The increase in plasma NO₃⁻ was greater following ingestion of 20 vs. 10 mmol KNO₃ (Δ = 430 ± 51 vs. 218 ± 19 μmol/L; P = 0.002). However, plasma NO₃⁻ increased to a similar degree in both trials (Δ = 0.219 ± 0.078 vs. 0.169 ± 0.044 μmol/L; P = 0.67). Presumably as a result, VO₂ peak did not differ between treatments (i.e., 18.0 ± 1.5 vs. 17.7 ± 1.3 mL·min⁻¹·kg⁻¹; P = 0.74). There was also no difference in maximal knee extensor power (4.52 ± 0.56 vs. 4.25 ± 0.59 W/kg; P = 0.69) across trials. 27% of subjects experienced moderate-to-severe nausea and/or vomited after ingesting the higher dose KNO₃, vs. only 9% after the lower dose.

CONCLUSION There was no difference in the efficacy of 10 vs. 20 mmol KNO₃ in influencing VO₂ peak or muscle power in patients with HFrEF. The higher dose, however, was associated with a greater frequency of gastrointestinal distress. Based on these preliminary data, it appears that 10 mmol KNO₃ is the preferred dose for a larger, multicenter trial.

Supported by award R34HL138253 from the NHLBI

1519 Board #281 May 30 10:30 AM - 12:00 PM Body Mass Index and Exercise Performance in Patients with Single Ventricle Fontan Circulation

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Single ventricle physiology is the most devastating of the congenital heart diseases affecting nearly 5000 children annually. Staged surgical palliation that concludes with the Fontan surgery results in elimination of the pulmonary pump, increased venous pressures, and a decreased exercise tolerance. Body mass index (BMI) is associated with exercise performance in the healthy populations but its utility as a correlate to exercise performance in the Fontan population has not been explored. **PURPOSE:** Assess the utility of BMI as a predictor of exercise performance in Fontan patients. **METHODS:** A review of Fontan patients below 20 years of age who performed exercise testing at the Children's Hospital of Wisconsin was performed (n = 397). Age, gender, BMI, as well as exercise time (EXTM), VO₂ and HR were assessed. Maximal efforts were verified by a respiratory quotient (RQ) greater than 1.05. Mean and standard deviation were obtained for BMI at each age category. Correlations between BMI and EXTM were determined. **RESULTS:** Fontan patient's BMIs fall on average near the 50th percentile, consistent with normal growth across early lifespan. BMI did not predict EXTM in this patient population. Sub-analysis of patients that fell below the 5th or above the 85th percentile resulted in no prediction of EXTM. **CONCLUSION:** The determinants of exercise limitations of patients having undergone Fontan palliation are multi-factorial and complex. Our findings suggest that BMI may not be a sensitive marker in patients with complex congenital heart disease. The inability of BMI as a singular measure may not account for the diminished muscle size or function that may result from chronic states of hypoxia or altered cardiovascular physiology resulting in decreased EXTM. These results warrant further investigation into potential peripheral factors of exercise limitations not yet identified in this population of patients.

Age (yrs)	Gender	N	BMI (SD)	BMI Range	EXTM min (SD)	Correlation
4-6	M	12	15.1 (1.4)	13.6-18.3	9.4 (1.6)	-0.26
	F	11	15.4 (1.0)	14.2-16.7	8.6 (1.1)	-0.10
7-8	M	24	16.1 (1.6)	14.1-20.5	10.8 (2.2)	0.11
	F	26	15.8 (1.6)	13.2-23.8	10.1 (1.9)	-0.02
9-10	M	37	17.8 (4.2)	13.6-28.5	10.9 (2.2)	-0.34
	F	14	17.0 (2.8)	13.2-23.8	10.4 (1.2)	0.10
11-12	M	49	18.3 (3.9)	13.5-32.9	11.4 (1.8)	-0.35
	F	26	17.4 (3.0)	13.8-26.1	9.9 (1.9)	0.05
13-14	M	34	19.1 (3.8)	14.6-35.5	11.7 (1.8)	-0.23
	F	26	21.0 (3.3)	14.0-27.4	9.8 (2.2)	0.03
15-16	M	36	21.1 (5.8)	15.7-39.6	10.3 (2.5)	-0.26
	F	26	21.2 (4.3)	13.4-28.6	9.0 (2.3)	-0.27
17-18	M	37	21.6 (4.5)	15.9-38.3	10.8 (2.2)	-0.56
	F	14	24.3 (6.3)	15.3-34.7	9.0 (2.4)	-0.50
19-20	M	17	23.4 (3.6)	17.1-28.9	10.7 (1.3)	-0.08
	F	8	25.9 (5.1)	20.0-34.6	9.4 (1.8)	-0.56

1520 Board #282 May 30 10:30 AM - 12:00 PM
Desmin is Improved in the Gastrocnemius of Patients with Peripheral Artery Disease after Revascularization Interventions

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Patients with peripheral artery disease (PAD) develop a myopathy in their ischemic limbs which is characterized by myofiber degeneration, mitochondrial dysfunction and impaired leg function. Degenerated myofibers have cytoskeletal abnormalities the best described of which is a disorganized accumulation of desmin filaments.

Purpose: We hypothesized that the levels and organization of desmin in the myofibers of the gastrocnemius of PAD patients improve after revascularization and correlate with increases in mitochondrial respiration and calf muscle strength. **Methods:** Gastrocnemius biopsies were collected from 32 PAD patients (61.6 ± 5.2 yrs, 31.0 ± 9.0 kg/m²) before and six months after revascularization. Accumulation and organization of desmin protein in myofibers were determined by quantitative fluorescence microscopy and desmin gene transcripts were quantified by rtPCR of RNA in biopsy homogenates. The effects of revascularization on these parameters and their association with ischemic window, mitochondrial function determined by respirometry, and calf muscle strength determined by isokinetic testing with the Biodex system were evaluated. Data were analyzed in SPSS 21 using paired-t test and Pearson correlation with a level of significance at $p < 0.05$. **Results:** Revascularization reduced the abnormal accumulation of disorganized desmin protein and gene transcripts in the PAD gastrocnemius. The ischemic window ($\Delta = 529$ mm Hg x min; $p < 0.05$), myofiber morphology ($\Delta = 657 \mu^2$; $p < 0.05$), mitochondrial respiration (Δ ETC I = 12.3 ± 22 and ETC II = 21.6 ± 33 O₂ · min⁻¹ · unit · CS activity⁻¹; $p < 0.05$) and calf muscle strength ($\Delta = 8.33 \pm 19$ N*min) were significantly improved after revascularization. After revascularization, the decreased desmin expression was associated with a more structured appearance of the protein, suggesting a return to the normally filamentous structure. These changes in desmin correlated with improved mitochondrial function ($r = -0.406$; $p < 0.05$) and increased calf muscle strength ($r = -0.313$; $p < 0.05$). **Conclusions:** Revascularization operations improve the levels and organization of the desmin filaments in the gastrocnemius of patients with PAD and these changes correlate with improved mitochondrial function and calf muscle strength.

1521 Board #283 May 30 10:30 AM - 12:00 PM
Metabolomic Profiling of Amino Acid Metabolism in Peripheral Artery Disease Patients

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The spectrum of symptoms of peripheral artery disease (PAD) is classified according to the Fontaine classification. Patients presenting with intermittent claudication are classified in Stage II, and in the latest stages of PAD referred to as critical limb ischemia (CLI), patients exhibit rest pain with or without ulcers and gangrene. Although systemic risk factors for PAD have been established, an omics approach may represent an innovative method to comprehensively investigate the molecular basis of PAD pathogenesis. **Purpose:** To determine the metabolomics profile of amino

acid metabolism of patients with PAD and identify changes as the disease progresses.

METHODS: Blood samples were acquired from 24 Stage II PAD patients (PAD-II: 62.1 ± 6.9 yrs), 24 CLI patients (CLI: 68.2 ± 9.9 yrs), and 26 healthy controls (HC: 63.2 ± 7.4 yrs). For targeted metabolomic analysis to identify and quantify amino acid metabolite concentrations, serum was extracted, and samples were measured using the AbsoluteIDQ p400 kit, and an Orbitrap mass spectrometer coupled to an UltiMate 3000 Rapid Separation Quaternary high performance liquid chromatography (HPLC) system. To examine differences between groups, one-way ANOVA was carried out, followed by Tukey's test for post-hoc analysis. **RESULTS:** Relative to PAD-II and HC, CLI showed significantly lower content of alanine (HC: 296.5 ± 109.2 μ M, PAD-II: 361.2 ± 143.0 μ M, CLI: 247.4 ± 84.4 μ M; $p = 0.004$) arginine (HC: 106.8 ± 32.5 μ M, PAD-II: 114.7 ± 20.3 μ M, CLI: 94.2 ± 25.5 μ M; $p = 0.033$), glutamine (HC: 569.7 ± 82.8 μ M, PAD-II: 568.3 ± 93.2 μ M, CLI: 505.3 ± 118.9 μ M; $p = 0.043$), histidine (HC: 75.7 ± 10.8 μ M, PAD-II: 77.2 ± 12.6 μ M, CLI: 54.6 ± 16.4 μ M; $p < 0.001$), ornithine (HC: 68.5 ± 15.7 μ M, PAD-II: 61.3 ± 17.0 μ M, CLI: 54.6 ± 26.1 μ M; $p = 0.065$), proline (HC: 202.3 ± 54.2 μ M, PAD-II: 220.3 ± 63.7 μ M, CLI: 169.3 ± 54.5 μ M; $p = 0.011$), tryptophan (HC: 50.9 ± 13.9 μ M, PAD-II: 53.8 ± 17.9 μ M, CLI: 32.7 ± 10.9 μ M; $p < 0.001$), and tyrosine (HC: 62.7 ± 15.6 μ M, PAD-II: 58.3 ± 18.2 μ M, CLI: 47.2 ± 14.8 μ M; $p = 0.004$). **CONCLUSION:** The metabolic fingerprint of amino acid metabolites of CLI is considerably different from PAD-II and HC. Perturbations in amino acid metabolism may contribute to CLI pathology and may serve as a diagnostic/prognostic tool to alter the management of CLI.

C-46 Free Communication/Poster - Obesity

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

1522 Board #284 May 30 10:30 AM - 12:00 PM
Exercise Mitigates The Loss In Muscle Mass And Functionality In Obese Women Undergoing Bariatric Surgery

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INTRODUCTION: Bariatric surgery effectively reduces weight and some comorbidities in obese patients; however, surgery incurs in severe muscle waste and functionality impairments, warranting the investigation of therapeutic strategies to mitigate these outcomes. **PURPOSE:** To examine the effects of exercise training on vastus lateralis fiber cross-sectional area (fCSA), strength and functionality in women undergoing bariatric surgery. **METHODS:** Sixty-two obese women were randomly allocated to receive either bariatric surgery (RYGB: BMI = 47 ± 8) or bariatric surgery plus exercise training (RYGB+ET: BMI = 49 ± 7). Patients were assessed at baseline (PRE), three (POST3), and nine months (POST9) after surgery for fCSA, lower- and upper-limb 1RM, and timed-up-and-go (TUG) and timed-stands (TST) test. The 6-month exercise intervention started at POST3 for RYGB+ET, while RYGB followed standard care. **RESULTS:** Type I and II fCSA was decreased in both RYGB (-21 and -27%) and RYGB+ET (-22 and -27%) at POST3 (all $p < 0.0001$). RYGB+ET increased types I and II fCSA from POST3 to POST9 (23%, $p = 0.0053$ and 32%, $p = 0.0055$), whereas no changes were observed in RYGB (4% and 1%, respectively; both $p > 0.05$). Importantly, type I and II fCSA were significantly greater in RYGB+ET than in RYGB at POST9 (both $p = 0.0001$). Lower- (RYGB = -32% and RYGB+ET = -24%, both $p < 0.0001$) and upper-limb 1RM (RYGB = -26% and RYGB+ET = -29%, both $p < 0.0001$) were reduced at POST3. Exercise increased lower- and upper-limb strength (49%, $p < 0.0001$ and 11%, $p = 0.0024$, respectively). In contrast, no differences were observed in RYGB (1% and 4%, respectively; both $p > 0.05$). Additionally, lower-limb 1RM was significantly greater in RYGB+ET than in RYGB at POST9 ($p < 0.0001$). No effects of surgery were observed in either TUG or TST (all $p > 0.05$). RYGB+ET increased TUG and TST scores from POST3 to POST9 (11%, $p < 0.0001$ and 26%, $p < 0.0001$, respectively), while no significant differences were observed in RYGB (2% and 3%, respectively, both $p > 0.05$). TST were significantly greater in RYGB+ET than in RYGB at POST9 ($p < 0.0001$). **CONCLUSIONS:** Our data suggest that a 6-month exercise training program is effective in counteracting the loss of muscle mass, strength and functionality that occur after bariatric surgery. Clinicaltrials.gov: NCT02441361

- 1523** Board #285 May 30 10:30 AM - 12:00 PM
The Role of Physical Activity on Abdominal Fat Patterning in Pre and Post-Menopausal Women
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Changes in the hormonal milieu with menopause are associated with increases in both total body fat and abdominal fat storage (AFS), both of which are related to an adverse metabolic profile and increased cardiovascular disease risk. Physical activity (PA) is a common intervention to ameliorate adipose fat accumulation during all life-stages.

PURPOSE: To examine differences in the protective effect of physical activity on total adiposity and fat patterning in pre and post-menopausal women.

METHODS: A total of 1018 women (pre-menopausal 425; post-menopausal 593) participated in the study. Each patient completed anthropometric measurements and a physical activity survey using the HealthSnap platform, which encompasses a streamlined health evaluation with lifestyle recommendations. Patients were stratified by age to predict menopausal status (pre-menopausal <35 yrs; post-menopausal >45 yrs). BMI was computed as kg/m² and AFS was determined using a waist-to-hip ratio above 0.85. PA was defined as MET-minutes equivalent to >75 minutes of vigorous activity, or >150 minutes of moderate activity, per week.

RESULTS: As expected, in both groups of pre and post-menopausal women, a significant association was observed between PA and BMI (RR=1.8, CI: 1.24-2.70 and RR = 2.18, CI: 1.67-2.80; p<0.001, respectively). In contrast, PA was only associated with AFS patterning in post-menopausal (RR=1.45, CI: 1.24-1.70; p<0.001) but not pre-menopausal women (RR= 1.034, CI: 0.83-1.30; p=0.74).

CONCLUSIONS: PA is protective against BMI in both pre and post-menopausal women. However, PA appears to be protective against the development of AFS in post-menopausal women, but not pre-menopausal women. To our knowledge, this is the first study to show a dichotomous relationship between PA and an AFS patterns between two life stages in women. These findings suggest that exercise is an effective therapeutic intervention to prevent or reduce abdominal fat deposition and its associated health consequences. These adverse health risks associated with endocrine changes in post-menopausal women may be ameliorated by meeting weekly PA recommendations.

- 1524** Board #286 May 30 10:30 AM - 12:00 PM
Obesity Further Impairs Neuromuscular and Functional Performance in Older Women
 Ryan M. Miller, Eduardo D.S. Freitas, Aaron D. Heishman, Japneet Kaur, Brady S. Brown, Michael G. Bembem, FACSM.
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(No relevant relationships reported)

INTRODUCTION: Age-related changes in body composition consists of reductions in total body lean body mass as well as a concomitant increase in total body fat through the 8th decade of life. Accompanied with these alterations in body composition is the gradual reduction in muscular strength. Obesity has been suggested to further impair neuromuscular performance; however, previous data often employs the body mass index (BMI) approach to classify obesity, whereas waist circumference (WC) may be a better indicator considering the redistribution of adiposity and spinal compression associated with natural aging. **PURPOSE:** The purpose of this study was to examine the differences in grip strength (HGS), jump power (JPOW), bench press one-repetition maximum (BPIRM), timed up and to (TUG) speed, and Berg Balance testing (BBT), in women between the ages of 50 to 70 years classified as having normal WC (≤89cm) or elevated WC (>90cm). Women with normal WC were considered non-obese and those with elevated WC were classified as obese. **METHODS:** Forty-one older women (non-obese: n = 21, obese: n = 19) completed two visits which consisted of visit 1 including consenting, questionnaires, and familiarization trials and visit 2 including body composition analysis via dual-energy X-ray absorptiometry (DXA) and performed BPIRM, VJ, JPOW, HGS, TUG, and BBT. Independent samples t-tests were used to determine mean differences between non-obese and obese women and Pearson's correlation coefficients examined the relationships between WC and performance measures. **RESULTS:** According to the physical activity scale for the elderly questionnaire, 38/41 women met the recommended amount of physical activity when stratified by age and sex. With the exception of the BBT (p=0.35), women classified as non-obese performed significantly better for the BPIRM (p=0.04, ES: 0.25), VJ (p<0.01, ES: 0.71), JPOW (p=0.02, ES: 0.54), HGS (p<0.001, ES: 1.3), and TUG (p<0.001, ES: 0.94). Additionally, WC was inversely, but significantly correlated with HGS (r = -0.51, p=0.01) and TUG (r = -0.48, p=0.01) values. **CONCLUSION:** These data suggest that neuromuscular and functional measures may be further reduced when accompanied with obesity in older women. Remarkably, these differences were still observed with no differences in physical activity.

- 1525** Board #287 May 30 10:30 AM - 12:00 PM
Limiting Factors In Cycling And Knee Extension Exercise In Obese Subjects
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In whole body exercise like cycling, maximal oxygen uptake is mainly limited by cardiac output rather than the oxygen extraction and utilization capacity of the muscle¹. When the exercise is performed with small muscle mass (like in single leg knee extension exercise), the muscle oxygen uptake should be not limited by central circulation, but from peripheral factors like peak muscle perfusion, oxygen diffusion or mitochondrial respiratory capacity². Obese patients (OB) compared with normal weight people (CTRL) have similar peak oxygen consumption (V'O₂ Peak), lower V'O₂ Peak for 1 Kg of fat free mass and lower peak work rate in Cycling Exercise³. On the other hands Obese show greater isometric force and hypertrophy³. **PURPOSE:** In the present study, we investigated if maximal oxygen uptake is mainly limited by cardiac output rather than the capacity to oxygen extraction and utilization of the muscle in OB and CTRL subjects, during maximal incremental test on Cycle Ergometer (CE) and on single leg Knee Extension (KE) ergometer. **METHODS:** 15 OB (age 25±7 y; BMI 43±7 kg/m²) and 13 CTRL subjects (age 27±7 y; BMI 22±3 kg/m²) participated in this study. V'O₂ and Cardiac Output (CO) were measured during CE and KE. Maximal voluntary contraction (MVCs) of knee extensor muscle were performed before and immediately after the two incremental tests. **RESULTS:** Peak V'O₂ (mL min⁻¹) and CO (mL min⁻¹) were significantly higher (p<0.05) in CE than KE with no differences between OB and CTRL (V'O₂ CE: OB 2.68±0.68, CTRL 3.04±0.65; V'O₂ KE: OB 1.36±0.51, CTRL 1.15±0.26) (CO CE: OB 20.81±5.42, CTRL 20.61±4.04; CO KE: OB 15.97±5.89, CTRL 12.00±2.45). Maximal work rate (W) was lower in OB than CTRL (191±38 vs 226±39, p<0.05) in CE but similar between two groups in KE (62±13 vs 61±14, p>0.05). The MVC reduction after CE was lower in OB compared with CTRL (14±13 vs 26%±16%, p<0.05), while in KE was the same (32±11 vs 32%±18%). **CONCLUSIONS:** The limiting factor during KE should reside in the muscle for both groups, instead the performance during CE might be limited due to central mechanisms. This is particularly true for OB where cardio respiratory system might have played a role in determining the cessation of CE as it can be evinced by a lower MVC reduction at exhaustion compared to the one produced after KE. Supported by Municipalities of Gemona del Friuli (Udine, Italy)

- 1526** Board #288 May 30 10:30 AM - 12:00 PM
12-week of Tai Chi Training Reduces Visceral Fat in Centrally Obese Older Adults
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Excess visceral fat is associated with metabolic abnormality and increased susceptibility to diabetes and cardiovascular diseases. It is known that visceral fat is reduced with strenuous physical exercise. However, older adults (age ≥ 50) may prefer to manage their visceral fat with alternate exercise modalities. **PURPOSE:** To examine the effectiveness of Tai Chi, a popular mind-body exercise among older adults, in the reduction of visceral fat in centrally obese older adults. **METHODS:** This randomized controlled trial was conducted from March to August, 2018. In this three-arm, single-blinded randomized controlled trial, 102 Chinese adults aged ≥50 years with central obesity (male with waist circumference (WC) ≥ 90 cm / female ≥ 80 cm) were randomly assigned to Control (n= 33; received no intervention), Fitness (n= 35; received 12-week conventional exercise intervention) or Tai Chi groups (n= 34; received 12-week Tai Chi intervention). The primary outcome was the determination of visceral fat mass by dual-energy x-ray absorptiometry at 12-week post-randomization, while the secondary endpoints were the risk factors of metabolic syndrome (i.e. WC, blood pressure, fasting blood glucose, high-density lipoprotein-cholesterol and triglyceride). Data were analyzed by Generalized linear model with baseline as covariate. Pairwise comparison was done by closed test procedure. **RESULTS:** Visceral fat was reduced by 1.6% and 4.1% in the Tai Chi and Fitness groups respectively whereas the control group manifested a 3.8% increase. A main effect of intervention was observed in visceral fat (P<0.001). The pairwise comparison shown that both the Tai Chi (P=0.001) and Fitness (P=0.022) groups exhibited lower visceral fat content compared with their control counterpart. A main effect of intervention was observed in waist circumference (P<0.013) and triglyceride (P<0.046). Pairwise comparisons showed that the waist circumference (P=0.011) and triglyceride level (P=0.043) were reduced significantly in response to Tai Chi intervention.

CONCLUSIONS: These data suggest that Tai Chi training reduces visceral fat, waist circumference and blood triglyceride.

Supported by Health and Medical Research Fund 12131841

1527 Board #289 May 30 10:30 AM - 12:00 PM

Functional Evaluation and VO₂-kinetics in Obese Patients Before and After Sleeve Gastrectomy

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(No relevant relationships reported)

Sleeve gastrectomy (SG) has become an important therapeutic option for patients with severe obesity, showing a positive impact on patients' comorbidities. Even though poor cardiorespiratory function is a powerful predictor of mortality, functional evaluation has been given little attention after SG.

PURPOSE

To investigate the effects of SG on functional capacity six months after surgery, with specific analysis of peripheral oxidative muscle metabolism by determination of VO₂-kinetics.

METHODS

In this longitudinal observational study 36 patients (age 44±11 years, 78% females) with severe obesity (BMI 43.95±5.67 kg/m²) were evaluated one month before (pre-SG) and six months after SG (post-SG). A maximal cardiopulmonary exercise test was performed on treadmill with an initial 5 min constant, moderate load exercise and a subsequent incremental Bruce protocol. VO₂-kinetics during constant load exercise were analyzed by mono-exponential function. Furthermore, muscle strength was evaluated by isometric handgrip strength test. Patients' physical activity level was assessed by the Global Physical Activity Questionnaire (GPAQ).

RESULTS

As expected, a significant weight loss (-31.14±9.45 kg, p<0.001) and a reduction of waist circumference (-15.35 cm, p<0.001) were observed post-SG, associated with improved exercise time (14.48±2.5 vs 16.90±2.15 min; p<0.001) and capacity (8.38±2.5 vs 10.66±2.08 METs; p<0.001). While the VO₂peak/kg was significantly increased, a reduction of the absolute VO₂peak and Oxygen Uptake Efficiency Slope (OUES) were shown after surgery (all p<0.001). Furthermore, the time-constant Tau (t) of the fundamental phase of VO₂-kinetics significantly worsened post-SG (37.71±12.20, vs 43.75±11.35 s; p<0.02). However, muscle strength remained unchanged in these patients (handgrip: 29.87±11.73 vs 28.91±10.83 kg; p=0.1), showing also an increased level of weekly physical activity post-SG (GPAQ, p<0.01).

CONCLUSIONS

Even though patients after SG improved functional capacity due to a significant weight loss, absolute aerobic capacity and VO₂-kinetics significantly worsened despite increased physical activity. The study findings thus suggest an impaired peripheral oxidative muscle metabolism post-SG without affecting patients' muscle strength.

1528 Board #290 May 30 10:30 AM - 12:00 PM

Athletic Obesity and Long-Term Health

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(No relevant relationships reported)

PURPOSE: Obesity in athletes is closely correlated with many comorbidities such as hypertension, dyslipidemia, osteoporosis, diabetes mellitus, left ventricular hypertrophy, and lower self-esteem; all of which can lead to decreased quality of life both during an athlete's career and after. It is the objective of this systematic review to compare the long and short-term health risks associated with athletes who are clinically overweight or obese.

METHODS: Studies were obtained using online databases such as PubMed, Google Scholar, and Scopus. Search terms included obese, obesity, athletes, body composition, health risk, anthropometry, adult, American Football, rugby, professional, athletes, BMI, female, women, overweight, BF%, body image, sumo wrestling, unhealthy, left ventricular hypertrophy, health, retired, and NFL. To be included in this review, articles needed to meet a list quality assessment.

RESULTS: Active collegiate and professional level athletes, regardless of their BMI, are shown to have healthier BF% than those of comparable BMI. These findings are consistent with linemen, rugby players, and lightweight sumo wrestlers. However, when comparing football players and non-athletes of comparable BMI it was concluded that linemen had an even greater risk for developing CVD and metabolic syndrome (metsyn) than non-athletes. Little information could be found on the effects of obesity among female athletes. Retired Athletes who were obese due to the nature of their professional sport and maintained obesity status were more likely to have

sustained cognitive impairment during their career and cardiovascular diseases (CVD). Furthermore, a significant increase in mortality due to CVD has been directly linked to athletes who retire from a career in professional football.

CONCLUSIONS: In conclusion, athletes that compete at a high level generally have a healthier body fat percentage (BF%) and cholesterol vitals than comparable non-athletic populations. However, due to their excessive amount of muscle mass, these athletes are susceptible to high BP and other cardiovascular risks putting them at greater risk for LVH. This is consistent with observations that athletes who maintain high BMI after their career will develop and sustain cardiovascular-related diseases and other severe health risks.

1529 Board #291 May 30 10:30 AM - 12:00 PM

Mechanical Assistance During Unloaded Pedaling Improves the Dynamic Range of the Metabolic Response in Obesity

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Reported Relationships: T. Popoola: Industry contracted research; MITSUBISHI ELECTRIC ENGINEERING Co.,LTD..

PURPOSE: Obese individuals have a greater oxygen uptake (VO₂) than lean individuals for a given work rate during cycling exercise due to higher resting metabolic rate and metabolic cost from lifting heavier legs against gravity. This can result in the majority of the total increase in VO₂ occurring early in the exercise test, resulting in short test duration and obscuring the gas exchange details. We hypothesized that mechanical assistance of pedaling early in exercise could reduce the initial increase in VO₂ of obese subjects, and increase the VO₂ range.

METHODS: 20 obese (O, BMI 40.2 ± 6.1 kg/m²) and 10 lean otherwise normal subjects (L, BMI 24.9 ± 2.2) were tested. Subjects performed 2 symptom-limited ramp incremental tests on a cycle ergometer capable of providing variable degrees of mechanical assistance to pedaling (Ergo-strength, Mitsubishi Electrical Engineering, Osaka, Japan). Ventilation and pulmonary gas exchange were measured breath by breath (Vyair, Yorba Linda, California). During warm up, in random order, the subjects performed either unmodified cycling (UM) or mechanical assistance (MC) to pedaling. After warm up, each subject performed a progressively increasing test to exhaustion.

RESULTS: The MC protocol resulted in a lower initial VO₂ compared to UM in 19 of 20 O subjects and 8 of 10 L subjects, with average differences of 165 +/- 125 ml/min (p < 0.00001) and 101 ml/min +/- 94 (p < 0.008) for O and L, respectively, by paired T-tests. Peak VO₂ did not differ systematically within subjects by protocols (p=NS).

All Values L/min except DVO ₂ /DWR: ml/min/W	VO ₂ atRest	Warm Up UM	Warm Up MC	DVO ₂ /DWR UM	DVO ₂ /DWR MC	Peak VO ₂ UM	Peak VO ₂ MC
Obese	0.352±0.07	0.706±0.20	0.541±0.17	10.3±1.4	11.2±1.1	2.006±0.56	1.974±0.56
Lean	0.290±0.05	0.501±0.01	0.400±0.08	9.3±1.7	9.64±1.5	2.897±0.92	2.267±0.66

CONCLUSIONS: Mechanical assisted cycling during the initial phase of an incremental exercise test was effective in modulating the initial increase in VO₂ with unloaded cycling, and increases the VO₂ testing range in obese and normal weight subjects. This may be a significant proportion of the entire response in a patient with exercise limitation, and therefore useful in exercise testing and training. Funding: MITSUBISHI ELECTRIC ENGINEERING Co.,LTD.

C-47 Free Communication/Poster - Pulmonary/Respiratory

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1530 Board #292 May 30 10:30 AM - 12:00 PM
Using Rhythmic Auditory Stimulation to Increase Cadence in Individuals with Chronic Obstructive Pulmonary Disease

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Rhythmic Auditory Stimulation (RAS) uses the physiologic effects of auditory rhythm to facilitate movements that are inherently rhythmic, such as walking. There is a strong sensorimotor connection between the brain and the motor system while walking to rhythmic cues that occurs without cognitive learning efforts.

PURPOSE: To determine if cadence and Six-Minute Walk Distance (6MWD) are increased while walking to RAS-tempo enhanced music as compared to walking to music-without tempo enhancement (MC) or no-music (NM) in individuals with Chronic Obstructive Pulmonary Disease (COPD). **METHODS:** Three 6-Minute Walk Tests (6MWT) were completed in random order under three conditions (RAS, MC, NM). Tempo for the MC walk was matched to the patient's usual cadence, which was determined by a one-minute manual step count. Cadence was measured manually for 60-seconds between minutes 1-2, 3-4, and 5-6 for all 6MWT conditions. The tempo of the music for the RAS walk was increased 5-10 beats per minute higher than usual cadence. **RESULTS:** Twenty-five older adults (age=71±5yr) with moderate to severe COPD (47±15.0% FEV₁ % predicted), with 56±27 years of smoking were enrolled. The mean usual cadence was 103±8 steps/min in one minute. When comparing RAS to NM, cadence was consistently significant at all minute intervals 1-2 (110vs105), 3-4 (110vs107), and 5-6 (110vs107) respectively. When comparing cadence of NM to MC, and RAS to MC no consistent significant increases were found. Participants matched their cadence to the elevated tempo of the RAS music during the entire 6MWT (110 ± 12 steps). Individuals walked 12m further during the 6MWT with RAS (463 ± 72 m) when compared to NM (451 ± 81 m); t (24) = -2.63, p=.015) or MC (451 ± 80 m); t (24) = -2.26, p=.033). **CONCLUSIONS:** Best method for prescribing cadence through music tempo in individuals with COPD has not been established. Individuals walked further and were able to match and sustain elevated cadence during the RAS walking condition. This observation may support the premise that beat perception mechanisms can be neurologically entrained. RAS music may be a useful tool in pulmonary rehabilitation to increase walking distance in individuals with COPD. Supported by RR&D, Veterans Administration

1531 Board #293 May 30 10:30 AM - 12:00 PM
Ventilatory Efficiency Among Patients With Pulmonary Hypertension With Varying Levels Of Adaptation To Exercise Training

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(No relevant relationships reported)

The 6-minute walk test (6MWT) is universally accepted as a measure of functional capacity in patients with pulmonary hypertension (PH). While aerobic exercise training (AET) has generally been shown to improve exercise tolerance and 6MWT distance in patients with PH, some patients have been observed to adapt differently to AET, with minimal or even negative changes in 6MWT distance being reported. Differences in patient characteristics and peak ventilatory efficiency to AET have not been characterized and compared in these subset of patients. **Purpose:** To determine differences in ventilatory efficiency, defined as peak ventilatory equivalents for O₂ uptake (VE/V_{O₂}), peak ventilatory equivalents for CO₂ output (VE/V_{CO₂}), end-tidal CO₂ (PETCO₂) and tidal volume (TV), in patients with high (HI, >42 meters), low (LI, 0-42 meters) and negative (NEG, <0 meters) change in 6MWT distance after AET. **Methods:** Subjects were 25 females (age 54±11 years; BMI 31±7 kg/m²) enrolled in the NIH Exercise Therapy for Advanced Lung Disease Trial. Participants completed 24-30 supervised treadmill walking exercise sessions, over 10 consecutive weeks, at a training intensity of 70% to 80% of heart rate reserve. The thrice-weekly sessions were 30-45 minutes in duration. A cardiopulmonary exercise test and 6MWT was completed before and after the 10-weeks of training. Ten of the 25 subjects were classified as HI (range = 47-143 meters), 11 were classified as LI (range = 4 - 37 meters) and 4 were classified as NEG (range = -17-53 meters). **Results:** After AET, peak values in VE/V_{O₂}

(p=0.02), VE/V_{CO₂} (p=0.002), PETCO₂ (p=0.016) and TV (p=0.016) were improved for the HI versus NEG group. Peak values for VE/V_{CO₂} (p=0.003) and TV (p=0.041) were improved for the LI versus NEG group. **Conclusion:** Previous studies suggest that reduced ventilatory efficiency (VE/V_{CO₂}) is associated with a poor prognostic outcome in patients with PH. To our knowledge this is the first study to look at changes in ventilatory efficiency after AET, specifically in HI, LI and NEG subsets. Findings from this study suggest that reduced ventilatory efficiency may also contribute to reduced functional capacity in patients with PH, contributing to the etiological basis for the association between 6MWD and mortality in these patients. Funding NIH IRP [1 Z01 CL060068-05 CC].

1532 Board #294 May 30 10:30 AM - 12:00 PM
Is The EVH Test Best For Diagnosing Exercise Induced Bronchoconstriction In Swimmers?

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Competitive swimmers have high rates of exercise induced bronchoconstriction (EIB), which may be associated with repeated exposure to chlorinated pool water. The eucapnic voluntary hyperpnea (EVH) test is often used in a laboratory setting to provoke a reduction in lung function associated with EIB. However, swimmers experience EIB symptoms in warm, humid and chlorinated environments. The relationship between EVH testing environment and the development of EIB from swim exercise is unclear.

PURPOSE: To compare the provoking effects of inspired air and high-intensity exercise in inducing EIB in swimmers to laboratory-based EVH methods.

METHODS: 15 collegiate swimmers (n=5 male, n=10 female; 21±2 years) completed three days of testing in random order. On day one, subjects performed an EVH test in a laboratory (EVH-L). On a separate day, swimmers performed a modified EVH test, while breathing chlorinated pool air (EVH-Cl). On a third day subjects completed a swimming challenge, performing consecutive 200 and 400 m freestyle efforts at 85 % of their season's best time (Average achieved 200 and 400 m time; 2:18.52±7.79 and 4:55.22±20.38, respectively) and age predicted heart rate maximum. Lung function was measured at baseline, as well as 3, 5, 10, 15, and 20 minutes following EVH testing and swim exercise. **RESULTS:** Greatest achieved fall index of forced expired volume in one second (FEV₁) was significantly different between all three methods (p<0.05). EVH-L elicited a -9.7±6.4 % fall compared to the EVH-Cl test, -6.6±9.2 % (p>0.05) and swim effort, -3.0±7.5 % (p<0.05). A greater Pearson's correlation in FEV₁ fall index between EVH-L vs. EVH-Cl (r=0.78, p<0.05) was seen compared to EVH-L vs. Swimming (r=0.20, p>0.05) and EVH-Cl vs. Swimming (r=0.50, p>0.05). A greater reduction in forced expired flow between 25 and 75 % lung volume (FEF₂₅₋₇₅) was induced by the EVH-L (-16.6±8.7 %) compared to the EVH-Cl (-8.2±14.9 %) (p>0.05) and swimming test (-1.3±15.6 %) (p<0.05).

CONCLUSION: The EVH-L elicits a greater bronchoconstrictive response, compared to EVH-Cl and swimming. There is little relationship in reduction of lung function between the EVH-L test and swimming.

Funding: Natural Sciences and Engineering Research Council of Canada

1533 Board #295 May 30 10:30 AM - 12:00 PM
Red Blood Cell Deformability is an Independent Predictor of Exertional Dyspnea in Deployed Veterans

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(No relevant relationships reported)

PURPOSE:

Respiratory symptoms on exertion that are disproportionate to cardiopulmonary function represent a challenging clinical scenario that has been increasing in frequency among Iraq and Afghanistan veterans following their deployment. Among their exposures were burning trash, dust, sand, and air pollution. We hypothesized that impairment in oxygen delivery, due to impaired red blood cell (RBC) deformability, may contribute to reports of dyspnea in this population.

METHODS:

We recruited 18 symptomatic Iraq and Afghanistan veterans (34.1±7.0 yrs; 2 female) and 13 asymptomatic controls (n = 13; 34.1±8.9 yrs; 3 female) to participate in this study. All participants completed spirometry and maximal cardiopulmonary exercise testing. Blood samples were obtained before and immediately post-exercise for the determination of RBC deformability, calculated as cell deformation at infinite stress (EI_{MAX}), by laser diffraction analysis using an ektacytometer. Dyspnea was assessed at

peak exercise via the Borg breathlessness scale. We examined the association between EI_{MAX} (rest and peak exercise) and peak dyspnea, adjusting for age, body mass index, smoking and airway obstruction (FEV_1/FVC).

RESULTS:

Demographics were similar between groups, but spirometry was reduced in veterans (veterans vs. controls; FEV_1 : 95.2±18.3 vs. 114.3±14.7% predicted; FVC: 101.0±13.6 vs. 116.0±13.3% predicted; $p < 0.01$, Hedges' $g = 1.11 - 1.17$). Peak exercise capacity was similar (VO_2/kg : 34.9±8.9 vs. 36.1±10.5 ml·kg⁻¹·min⁻¹), but veterans endorsed greater dyspnea (5.6±1.8 vs. 3.6±1.0 Borg units; $p = 0.001$, $g = 1.32$). EI_{MAX} was similar at rest (0.59±0.04 vs. 0.57±0.02; $p = 0.08$, $g = 0.67$), but not at peak exercise (0.59±0.04 vs. 0.56±0.03, $p = 0.01$, $g = 0.83$). In our adjusted model, larger EI_{MAX} at rest ($\beta = 22.8$, 95% CI 4.7, 40.9, $p = 0.016$) and immediately post-exercise ($\beta = 19.2$, 95% CI 3.1, 35.3, $p = 0.016$) were associated with greater dyspnea at peak exercise.

CONCLUSION:

In our sample, increased RBC deformability measured at rest and immediately post-exercise was independently associated with exertional dyspnea. Future studies are necessary to confirm these findings and investigate mechanisms of altered RBC rheology in the contexts of dyspnea.

Funding: VA RR&D (1I21RX001079; MJF)

1534 Board #296 May 30 10:30 AM - 12:00 PM

Respiratory Resistance And Reactance (FOT) Classifications In Chronic Obstructive Pulmonary Disease And Healthy Control Patients.

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(No relevant relationships reported)

Forced oscillation technique (FOT) is a method of measuring lung obstruction of central airways (resistance, Rrs) and elastic properties/distal airway ventilation (reactance, Xrs), which is different from spirometry since it is performed during tidal breathing, utilizing various sound frequencies (5, 11, and 19 Hz) to separate out regions of the lungs and isolates breathing cycles (inspiration and expiration). **PURPOSE:** To evaluate FOT metrics of lung mechanics and obstruction within a chronic obstructive pulmonary disease (COPD) population based upon severity (mild [MLD], moderate [MOD], and severe [SEV]). **METHODS:** Seventeen COPD, and fourteen healthy (H) patients (age: 69.5±5.8 vs. 49.3±17.6 yr.*; height: 169.9±11.3 vs. 163.7±18.1 cm; weight: 77.8±18.8 vs. 83.3±32.4 kg, COPD vs. H respectively, * $p < 0.05$) completed spirometry and FOT measurements. COPD participants completed the St. George Respiratory Questionnaire (SGRQ) and severity was classified based on GOLD spirometry (MLD, MOD, and SEV). **RESULTS:** In those with MOD&SEV COPD, total Rrs and Xrs at all frequencies, except expiratory R_{11} , were significantly different ($p < 0.05$) from H, but only R_{19} was different for MLD participants. R_5 : 3.9±1.1 v 3.1±1.3, 5.9±2.5*cmH₂O/L/s; X_5 : -1.1±0.9, -1.4±0.6, -4.8±3.2*cmH₂O/L/s; R_{19} : 0.3±0.07, 2.4±0.9*, 3.3±1.0*cmH₂O/L/s; X_{19} : 0.4±0.03, -0.2±0.7, -1.1±1.0*cmH₂O/L/s, for H, MLD, and MOD&SEV groups respectively, * $p < 0.05$ vs. H. No significant difference ($p > 0.05$) between COPD severities were shown for Rrs or Xrs at 5, 11, or 19 Hz. SGRQ scores were not different based on spirometric severity (M: 44.6±18.6; MOD: 42.9±15.2; S: 43.8±11.8). **CONCLUSION:** FOT metrics made distinctions between COPD MOD&SEV and H, as well as MLD and H for mixed respiratory tract obstruction. However, no distinctions between COPD severities could be made. Obstruction increased with severity highlighting that more heterogeneous total airway obstruction (frequency dependent) is observed with mild severity patients, followed by more homogeneous obstruction as severity increased. Elastic properties and efficiency of ventilation decreased (became more negative) with increased COPD severity as airflow to and from distal airways become more limited due to hyperinflation from loss of alveolar support and elastic recoil.

1535 Board #297 May 30 10:30 AM - 12:00 PM
Asthma and EIB Testing Among Collegiate Athletes in Indoor Winter Sports

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(No relevant relationships reported)

Pulmonary conditions, such as asthma and exercise-induced bronchoconstriction (EIB), influence airway diameter, and these conditions may be impacted by seasonal patterns. Systematic, team-wide screening among collegiate athletes is infrequent, and evidence shows a range of prevalence rates. **PURPOSE:** The goal of the current study was to investigate prevalence of asthma, undiagnosed asthma, and EIB in collegiate athletes practicing and performing in indoor arenas for winter sports. **METHODS:** Data collection occurred between mid- and late-fall. The testing protocol began with

baseline spirometry; athletes expired maximally and were encouraged to achieve a 6-second plateau. Values were taken in duplicate. Subjects failing to achieve a forced expiratory volume in one second (FEV_1) at or over 70% of a predicted value were noted and removed. Athletes followed with performance of a bout of exercise intensifying to 80-90% of predicted maximal heart rate. Confirmation of appropriate exercise intensity was verified with maximal ventilation values ($35 \times FEV_1 \times 0.5$ and $35 \times FEV_1 \times 0.6$). Athletes continued at target heart rate for 4 minutes. Athletes repeated maximal spirometry efforts post-exercise at 2, 5, 10, 15, and 20 minutes. Values were reviewed by a registered respiratory therapist, and a drop in $FEV_1 > 10\%$ from baseline was considered positive for EIB. **RESULTS:** Sixty athletes (wrestling or basketball, males=48, females=12) volunteered for testing. Four athletes confirmed previous diagnosis of asthma. Among the 56 tested, 54 obtained a minimum of 70% of predicted FEV_1 at pre-test (2 wrestlers were noted and removed). Among the 54 undergoing the exercise protocol, 11 (of 54=20.4%) tested positive for EIB as they failed to maintain 90% of their pre-exercise FEV_1 (mean drop 14.2±2.3%) at one of the post-exercise time points. In 3 subjects, one from each sport, results were not conclusive. **CONCLUSIONS:** Evidence of reduced pulmonary function was present in athletes across the sports spectrum. Over 20% of the athletes exemplified undiagnosed asthma or underlying EIB, which may have been exacerbated by seasonal patterns. Awareness and systematic testing of these pulmonary conditions in collegiate athletes would support health and potentially effect performance outcomes.

1536 Board #298 May 30 10:30 AM - 12:00 PM
Echogenicity Is Related to Skeletal Muscle Strength in Patients with Acute Respiratory Failure

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Reported Relationships: **M.J. Berry:** Industry contracted research; Isagenix, LLC.

Patients with acute respiratory failure (ARF) show changes in skeletal muscle structure and strength. **PURPOSE:** The purpose of this study was to examine the relationship between muscle thickness (MT), echogenicity, and strength in patients with ARF. **METHODS:** Thirteen (6 females/7 males) patients with ARF participated in the study. Knee extensor (KE) strength was measured via a handheld dynamometer and quadriceps images were obtained via ultrasonography at hospital discharge. The ultrasound images were used to obtain MT and both mean and standard deviation echogenicity of the rectus femoris, vastus lateralis (VL), and vastus medialis. Partial correlations, controlling for age BMI and fluid intake, were used to describe the relationships among KE strength and echogenicity and MT. **RESULTS:** KE strength and vastus lateralis standard deviation echogenicity were significantly correlated when controlling for age, BMI and fluid intake ($r = .69$, $P = .029$). Mean ± standard deviation knee extensor strength and vastus lateralis standard deviation echogenicity were 19.1 ± 8.0 kg and 19.8 ± 5.4 units. No other correlations between strength and ultrasound measures were found to be significant. **CONCLUSION:** These results show skeletal muscle echogenicity to be significantly correlated with skeletal muscle strength in patients with ARF. As such, it may be useful in identifying muscle weakness in these patients when they are unable or unwilling to perform voluntary strength testing.

1537 Board #299 May 30 10:30 AM - 12:00 PM
Participation In Norseman Extreme Triathlon; The Effect On Lung Function And Oxygen Saturation

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(No relevant relationships reported)

PURPOSE: Primary: To examine changes in lung function, forced expiratory volume in one second (FEV_1) and forced vital capacity (FVC), and oxygen saturation (SpO_2) from before to after participation in Norseman extreme triathlon, consisting of 3.8 km open water swim, 180 km cycling and 42 km running. Secondary: To assess possible relationships between the physiological variables and respiratory symptoms and training volume. **METHODS:** In a quasi-experimental non-controlled study, 57 recreational triathletes (45 males and 12 females) aged 40.3 (9.0) years (mean (SD)) measured lung function by maximal expiratory flow volume loops (FEV_1 and FVC) and SpO_2 by pulse oximetry the day before the race, 8-10 minutes after finishing the race and the day after the race. Weekly training volume and respiratory symptoms were recorded with a modified AQUA-questionnaire at baseline. Anova for repeated measures was used to test for differences in lung function and SpO_2 and statistical significance was accepted at 0.05 level. The study was approved by the Regional Ethical Committee.

RESULTS: Twenty-six participants (46%) developed exercise-induced bronchoconstriction (EIB) defined as $\geq 10\%$ reduction in FEV_1 from baseline immediately after the race and 16 participants (28%) had still EIB the day after the race. FVC and FEV_1 were significantly reduced immediately after the race (mean: 8.9% and 11.8% respectively) and the day after the race (mean: 6.2% and 7.5% respectively). Thirty-five participants (61%) developed mild to moderate exercise induced arterial hypoxemia (EIAH) defined as $\geq 4\%$ reduction in SpO_2 from baseline. Further, oxygen saturation was significantly reduced immediately after the race (mean: 4.6%) and the day after the race (mean: 2.4%), respectively. There were no significant correlation between changes in lung function and SpO_2 , respiratory symptoms or training volume ($p > 0.05$). **CONCLUSIONS:** Our results demonstrated that 46% of the participants developed EIB and 61% developed EIAH after Norseman extreme triathlon. The reduction in lung function may be due to fatigue in the respiratory muscles. Further investigation is needed to confirm our results as well as examine the mechanisms in age group triathletes.

C-48 Exercise is Medicine®/Poster - EIM - Cancer, Diabetes, Metabolic Syndrome, Obesity

Thursday, May 30, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

1538 Board #300 May 30 10:30 AM - 12:00 PM

Resistance-training Induced Regional Body Composition Changes In Females With Obesity Vs. Normal Weight Obesity

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Title: Resistance-training induced regional body composition changes in females with obesity vs. normal weight obesity

Selvaraj, BS, Mahan, C., Kloiber, S., Givan, A., Clements, M., Sanguinette, D., Larumbe-Zabala, E., Fernandez-del-Valle M.

Purpose: The aim of this study was to compare the effects of resistance training on regional body composition and fat loss, including upper and lower limbs and trunk, in females with obesity and normal weight obesity (NWO).

Methods: A total of 12 young females with obesity (BMI: 34.1 ± 3.3 ; percentage body fat [%BF]: 49.2 ± 2.9) and 15 with NWO (BMI: 22.2 ± 1.8 ; %BF: 35.1 ± 4.5) were randomized into control (obesity n=6, NWO n=8) and resistance training (obesity n=6, NWO n=7). Dual-energy X-ray absorptiometry (DXA) and a maximal strength test were performed before and after a 3-week intervention. Percent change (%Δ) of left and right trunk, arms, legs (LTfat, RTfat, LAfat, RAfat, LLfat and RLfat, respectively) and body fat were recorded. Training consisted of 3 sessions/week for 3 weeks, and 3 sets of 10 repetitions including 7 exercises that targeted major muscle groups. Participants were trained at 80% of their 1-repetition maximum.

Results: Non-parametric tests showed a statistically significant difference in %ΔLTfat ($-1.05 \pm 3.99\%$, $p=0.032$) and a trend in %ΔBF ($-1.73 \pm 1.93\%$, $P=0.056$) in the resistance training obesity group when compared to control. No statistically significant changes were found in NWO group.

Conclusion: Resistance training has shown to induce significant changes in the obesity group by reducing LTfat content. However, no changes were detected in the NWO group. Future research should include larger sample size to facilitate the detection of regional body composition changes and to help understand the differential impact of resistance training in women with obesity and NWO.

1539 Board #301 May 30 10:30 AM - 12:00 PM
Selective Effectiveness Of 10wk-exercise Protocols On Mets Reduction

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(No relevant relationships reported)

MetS is recognized as a pervasive condition whose abnormalities result from a mismatch between contemporary environment and our ancient tailored genome. Hence, diet and physical exercise are considered the pillars in the implementation of effective strategies against MetS.

PURPOSE: The responses of MetS subjects to different types of physical exercises was investigated in a dynamic cohort study ("Move for Health" program) based on spontaneous demand for healthy lifestyle with supervised exercises and dietary counseling.

METHODS: Demographic, socio-economic and physical activity was recorded from IPAQ (version 8) and dietary quality (HEI) and food intake, from a 24h questionnaire recall. Anthropometry and fast-blood analysis were used for MetS diagnosis (NCEP-ATP III). After clinical selection and baseline assessments they were spontaneously assigned to structured protocols involving supervised exercises of strength (Pac, n=43) isolated or combined with endurance (walking) exercises (PMi, n=146), hydro-gymnastics (PHy, n=50) and treadmill high-intensity exercises (PHit, n=63), applied during 10 weeks. Nutritional counseling was conducted weekly. Protocols were compared statistically using SAS vs 9.3 for $p=0.05$.

RESULTS: Sample of 55.5 ± 108 yrs old (n=302), predominantly female (88%), presented adequate physical activity (91%), cardio-respiratory fitness (63%) and strength (78%), referring themselves as in good health (67.8%). At baseline, groups were similar in anthropometry, fitness and MetS (averaging 48.7%). Altered components of MetS ranked from waist circumference (72.9%) to triglycerides (37.9%). After 10-wk of exercises, increased aerobic capacity was found in all groups and, strength only in Pac and PMi. MetS reduction averaged 16.9%, mainly and significantly in PHy (25.4%) and PMi (12.7%). Among the MetS components, a major decreasing to exercise protocols was found in hyperglycemia (20.6%) and hypertension (15.9%).

CONCLUSIONS: The reduction of MetS occurred in different types of physical exercises with higher responsiveness in PHy and PMi having hyperglycemia and hypertension as its most responsive components. Support CNPq and CAPES.

1540 Board #302 May 30 10:30 AM - 12:00 PM

Reason To Exercise In Diabetic Populations: Use Of Rapid-acting Insulin Predicts Falls In At-risk Patients

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(No relevant relationships reported)

Diabetes is present in 9.4% of American adults. Insulin is used in Type 1 and Type 2 cases, but without lifestyle change, it can hasten the progression of the disease. Limited data supports an association between diabetes and fall risk in older adults, with greater risk found among insulin-treated patients. Little is known about different insulin classes.

PURPOSE: To evaluate the effect of insulin classes on incidence of falls in older adults.

METHODS: We conducted retrospective and prospective analyses of 615 hospital patients age ≥ 65 years who sustained a fall in 2015. Data was extracted from their first fall-related admission that year, including demographic reports, health history, injury characteristics, relevant diagnoses, and home medications. We exported the number of previous falls since 2010 and used logistic and Poisson regressions to test the effect of insulin on the odds of experiencing falls and the total number experienced. We then tracked patients forward until August 2016 and tested the effect of insulin on return visits for new fall-related admissions.

RESULTS: Patients were 80.0 ± 9.1 years old, 6.2% used long-acting insulin, 0.5% used intermediate insulin, and 4.2% used rapid-acting insulin. They were admitted 1.9 ± 1.3 times previously and had 0.5 ± 0.9 return visits. There was no relationship with intermediate insulin and the number of previous ($P=0.223$) or future ($P=0.383$) falls. Long-acting insulin associated with modest increases in the number of previous ($P=0.053$) and return ($P=0.050$) falls. Rapid-acting insulin significantly predicted both. Controlling for weather, age, balance, and cognitive condition, patients using rapid-acting insulin had a 4.2-fold increase in the odds of sustaining multiple previous falls ($P=0.002$; 95% CI of odds ratio=1.68-10.54), a 37.2% increase in the number of previous visits ($P=0.012$; 95% CI of IRR: 1.07-1.76), a 2.4-fold increase in the odds of readmission ($P=0.033$; 95% CI of odds ratio: 1.07-5.50), and a 64.3% increase in the number of return visits ($P=0.026$; 95% CI of IRR: 1.06-2.54).

CONCLUSIONS: Diabetics taking rapid-acting insulin express an elevated risk of falls. Exercise may serve two functions in this population: it can mitigate the acute and chronic effects of diabetes via non-insulin dependent glucose uptake, and it can protect against fall risk.

1541 Board #303 May 30 10:30 AM - 12:00 PM
The Effects of Traditional Chinese Exercise on Sugar Metabolism And Physical Fitness

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Purpose: Exercise therapy of traditional Chinese medicine (TCM) has a long history in treating diabetes. Few evidence to date have shown its effects on the glucose metabolism and muscle fitness. We evaluated the effects of TCM exercise therapy and sedentary lifestyle on sugar metabolism and physical fitness in both female individuals with prediabetes and type II diabetes mellitus (T2DM).

Methods: Thirty-three diabetic subjects and 33 prediabetic subjects were randomly divided into the exercise therapy group (diabetic: ED, prediabetic: EP) or sedentary group (diabetic: CD, prediabetic: CP) as a 2:1 ratio. ED and EP groups were given the same traditional exercise for moderate intensity, 50min, 3 times a week. Hemoglobin a1c (HbA1c), fasting insulin, oral glucose tolerance test (OGTT), peak oxygen uptake (VO_{2peak}), grip strength, back strength, and sit-ups (muscle endurance) were taken at the pro and post of 12-week-exercise. Responses were compared between prediabetes and diabetes.

Results: Compared with CP and CD group, HbA1c decreased by 0.156 mmol/L ($P < 0.05$) and 0.45 mmol/L ($P < 0.01$) with EP and ED, respectively. Fasting insulin decreased by 4.61 cycles U/mL in EP group, and 13 of them returned to normal blood glucose, both fasting and postprandial ones, according to the OGTT test. The VO_{2peak} , muscle strength and endurance of the diabetic groups were significantly lower than those of the prediabetic groups ($P < 0.001$). VO_{2peak} of the exercise groups increased significantly (EP: +6.55%, ED: +33.43%, $P < 0.001$). Muscle fitness improvements were significant ($P < 0.05$) on the grip strength (ED: +1.75kg, CD: -0.44kg), back strength (ED: +8.47kg, CD: -0.27kg), and sit-ups (ED: 3.50 more, CD: 0.18 less) in diabetic groups but not obvious in prediabetic groups.

Conclusions: The VO_{2peak} and muscle fitness of diabetic patients were significantly lower than that of prediabetes. TCM exercise therapy can improve sugar metabolism and physical fitness, which is safe and effective. The same traditional exercise is better for diabetes than prediabetes.

Supported by: JDZX2015136 and GASC2014B007.

1542 Board #304 May 30 10:30 AM - 12:00 PM
Combined Metformin and Exercise Treatment Improves Glucose Control and Insulin Sensitivity in Type-2 Diabetes Patients.

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BACKGROUND: The antidiabetic medicine, Metformin, and exercise are cornerstones in the treatment of type-2 diabetes. However, there is conflicting evidence about the benefits of combining both interventions. **PURPOSE:** To compare free-living ambulatory glycemic control and insulin sensitivity among the separated and combined effects of metformin and exercise.

METHODS: Twelve middle-aged (55.5 ± 1.4 years) adults, diagnosed with type-2 diabetes and obesity ($BMI 32.0 \pm 1.2$ kg/m²) undergoing pharmacological treatment with metformin (>3 yrs.) participated in the study. All participants underwent 4 trials in a randomized order: i) taking their habitual doses of metformin (MET), ii) after 48-hours of metformin withdrawal, which was replaced by two (43 min) daily bouts of high-intensity interval training (EX), iii) combining medicine and exercise (MET+EX), and iv) a Control trial withdrawing from metformin (48-hours) and exercise (CONT). Ambulatory glycemic control was inferred from interstitial fluid glucose concentration (IFG), which was frequently monitored during 72 h (FreeStyle Libre, Abbott, USA) in each experimental condition. In addition, after an overnight fasting, a blood sample was collected 24 h after each experimental condition for the assessment of glucose and insulin concentration and subsequent calculation of insulin sensitivity (i.e., HOMA-IR). **RESULTS:** During the 72 hours of IFG monitoring an average of 109 + 11 readings per trial were obtained (i.e., 1.5 readings per hour). IFG in EX (7.3 ± 1.9 mmol/L) was similar than CON (7.3 ± 1.9 mmol/L; $P=0.604$). However, in MET (6.9 ± 1.6 mmol/L) and MET+EX (6.6 ± 1.3 mmol/L) IFG was significantly lower than CONT ($P < 0.001$ and $P=0.05$, respectively). IFG peaks (i.e., IFG > 11.1 mmol/L) were more frequent in CONT than in the rest of the trials. However, IFG peaks frequency was lower in MET+EX than in MET ($P=0.025$) and EX ($P=0.030$). Finally, insulin resistance (i.e., HOMA-IR) was lower than CONT in MET+EX ($P=0.031$) and in MET ($P=0.001$) but not in EX alone. **CONCLUSIONS:** The combination of metformin and exercise reduces the occurrence of IFG peaks thus improving glucose control in

a sample of type-2 diabetic individuals in a free-living situation. Monitoring of IFG seems adequate to track the effects of both, exercise and pharmacological treatment (metformin).

1543 Board #305 May 30 10:30 AM - 12:00 PM
A Review Of Intervention Of Baduanjin For Diabetes And Complications

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PURPOSE: The traditional Chinese guidance technique--fitness qigong · Baduanjin exercise, which means the eight-section brocade exercise in English, has the functions of body building. It is widely used in diabetic patients as exercise therapy, we systematically reviewed the history and role of Baduanjin exercise applied to diabetes and its complications.

METHODS: The source and historical evolution of Baduanjin exercise were systematically analyzed based on ancient Chinese literature. Health benefits of Baduanjin exercise intervention in diabetes and its complications were summarized based on clinical research literature.

RESULTS: (1) The development of Baduanjin exercise went through five periods:

①The guidance technique in ancient times about 2000 BC was its origin; ②The Northern Song Dynasty from 960 to 1127 AD was the formation period of movements; ③It became popular in the Southern Song Dynasty from 1127 to 1279 AD and was first recorded in the book "Yijianzhi". And it became mature from the Southern Song Dynasty to Yuan Dynasty of 1280; ④It was widely spread and promoted in the Ming and Qing Dynasties from 1368 to 1912; ⑤After the foundation of the People's Republic of China in modern times, a lot of books in regard to Baduanjin exercise were published. The fitness qigong management center of General Administration of Sport of China organized the compilation and creation of the exercise, which was named "fitness qigong · Baduanjin exercise". The nationwide fitness program was carried out actively and the exercise was promoted around the world. (2) After practicing Baduanjin exercise for 3-6 months, FBG and HbA1C can be significantly reduced. BP, TG and blood lipid levels such as LDL-C, HDL-C can be adjusted. The SNCV and MNCV can be enhanced. Psychological index scores such as HAMD, SDS, SAS, DSQL and so on of diabetes patients with depression or anxiety can be improved.

CONCLUSIONS: The development of Baduanjin exercise went through five stages. As an exercise therapy, it can improve glucose and lipid metabolism and diabetic neuropathy. The level of mental health can be enhanced. Therefore, it deserves to be widely promoted and co-developed internationally to gain more benefits. Fund support: The Technology Research Project of the fitness qigong center of General Administration of Sport of China (QG2017038)

1544 Board #306 May 30 10:30 AM - 12:00 PM
Relationships Between Exercise Level, Beliefs About Exercise, And Exercise Promotion Among Cardiologists And Oncologists

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PURPOSE: This study examined the relationships between cardiologists' and oncologists' exercise levels, beliefs about exercise for their patients, and frequency of discussing or recommending exercise.

METHODS: A survey was distributed to oncologists and cardiologists via Qualtrics. Questions and responses were: (1) "I believe exercise is safe for most of my patients, most of patients are capable of exercise, exercise is effective for improving my patients' well-being, and exercise can reduce likelihood of disease recurrence, or increase chances of survival in my patients (strongly disagree to strongly agree), (2) "How often do you discuss exercise with your patients?" (none/few, some, most/all visits), (3) "What percent of patients have you recommended should exercise in the past month?" (none/few, some, most/all), and (4) "How do you provide information about exercise" (referral as a yes/no option). Self-reported exercise was categorized at meeting exercise guidelines or not. Fisher's Exact (FE) tests with Cramer's V were used to compare the proportion of responses in each category between questions. **RESULTS:** Out of 154 surveys distributed, 58 (n=25 cardiologists, n=33 oncologists) were returned (37.7% response rate). Respondents were $M=45.7 \pm 11.3$ years old and 63.6% male. Those who agreed (vs. neutral/disagreed) with "...exercise can reduce likelihood of disease recurrence or increase survival..." were more likely to refer patients to an exercise program ($FE=5.588$, $p=.040$, $V=.324$). Cardiologists who agreed with the same statement were more likely to discuss exercise at most/all patient

visits ($FE=9.351$, $p=.027$, $V=.514$). More than half (58.6%) reported meeting exercise guidelines, and there were no differences in beliefs about exercise for patients between those meeting vs. not meeting guidelines.

CONCLUSION: Cardiologists and oncologists who believe exercise can reduce the likelihood of disease recurrence or improve survival for their patients, may be more likely to discuss exercise or refer patients to an exercise program. Beliefs about exercise did not differ by exercise level. These findings suggest that cardiologists' and oncologists' beliefs about the benefits of exercise for improving disease outcomes may be a viable path to increase exercise promotion.

1545 Board #307 May 30 10:30 AM - 12:00 PM

Effects of Exercise on Sexual Function in Men with Advanced Prostate Cancer.

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Normal 0 false false EN-US JA X-NONE /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Table Normal"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshadow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0cm 5.4pt 0cm 5.4pt; mso-para-margin:0cm; mso-para-margin-bottom:0.0001pt; mso-pagination:widow-orphan; font-size:12.0pt; font-family:"Calibri", sans-serif; mso-ascii-font-family:Calibri; mso-ascii-theme-font:minor-latin; mso-hansi-font-family:Calibri; mso-hansi-theme-font:minor-latin; mso-bidi-font-family:"Times New Roman"; mso-bidi-theme-font:minor-bidi;} **PURPOSE:** To report the effects of a 12-week modular multimodal exercise program (M3EP) comprising of resistance, aerobic and flexibility training on sexual health and function in men with advanced prostate cancer. **METHODS:** Prostate cancer patients (70.0 ± 8.4 yr; body mass index 28.7 ± 4.0 kg·m⁻²) with bone metastases (rib/thoracic spine, 66.7%; lumbar spine, 43.9%; pelvis, 75.4%; femur, 40.4%; humerus, 24.6%; other sites, 70.2%) were randomly assigned to a supervised exercise program (3 days/week) comprising resistance, aerobic and flexibility exercises (EX; n=28) or usual care (UC; n= 29) for 12-weeks. Outcome measures of sexual health and function (International Index of Erectile Function (IIEF), the Expanded Prostate Cancer Index Composite (EPIC) and the EORTC-PR25 were assessed at baseline and 12-weeks. **RESULTS:** After adjusting for baseline values, there were no differences between groups for any of the measures of sexual function and activity, $p>0.05$. Additionally, there were no differences between groups for urinary and bowel function as assessed by the EORTC-PR25 ($p>0.05$). **CONCLUSIONS:** A M3EP program does not improve indices of sexual health and function in men with advanced prostate cancer. <!--EndFragment-->

1546 Board #308 May 30 10:30 AM - 12:00 PM

Baduanjin's Impact on Quality of Life and Sleep Quality in Breast Cancer Survivors Receiving: An Intervention Study

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Purpose

To investigate the impact of Baduanjin, a traditional Chinese exercise intervention, on quality of life and sleep quality in breast cancer survivors receiving aromatase inhibitors.

Patients and Methods

A 3-month intervention study was conducted in 68 breast cancer survivors who were receiving treatment with aromatase inhibitors (AIs). All patients were instructed to participate in 12 weeks of Baduanjin exercise training, which involved three 90-minute sessions per week. Group 1 attended ≥ 2 sessions per week ($n=33$), while group 2 attended <2 sessions per week ($n=35$). Questionnaires measuring quality of life (QOL) and sleep quality were completed at baseline and 3 months after the intervention. Quality of life was assessed using the European Organization for Research and Treatment of Cancer Quality-of-Life Questionnaire Core 30 (EORTC QLQ- C30). Sleep quality was measured using the Pittsburgh Sleep Quality Index (PSQI).

Results

The indexes of quality of life, which included functional scores, general health and symptom relief, significantly improved in group 1 ($P<0.05$) and had a larger effect size compared to group 2 (P value for group difference <0.05). Compared with group 2, group 1 had a higher score on the functional scales ($P<0.05$), while the functional scale scores for group 2 worsened. The overall PSQI score in group 1 decreased by 4.85 points (47.92%) ($P<0.01$) and was lower than that of group 2 (P for group difference <0.05).

Conclusion

A 12-week Baduanjin exercise training program led to improvements in the quality of life and sleep quality of breast cancer patients receiving AIs.

1547 Board #309 May 30 10:30 AM - 12:00 PM

Evaluating The Translation Of Dutch Exercise Oncology Trials Into Clinical Practice Using The RE-AIM Framework

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(No relevant relationships reported)

PURPOSE: Implementation of exercise programs for cancer patients is challenging. This study evaluated the potential for implementation of exercise programs from Dutch exercise oncology trials.

METHODS: Three randomized controlled trials (PACES, REACT, PACT), examining effects of exercise during or following chemotherapy treatment with curative intent, were evaluated using the 5 dimensions of the RE-AIM framework: Reach, Effectiveness, Adoption, Implementation, and Maintenance.

RESULTS: *Reach:* Participation rates were 37-45%. Compared to non-participants, participants were higher educated, less fatigued or distressed, and had higher scores on behavioral variables. *Effectiveness:* No serious exercise-related adverse events occurred. Significant benefits of exercise were found for physical fitness, fatigue, and quality of life. A significant benefit on chemotherapy completion was found in one study but not in another. *Adoption:* To enable twice weekly exercise session attendance close to patients' homes, local physiotherapists (PTs) were educated about exercise supervision for cancer patients. Generally, the PTs felt sufficiently capable to deliver exercise programs, but less capable to support behavioral change. *Implementation:* 61-89% of participants had high attendance at the supervised sessions. Education, additional radiotherapy, BMI, fatigue and self-efficacy predicted adherence in some studies. Basic insurance does not cover the program, but some additional coverage policies do. Some evidence for cost-effectiveness of the programs was found.

Maintenance: Exercise-induced gains in physical fitness and quality of life post cancer treatment, and benefits from exercise during chemotherapy on physical activity and function maintained, whereas maintenance of fatigue benefits were inconsistent across studies. Sustainability of program delivery is ensured by incorporation of the exercise protocols in post-graduate oncology education for PTs. A quality control system has been implemented via Onconet.

CONCLUSIONS: The exercise programs have high potential for successful implementation in clinical oncology practice, but reach and adherence should be monitored, and lack of reimbursement is currently a barrier. Future studies should focus on improving maintenance of benefits.

1548 Board #310 May 30 10:30 AM - 12:00 PM

Effects of Different Volumes of Combined Training in Breast Cancer Survivors: A Pilot Study

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PURPOSE: We aimed to assess the effects of different volumes of eight-week combined training on neuromuscular, cardiorespiratory, fatigue and quality of life parameters in breast cancer patients in stages I-III who have finished treatment, such as surgery, chemotherapy and radiotherapy. **METHODS:** Ten women (57.1 ± 9.6 years) were placed into either a group based on a single set (SS) protocol or a group following multiple sets (MS) protocol for prescribed resistance exercises. The eight-week combined training included resistance and aerobic exercise within the same training sessions, which were performed twice a week. Resistance exercises were performed with sets of maximal repetitions and along the training the number of repetitions decreased. The intensity of aerobic exercise was based on the anaerobic threshold, monitored by relative heart rate (first weeks) or velocity of the anaerobic and aerobic thresholds (last weeks). Before and after the intervention, the following variables were evaluated: maximal dynamic and isometric strength of knee extensors, maximal isometric electromyography (EMG) activity of vastus lateralis, muscle thickness of quadriceps, peak oxygen uptake, fatigue and quality of life. The training-related effects were assessed using a Generalized Estimating Equations and Bonferroni post-hoc test ($\alpha=0.05$). **RESULTS:** The maximal dynamic strength of knee extensors (SS: 32.10 ± 45.70 vs. MS: $23.33 \pm 13.59\%$, $p<0.001$), muscle thickness of quadriceps (SS: 14.60 ± 4.64 vs. MS: $25.50 \pm 19.30\%$, $p=0.001$), peak oxygen uptake (SS: 8.67

± 8.76 vs. MS: $12.07 \pm 12.04\%$, $p < 0.001$) and quality of life (SS: 2.71 ± 6.91 vs. MS: $5.75 \pm 7.97\%$, $p = 0.039$) increased after training, with comparable changes for both groups. For maximal isometric strength of knee extensors and EMG activity of vastus lateralis there were no significant changes in both groups after training. For cancer-related fatigue, only the MS group showed decreases ($16.24 \pm 135.32\%$). We highlight these results are preliminary. **CONCLUSIONS:** In this pilot study, a short period of combined training, independent of the volume of resistance training, promoted key benefits for functional variables and quality of life in sedentary breast cancer survivors.

1549 Board #311 May 30 10:30 AM - 12:00 PM
Feasibility Of Exercise Prehabilitation During Neo-adjuvant Chemotherapy In Oesophago-gastric Cancer Surgery

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 (No relevant relationships reported)

PURPOSE:

To determine the feasibility and potential benefits of patients diagnosed with operable gastro-oesophageal cancer undertaking a structured-exercise cancer prehabilitation program (prehab) during neo-adjuvant chemotherapy (NAC) versus patients on a standard care pathway.

METHODS:

Patients were enrolled in a prospective, cohort-controlled trial. Prehab was based on World Health Organisation (WHO) 'recommended levels of physical activity for adults over the age of 18'.

Cardiopulmonary exercise tests (CPEX) were performed at 4 time-points: 1. Baseline/pre-NAC. 2. Post-NAC. 3. Before surgery. 4. After surgery. Participants wore wearable tracker devices.

CPEX variables analysed included anaerobic threshold (AT) and peak oxygen uptake (VO₂peak).

Clinical and pathological data variables were recorded.

RESULTS:

At time of writing, 25 male and female patients, aged 25 - 78years, had participated in the study; 22 had undergone surgery. Mean baseline AT in the prehab group was 17.57 ± 3.35 SD (range 10.77 - 20.94; $n = 10$) ml/kg/minute, compared to 15.19 ± 3.57 SD (range 11.10 - 22.90; $n = 12$) ml/kg/minute in the control group.

Mean baseline VO₂peak achieved was 27.55 ± 5.63 SD (range 15.18 - 36.83) ml/kg/minute and 23.39 ± 4.06 SD (range 18.75 - 29.94) ml/kg/minute, respectively.

Mean values of AT and VO₂peak between the groups pre-surgery were of little scientific value. However, Δ VO₂peak in individual patients showed a trend towards improvement in the prehab cohort. Post-surgery values decreased markedly in both groups:

Mean AT prehab decreased to 13.46 ± 2.29 SD (range 10.54 - 15.91) ml/kg/minute versus 13.10 ± 2.60 SD (range 10 - 18.4) ml/kg/minute in control group.

Mean VO₂peak reduced to 20.33 ± 4.94 (range 14.01 - 26.81) ml/kg/minute compared to 19.56 ± 2.74 SD (range 18.00 - 24.76) ml/kg/minute respectively.

CONCLUSIONS: Cancer prehabilitation during NAC is feasible. Recovery of peak oxygen uptake shows an improvement trend in patients undergoing prehab during and after NAC. Post-surgery mean AT and VO₂ values confirm physiological stress in patients undergoing high-risk, intra-thoracic and intra-abdominal oesophagectomy.

1550 Board #312 May 30 10:30 AM - 12:00 PM
Moving Cancer Care Ontario's Exercise Guidelines Into Oncology Practice: Using The Theoretical Domains Framework To Validate A Questionnaire

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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to validate a questionnaire used to identify barriers and facilitators to use of exercise guidelines in oncology care.

METHODS: A questionnaire was designed to explore knowledge, beliefs, practices, barriers and facilitators to discussion of exercise guidelines in oncology patients. It was optimized for face and content validity through pilot testing, and administered to oncology care providers at a regional tertiary cancer. To offer more strategic and precise data collection, and to inform the development of interventions with a higher likelihood of applicability and success, we validated the questionnaire based on the

updated 14-item Theoretical Domains Framework (TDF). The TDF is a knowledge translation (KT) framework used to identify potential targets for health professional behavior change related to evidence-based practice. Cronbach's alpha was calculated to assess internal consistency between items within each domain of the TDF. **RESULTS:** Existing items were mapped successfully within the eight TDF domains deemed to be relevant to exercise discussion in oncology care. Internal consistency was generally high across domains, with all domains > 0.7 , with the exception of intentions, and beliefs about consequences. Four questions were removed, which increased the internal consistency within domains.

CONCLUSIONS: Many KT frameworks emphasize context in developing and assessing the effectiveness of implementation strategies. Our questionnaire, based on a commonly used KT framework, has the potential to assist other researchers to collect valuable contextual data prior to the design phase of an intervention to promote exercise discussion in cancer practice. The consideration of these formative data in the development of KT interventions that have a greater likelihood of success in closing the gap between the known benefits of exercise in people with cancer and coverage in care planning.

1551 Board #313 May 30 10:30 AM - 12:00 PM
Exercise in Patients Newly Diagnosed with Multiple Myeloma - a Randomized Controlled Feasibility Study

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Exercise is considered a feasible, safe and beneficial complementary treatment for patients with hematological cancer. However, there is a lack of knowledge regarding exercise interventions (EI) in patients with newly diagnosed multiple myeloma (MM).

Our ongoing randomized controlled trial (RCT) examines the effect of an EI in newly diagnosed patients with MM, irrespective of age and treatment regimen, on muscle strength, physical function and physical activity. **PURPOSE:** To report an interim analysis of feasibility and safety of the early initiated exercise intervention.

METHODS: A two-center RCT with blinded outcome assessors. Baseline tests are carried out three days after starting anti-myeloma treatment, followed by randomization to control group (CG) or intervention group (IG). The EI is a 10-week supervised and home-based exercise program comprising aerobic and strengthening exercises and physical activity. Feasibility outcome measures are study eligibility, acceptance and drop-out rates. Further, intervention adherence, tolerability and safety by registration of adverse events (AE) are assessed. IG is compared to CG by k-sample test for medians and by Fisher's exact test for categorical variables. **RESULTS:** Of 49 patients screened, 80% were eligible for inclusion, 77% accepted participation. Median age 69 years, range (38-90), 77% were men. No difference between CG and IG in age ($p = 0.713$) and gender ($p = 0.666$). From IG, five patients dropped out (29%); prior to start of intervention due to no surplus energy ($n = 3$), treatment near by home town ($n = 1$) or because of sudden impairment ($n = 1$). Adherence was high; 99% of the supervised ES were completed and 89% of the home-based ES were completed. Tolerability was high; only two patients had to discontinue one supervised ES, each due to non-serious AE (pain and dyspnea/dizziness). No serious AE (e.g. pathological fractures) were reported. **CONCLUSION:** Early initiated exercise in patients with MM, regardless of age and treatment regimen, is feasible, tolerable and safe and may be important in preventing physical decline during treatment for MM. **SUPPORTED BY:** Zealand University Hospital; Region Zealand; Region of Southern Denmark; REHPA, The Danish Knowledge Centre for Rehabilitation and Palliative Care; Amgen; The Association of Danish Physiotherapists.

1552 Board #314 May 30 10:30 AM - 12:00 PM
Effects Of Exercise And Yoga On Sleep Problems In Women With Breast Cancer: A Meta-analysis

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(No relevant relationships reported)

Sleep problems are one of the top five long-term health issues in breast cancer patients. However, the optimal treatment still needs to be defined. Exercise and yoga are promising approaches. **Purpose:** To conduct a meta-analysis evaluating the effects of physical exercise and yoga interventions on self-reported and objective sleep problems in breast cancer patients during or post-cancer treatment. **Methods:** PubMed, Web of Science and Cochrane library databases were systematically searched for randomized controlled trials with any type of exercise or yoga intervention in women with breast cancer. Outcomes were self-reported or objective measurements of sleep. Standardized mean differences (SMDs) using random-effects models were calculated. **Results:** The meta-analysis included 22 trials with 2091 participants. Sleep was assessed in

17 studies with the Pittsburgh Sleep Quality Index (PSQI). Only 6 studies included objective sleep assessments (ActiGraph). Physical exercise interventions included aerobic exercise, resistance exercise or a combination of both. Most interventions were supervised. Yoga interventions comprised various yoga protocols. Also 3 studies with Tai-Chi or Qigong were included in the yoga group for the meta-analysis. Both, physical exercise interventions (SMD -0.32; 95% CI -0.54 to -0.10) and yoga interventions (SMD -0.27; 95% CI -0.44 to -0.09), resulted in improvements of sleep problems. There was no significant difference between the effects of physical exercise and yoga. Subgroup analyses revealed no clear difference between interventions conducted during cancer therapy versus post therapy. Considering the PSQI subscores, exercise resulted in improvements of sleep quality (SMD -0.28; 95% CI -0.44 to -0.11) and of sleep disturbances (SMD -0.26; 95% CI -0.45 to -0.06). Regarding the objective sleep measurements, no significant effects were found, however, the number of studies was very limited. **Conclusions:** Physical exercise as well as yoga, Tai-Chi or Qigong might reduce sleep problems and improve subjective sleep quality in breast cancer patients, both during and after cancer treatment. Effect sizes were small to moderate. Future studies should clarify which type of intervention might be most effective depending on individual patients' and treatment characteristics.

1553 Board #315 May 30 10:30 AM - 12:00 PM

Preventive Action Of Cardiorespiratory Fitness On Health Outcomes In Childhood Acute Lymphoblastic Leukemia Survivors

Maxime Caru¹, Valérie Lemay¹, Mariia Samoilenko¹, Simon Drouin¹, Nathalie Alos¹, Geneviève Lefebvre², Emile Levy¹, Sarah Lippé¹, Valérie Marcil¹, Serge Sultan¹, Laurence Bertout¹, Maja Krajcinovic¹, Caroline Laverdière¹, Marie-Josée Raboisson¹, Daniel Sinnett¹, Gregor Andelfinger¹, Daniel Sinnett¹, Daniel Curnier¹. ¹Sainte-Justine University Hospital, Montreal, QC, Canada. ²University of Quebec in Montreal, Montreal, QC, Canada.

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(No relevant relationships reported)

PURPOSE: Most childhood acute lymphoblastic leukemia (ALL) survivors develop chronic treatment-related adverse effects several years after the end of therapy. A regular practice of physical activity and a good cardiorespiratory fitness have the potential to reduce the risk of chronic diseases and to improve quality of life. It is currently unknown whether a good cardiorespiratory fitness or the regular practice of physical activity is enough to induce a preventive action on late adverse effects. The first aim of this study was to evaluate the association between a good cardiorespiratory fitness and major long-term health outcomes. The second aim of this study was to assess the association between the respect of physical activity guidelines and major long-term health outcomes.

METHODS: 247 ALL survivors underwent a cardiopulmonary exercise test. They also completed a physical activity questionnaire and a battery of clinical exams. We calculated the odds ratio to obtain the preventive fraction in order to evaluate the effects of cardiorespiratory fitness and physical activity levels on health outcomes (i.e. obesity, metabolic health, cardiac health, cognitive health and mood, bone health).

RESULTS: Despite their young age, 88% of the survivors presented at least one adverse health outcome, and 46% presented 3 or more adverse health outcomes. Their cardiorespiratory fitness had a median VO₂ peak reaching 84% of predicted value, which was lower than expected. In the analyses regarding cardiorespiratory fitness, statistically significant preventive fractions were observed for obesity (30%), low HDL-cholesterol (21%) and depression (26%). In the physical activity level analyses, statistically significant preventive fractions were observed for obesity (55%), depression (81%) and low bone mineral density (60%).

CONCLUSIONS: Our results indicated that a good cardiorespiratory fitness and physical activity level induced a preventive action for most health outcomes studied and was associated with a lower late adverse effects prevalence in ALL survivors. Clinicians and researchers have an important role to play in the reduction of late adverse effects in ALL survivors. This study provides additional evidence regarding the benefits of physical activity for cancer survivors

C-49 Basic Science World Congress/Poster - Circadian and Sleep Behavior in Adolescents

Thursday, May 30, 2019, 7:30 AM - 12:30 PM

Room: CC-Hall WA2

1554 Board #316 May 30 10:30 AM - 12:00 PM

Descriptive Analysis of Objectively Measured Physical Activity and Sleep Activity in Adolescents: a Preliminary Analysis.

Sarah N. Brown, Sarah E. Domoff, Aubrey L. Borgen, Ryan Foley, Rachael K. Nelson. *Central Michigan University, Mount Pleasant, MI.*

(No relevant relationships reported)

Although growing evidence suggests a link between physical activity (PA) behavior and sleep quality in adolescents, a causal relationship between these two variables has yet to be elucidated. Methodological differences in data collection (subjective vs. objective) has been highlighted as a limiting factor in data interpretation. In fact, the majority of the literature includes subjective or subjective combined with objective data, with only two studies comparing objective measures of both PA and sleep in adolescents within the same analysis. **PURPOSE:** To objectively examine PA behavior and sleep activity in adolescents using accelerometers. **METHODS:** 7 males and 3 females, age: 10±1 yrs., BMI: 20±5 were recruited for this study. PA and sleep were monitored by Actigraph wGT3x accelerometers worn on participants' non-dominant wrist to assess sedentary (SED), light-intensity (LPA), and moderate-to-vigorous activity (MVPA), as well as sleep activity including: total sleep time (TST), wake after sleep onset (WO), and average wake length (WL). Time spent awake and sedentary (aSED) was calculated as $aSED = SED - TST$. Participants were instructed to wear the accelerometer for 7 consecutive days only removing it while swimming, bathing, or playing contact sports. Our analysis only included data from participants who wore the accelerometer continuously for ≥4 days. **RESULTS:** On average participants accumulated 435±15 min/day of sleep equal to 7.3±0.3 hours per night. Participants also accumulated 473±24 min/day of MVPA, 371±29 min/day aSED, and 141±8 min/day LPA. There was not a significant difference between TST and MVPA per day ($p=0.22$). Participants spent the majority of their day sleeping (33% time/day) or engaged in MVPA (31%) followed by aSED (26%), and the fewest proportion of their day engaged in LPA (10%; $p<0.01$). We observed a negative association between LPA and TST ($p=0.01$). However, we observed a positive association between LPA and WO ($p=0.03$) and WL ($p=0.03$). No other significant associations were observed between PA and sleep variables. **CONCLUSION:** Outcomes of this analysis suggest that adolescents accumulate less than the recommended 8-10 hours of sleep per night and parameters of sleep disturbance may be linked to engaging in higher amounts of light-intensity physical activity.

1555 Board #317 May 30 10:30 AM - 12:00 PM
24-hour Movement Behaviors, Body Composition And Cognitive Performance In Adolescents

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(No relevant relationships reported)

PURPOSE: The purpose of this pilot study was to examine associations between 24-hour movement behaviors (sleep, physical activity, and sedentary time), body composition, and executive functions in adolescents with and without obesity. **METHODS:** Adolescents between the ages of 12 and 18 years ($n=30$, $n=14$ girls, mean age=14.9 years) wore accelerometers on the hip for 24-hours to measure total night sleep time, minutes of moderate-to-vigorous physical activity (MVPA), and percentage of waking wear in sedentary activity. Body composition including lean mass, fat mass and bone mineral density was measured using dual-energy x-ray absorptiometry. Cognitive performance, particularly attention and inhibitory control, was tested using the Go/NoGo task. **RESULTS:** Mean sleep time was 487.2 (SD 80.0) minutes per night, median minutes of moderate-to-vigorous physical activity were 16 (10.2, 25.3 25th to 75th percentiles) minutes per day, and 68.5% (SD 6.95) of waking time was spent in sedentary activity. There were no differences in sleep or sedentary time in adolescents with and without obesity, however, adolescents with obesity participated in less MVPA compared to those without obesity (median 13.4 vs 23.3 minutes per day respectively, $p=.024$). In linear regression models with all three behaviours as independent variables adjusted for total body mass, sex, and age, total sleep time (minutes/day), but not sleep efficiency, was positively associated with total body percent fat (0.05, 95%CI: 0.002, 0.11, $p=.043$) and negatively associated with total lean mass (-37.8 grams, 95%CI: -71.7, -4.0, $p=.030$). Using negative binomial regression adjusted for age and sex, there were no associations of any of the movement

behaviors with accuracy (errors of omission or commission) or reaction times. Body fat percentage (IRR 1.06, 95% CI: 1.01, 1.12), $p=.026$ and total lean mass (kg) (IRR 0.89, 95% CI: 0.80, 0.97, $p=.013$) were associated with omission errors of inattention. **CONCLUSION:** In this sample of adolescents, total sleep time was associated with body fat and lean mass. Body composition was associated with inattention. Novel interventions that integrate sleep strategies to improve health and cognitive performance in adolescents should be explored.

1556 Board #318 May 30 10:30 AM - 12:00 PM
What Affects the Sleep of Youth? Results from the 2017 Youth Risk Behavior Surveillance Survey

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Background/Purpose: Sleep plays a critical role in metabolism, memory, learning, and other vital functions. Sleep deprivation is associated with an increased risk of developing diabetes, cardiovascular disease, and many other complications. However, evidence has shown that youth are sleeping less than before. Understanding what influences sleep time is extremely important in designing interventions to help to improve the sleep time and sleep quality of youth. The aim of this study was to examine the influencing factors of sleep for youth age from 12 to 18 yr.

Methods: The data were derived from the 2017 Youth Risk Behavior Surveillance System (YRBSS) and a total of 14,765 youth responded to the survey. Descriptive analysis was used to explore the sleep patterns and Pearson's Chi-squared test was applied to examine the gender and race/ethnicity difference. Logistic regression was implemented to explore the impact of health-related behaviors such as physical activity (PA), playing video games (GAME), smoking (SMOKE), and drinking alcohol (DRINK) on sleep time.

Result: Only 23.88% female and 25.78% male reported having 8 or more hours of sleep on an average school night. Significant disparities exist among demographic subgroups of youth defined by gender ($\chi^2 = 5.70$, $p = 0.02$) and race ($\chi^2 = 30.13$, $p = 0.00$). Results of logistic regression were displayed in the table below:

Factor		Odds Ratio	SE	<i>p</i>
Age		0.79	0.02	0.00
Gender	Male	1.08	0.06	0.14
Race	Black	0.94	0.08	0.72
	White	1.14	0.07	0.03
	Asian	0.62	0.08	0.00
	Pacific Islander	0.58	0.20	0.11
	Native American	0.69	0.22	0.24
Obesity	Non-obese	1.22	0.10	0.01
PA		1.04	0.01	0.00
GAME		0.91	0.01	0.00
SMOKE		1.07	0.03	0.02
DRINK		0.83	0.03	0.00

Comparing with Hispanic youth, White youth tended to have longer sleep time ($p = 0.03$) while Asian youth had significantly less sleep time ($p = 0.00$). Youth who were non-obese and physically active were more likely to have 8-hour sleep, while those who played video games and consumed alcohol tended to sleep less.

Conclusion: About 75% of the youth did not meet the 8-hour sleep needs and promote physical activity and reduce alcohol consumption may help to increase the sleep time of youth.

D-08 Thematic Poster - Female and Sex-Specific Physiology

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-104B

1586 Chair: Saori Hanaki. *Weber State University, Ogden, UT.*
(No relevant relationships reported)

1587 Board #1 May 30 1:30 PM - 3:30 PM
Role Of Gender In Anti-oxidant Response To A Bout Of Aerobic Exercise In Healthy Adults

Anam Ahmad¹, Zoe Morris¹, Lisa M.K. Chin¹, Rebekah Feng¹, Leo Saligan¹, Leighton Chan¹, Randall Keyser, FACSM².

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(No relevant relationships reported)

Aerobic exercise acutely increases the production of reactive oxygen species (ROS), which creates an imbalance between free radicals and the body's antioxidant defenses, resulting in increased oxidative stress. Oxidative stress levels are reportedly higher in males compared to females, however there is limited knowledge regarding the role of gender in the antioxidant response following an acute bout of aerobic exercise.

Purpose: To determine whether changes in serum antioxidant levels after an acute aerobic exercise bout differed between genders. **Methods:** The study comprised of 15 healthy adults (9 females, 6 males; age 27±8 years; BMI 24±3 kg/m²) enrolled in the NIH Fatigue in Healthy Individuals Protocol (NCT00888563). During the first visit, subjects completed a treadmill cardiopulmonary exercise test (CPET) to volitional exhaustion. On a separate visit, subjects performed a vigorous-intensity continuous work rate (WR) test, to volitional exhaustion on the treadmill. Serum samples were collected before and immediately after the vigorous exercise bout. A Human Oxidative Stress Multiplex panel was used to determine serum peroxidase (PRX2) and catalase levels. Student's t-tests were performed between genders for WR and antioxidant levels. **Results:** Males performed vigorous-intensity exercise at a higher WR than females (p<0.0001). No difference was found in baseline PRX2 and catalase levels between males and females. Relative change in PRX2 (+32% in males; -17% in females) and catalase (+18% in males; -11% in females) was different between genders after a vigorous bout of aerobic exercise (p=0.0136, p=0.0344, respectively). This difference became insignificant when WR was accounted for. **Conclusion:** This study suggests that higher levels of oxidative stress in males may be explained by higher work rates. However, response to exercise-induced oxidative stress demonstrated that males (6 of 6) increased anti-oxidant levels, while females (8 out of 9) showed decreased levels. Previous studies have suggested that gender differences in oxidative stress may be related to an increased production of ROS by NADPH-oxidase in males, or antioxidant properties of estrogen which may assist in minimizing oxidative stress in females.

Funding: National Institute of Nursing Research, Division of Intramural Research

1588 Board #2 May 30 1:30 PM - 3:30 PM
Sex Differences in Anabolic Regulators during Development of Atrophic Pathology in Hindlimb-Unloading-Induced Disuse

Lisa T. Jansen¹, Megan E. Rosa-Caldwell¹, Wesley S. Haynie¹, Seongkyun Lim¹, Kirsten Dunlap¹, Jacob L. Brown¹, David E. Lee¹, Richard A. Perry¹, Michael P. Wiggs², Tyrone A. Washington¹, Nicholas P. Greene¹. ¹University of Arkansas, Fayetteville, AR. ²University of Texas at Tyler, Tyler, TX.

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Muscle atrophy is a comorbidity in many disease conditions, contributing to accelerated disease progression/terminal outcomes. Muscle wasting results alterations in the ratio of protein synthesis to degradation, with wasting conditions favoring degradation. Atrophic conditions differentially affect discrete muscle types. For many diseases, onset and progression of muscle atrophy presents differently between muscle fiber types and sex; **PURPOSE:** To assess gene content outcomes of three established anabolic regulators Pgc-1α4, IGF-1, and Deptor, in female and male mice during initiation and progression of disuse atrophy across multiple fiber types. **METHODS:** 100 female and male C57BL/6J mice were hindlimb unloaded for 0h, 24h, 48, 72 and 168h, to induce muscle atrophy. At assigned endpoints, soleus and gastrocnemius muscles were excised and processed for mRNA analysis of Pgc-1α4, IGF-1, and Deptor using RT-PCR. Data were analyzed by one-way ANOVA within

each sex, α=0.05. Pre-planned contrast comparisons determined sex differences at each time point, α=0.01. **RESULTS:** Soleus and gastrocnemius masses presented lower at 24h in female (-11.8%, -9%; p<0.05) and 48h in male (-16%, -13%; p<0.05) compared to control. In predominantly type I soleus, Pgc-1α4 mRNA content showed a decline from control across time in females, while spiking >9, >6-fold in males at 72h and 168h (p<0.05). In contrast, IGF-1 showed higher content in females at 72h and 168h (+77%, +27%; p<0.05) than males. In gastrocnemius, a more mixed fiber type, Pgc-1α4 content was 3-fold higher in females at 24h (p<0.05). Female IGF-1 content was significantly elevated compared to male at 72h (p<0.05). Deptor content in gastrocnemius was >3-fold from baseline at 24h in females and >2-fold from baseline at 48h in males (p<0.05) depicting the only mRNA content change aligning with the observed time course for appearance of loss in muscle mass. **CONCLUSION:** Anabolic regulator responses to atrophic stimuli differ across sex, muscle tissue and time course of muscle atrophy. These early findings could suggest Deptor as a novel therapeutic target to ameliorate muscle wasting conditions.

Supported by NIH Grant R15 AR069913/AR/NIAMS.Sponsoring Fellow: Stavros A. Kavouras; stavros.kavouras@asu.edu

1589 Board #3 May 30 1:30 PM - 3:30 PM
Similar Central and Peripheral Fatigue in Men and Women after Running

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(No relevant relationships reported)

PURPOSE: Women may be less fatiguable than men during prolonged endurance exercise. There are a paucity of studies which have compared fatigue in both sexes after moderately long duration running typical of marathon-type training. **METHODS:** We compared sex differences in peripheral and central fatigue in 8 men and 6 premenopausal women runners. Volunteers [38±2 and 32±2 yrs, p=0.017; VO_{2peak} 59±3 and 54±3, ml/kg/min, p=0.202, men vs women respectively] ate a standardized breakfast [6 Kcal/kg] 90 minutes prior to commencing testing. Water was provided at 1% of body mass/hr, during a 2-hr run at their ventilatory threshold [~65% VO_{2peak}], followed by a self-paced 2-km time trial. RPE and respiratory measures were determined every 20 minutes. Strength was tested in a semi-reclined position [75° hip flexion, to facilitate femoral nerve stimulation] pre-exercise, after the 2-hr run and post-time trial as follows: voluntary isometric quad strength was measured on the Biodex with the knee flexed 60°, and with superimposed peripheral magnetic stimulation [PMS] of the femoral nerve to determine central activation [CAR]. PMS was also applied in a 3-second pulse train on a relaxed muscle to measure peripheral fatigue. Changes in strength and in metabolic measures were analyzed with repeated measures ANOVA.

RESULTS: Following running, voluntary strength declined by ~16% in both sexes [effect of time p<0.001; sex X time p=0.206]. CAR also decreased in both men and women [effect of time p=0.020, time X sex p=0.762]. PMS-stimulated forces, our measure of peripheral fatigue, were unchanged after running: there was no effect of time [p=0.10] in men or women [time X sex, p=0.322]. Substrate use and RPEs did not differ between sexes.

CONCLUSIONS: We found that both sexes fatigued similarly after a 2-hr run plus a 2-km time trial, and that all of the fatigue was central in nature. While women may be more fatigue-resistant than men, those differences might not be apparent until a greater duration of running is engaged in, e.g. ultramarathon distances.

1590 Board #4 May 30 1:30 PM - 3:30 PM
The Effects Of Swimming On Bone Density In Female Collegiate Swimmers.

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(No relevant relationships reported)

Swimming provides numerous health benefits, but as a non-weight bearing activity research suggests it provides no constructive benefits on bone strength at dual energy x-ray absorptiometry (DXA)-measured hip and lumbar spine sites. However, little research has focused on skeletal sites stressed during swimming such as the upper arm. Purpose: To determine potential site-specific bone strength adaptations at the humerus among collegiate swimmers compared to sedentary controls.

Methods:

Bone geometry and strength were assessed by peripheral quantitative computed tomography (pQCT) in ten collegiate female swimmers (BMI 23 kg/m²; mean 13.9±1.5 pool hours/week) and ten sedentary controls (BMI 24 kg/m²; <150 minutes/week of physical activity) ages 18-23 years. Total volumetric bone mineral density (vBMD, mg/mm³) and total bone area (ToA, mm²) were assessed at the distal (4%) tibia. Cortical bone area (CoA, mm²), cortical density (vBMD), cortical thickness

(CoTh, mm), bone bending strength (polar strength-strain index (SSIp, mm³) were measured at the midshaft (66%) tibia, humerus (50%), and radius 33% sites. Using DXA areal BMD (g/cm²) was assessed at the hip, humerus and radius sites.

Results:

There were no significant between-group differences in DXA outcomes at any site. PQCT-derived outcomes are presented in Table 1. At the 66% tibia site the control group had a 14.8% greater CoA and 6.1% greater CoD compared to swimmers (both $p < 0.05$). However, no significant bone strength differences were found at the humerus, radius, or distal tibia sites.

Table 1: pQCT-derived Outcomes.

	Swim	Control	Significance ($p < 0.05$)
Radius 33%			
Cortical Area (CoA, mm ²)	78.4±3.4	85.0±3.6	0.215
Cortical Density (vBMD, mg/cm ³)	1191.3±8.6	1163.6±9.1	0.051
Cortical Thickness (CoTh, mm)	3.1±0.1	3.5±0.1	0.097
SSIp (mg/mm ⁴)	215.4±13.2	227.0±14.0	0.574
Humerus 50%			
Cortical Area (CoA, mm ²)	178.0±6.8	172.5±7.2	0.596
Cortical Density (vBMD, mg/cm ³)	1170.5±12.3	1173.0±13.0	0.890
Cortical Thickness (CoTh, mm)	4.1±0.1	4.0±0.2	0.856
SSIp (mg/mm ⁴)	886.0±55.2	868.5±58.4	0.835
Tibia 66%			
Cortical Area (CoA, mm ²)	270.1±13.5	313.2±14.2	0.045
Cortical Density (vBMD, mg/cm ³)	1074.4±8.0	1143.1±8.4	0.000
Cortical Thickness (CoTh, mm)	4.6±0.2	5.0±0.2	0.179
SSIp (mg/mm ⁴)	2121.5±134.2	2178.6±134.3	0.764
Tibia 4%			
Total Area (ToA, mm ²)	139.4±25.4	141.6±26.9	0.953
Total Density (vBMD, mg/cm ³)	507.0±35.5	538.1±38.5	0.571

Conclusion:

Our results showed that swimming does not appear to improve bone microarchitecture or strength, even at loaded sites such as the humerus. This data suggests that swimming should be supplemented with weight-bearing and resistance exercises to preserve bone strength. Future research should investigate whether site-specific bone adaptations occur at skeletal sites not yet measured.

1591 Board #5 May 30 1:30 PM - 3:30 PM Sex Differences in Recovery from Extreme and Severe Intensity Exercise

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(No relevant relationships reported)

Previous protocols investigating neuromuscular fatigue have typically discarded the first 2 of 6 electrical stimulation sets in recovery and have reported the average of the remaining force values. However, our lab has recently shown that central (as measured by maximal voluntary contraction force, MVC; and voluntary activation, VA) and peripheral fatigue (as measured by potentiated twitch force, Q_{tw}) had significantly recovered within 90 s following extreme intensity exercise and would otherwise be missed using contemporary protocols. **PURPOSE:** The purpose of this study was to test the hypothesis that MVC, VA, and Q_{tw} immediately following task failure of extreme intensity exercise would be significantly lower than those measured 2 min into recovery in both men and women, while remaining suppressed following severe exercise.

METHODS: Two men (26 ± 5 yrs; 109 ± 9 kg; 179 ± 1 cm) and two women (23 ± 2 yrs; 55 ± 3 kg; 159 ± 1 cm) performed 2 intermittent isometric knee extension tests to exhaustion at 40% (severe intensity) and 70% (extreme intensity) MVC in random order. Neuromuscular measurements were made every 30 s beginning immediately

after task failure for a total of 6 sets. The last two MVC, VA, and Q_{tw} were averaged and compared to the first measurement immediately following task failure using paired t-tests.

RESULTS: Q_{tw} and MVC significantly decreased following severe and extreme exercise ($p < 0.01$). However, VA was not different across severe or extreme exercise. VA was not different across recovery following severe or extreme exercise. MVC was not different following severe, however, had increased following extreme ($p = 0.02$) exercise. Q_{tw} was significantly recovered after severe ($p < 0.01$) and extreme ($p < 0.02$) exercise. Further, qualitative analysis suggests women may be able to recover MVC and Q_{tw} faster than men following extreme exercise, while these differences may not be evident following severe exercise.

CONCLUSIONS: These current data suggest central fatigue (as measured by VA) does not significantly impact exercise tolerance during severe or extreme exercise. Importantly, these data suggest that the measurements typically used to represent the condition of the muscle are taken too far post-exercise such that much of the recovery of the muscle has already occurred, especially following extreme exercise.

1592 Board #6 May 30 1:30 PM - 3:30 PM Skeletal Responses To An All-female Unsupported Antarctic Expedition

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(No relevant relationships reported)

Arduous training can result in an energy deficit, the consequences of which include impaired bone health and increased stress fracture risk, as determined by acute interventional or cross-sectional studies. Women are more prone to stress fractures than men, and possibly more susceptible to metabolic perturbations associated with reduced energy availability. No study has longitudinally examined the effect of a prolonged severe energy deficit on bone in women. **Purpose:** To investigate the skeletal effects of the first all-female trans-Antarctic expedition. **Methods:** Six women (mean ± SD, age 32 ± 3 years, height 1.72 ± 0.07 m, body mass 72.1 ± 3.8 kg) each hauled an 80 kg sledge over 1700 km in 61 days from coast-to-coast across the Antarctic. Whole-body areal bone mineral density (aBMD) (dual energy x-ray absorptiometry) and tibial volumetric BMD (vBMD), geometry, microarchitecture and mechanical properties (high-resolution peripheral quantitative computed tomography) were assessed 39 days before (pre-expedition) and 15 days after (post-expedition) the expedition. Serum and plasma markers of bone turnover were assessed pre-expedition, and 4 and 15 days after the expedition. **Results:** There were reductions in trunk (−2.6%), ribs (−5.0%) and spine (−3.4%) aBMD from pre- to post-expedition (all $P \leq 0.046$); arms, legs, pelvis and total body aBMD were not different (all $P \geq 0.075$). Tibial vBMD, geometry, microarchitecture and mechanical properties at the distal metaphysis (4% site) and diaphysis (30% site) were not different between pre- and post-expedition (all $P \geq 0.082$). Bone-specific alkaline phosphatase was higher 15 days post- than 4 days post-expedition (18.0 vs 16.3 $\mu\text{g}\cdot\text{L}^{-1}$, respectively, $P = 0.028$). Total 25(OH)D decreased markedly from pre- to 4 days post-expedition (112 vs 76 nmol·L⁻¹, respectively, $P = 0.008$). Sclerostin, procollagen 1 N-terminal propeptide, C-telopeptide cross-links of type 1 collagen and adjusted calcium were unchanged (all $P \geq 0.154$). **Conclusion:** The deleterious effect of the expedition on aBMD may be due to indirect and direct effects of prolonged energy deficit on bone turnover. We propose that weight-bearing exercise was protective against the effects of low energy availability on tibial vBMD, geometry, microarchitecture and strength.

Supported by UK Ministry of Defence (Army)

1593 Board #7 May 30 1:30 PM - 3:30 PM BMI as a Predictor of Bone Mineral Density Among Premenopausal Women

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(No relevant relationships reported)

Bone mineral density is an important women's health topic. Osteoporosis is one of the most common bone diseases and is expected to affect more than 61 million people in the U.S. by the year 2020. According to the International Osteoporosis Foundation, low body weight is associated with greater bone loss and increased fracture risk. Body Mass Index is a commonly assessed physical characteristic which has also been linked with bone health and could be a useful tool in osteoporosis prevention (Asomaning, Bertone-Johnson, Philip, Hooven, Pekow, 2006). Much of the existing research has historically focused on postmenopausal groups. **PURPOSE:** The purpose of this study was to assess whether BMI was a significant predictor of bone mineral density (BMD) among a group of premenopausal women. **METHODS:** A total of 42 premenopausal women (38.69 ± 7.95 years) participated in this study. Anthropometric

data were collected and BMD (g/cm²) was measured at the hips and lumbar spine with a Hologic dual energy x-ray absorptiometry (DEXA) machine. **RESULTS:** Significant correlations ($p < .05$) were found between lumbar spine and hip BMD, and BMI ($r = .33, p = .031$), ($r = .35, p = .022$) respectively. Regression analysis confirmed that BMI was a statistically significant predictor of BMD for both the hips $F(1,41) = 5.71, MSE = .02, p = .022, Adj. R^2 = .10$ and lumbar spine $F(1,41) = 5.02, MSE = .03, p = .031, Adj. R^2 = .09$. **CONCLUSIONS:** Among this group of premenopausal women, BMI was positively correlated with, as well as being a significant predictor of BMD at the hips and lumbar spine. Medical and fitness professionals may find it useful to advise clients about the importance of having a healthy BMI value not only for the management and prevention of obesity but also for healthy bone mineral density and osteoporosis prevention. Future research might establish more clear guidelines for the use of BMI as it relates to osteoporosis risk among men and women. IRB# 1213-0223

- 1594** Board #8 May 30 1:30 PM - 3:30 PM
Dynapenic Abdominal Obesity And The Incidence Of Falls In Older Women: An 18-month Follow-up Study
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 (No relevant relationships reported)

PURPOSE: To assess the association between dynapenic abdominal obesity (DAO) and the incidence of falls over 18 months in older community-dwelling women.

METHODS: A total of 188 older women (67.97 ± 6.02 years; 27.70 kg/m^2) underwent waist circumference (WC) measurement and had handgrip strength assessed at the dominant arm using a hydraulic dynamometer. Dynapenia was classified using the lower tertile of handgrip strength as cut-off value (20.7 kgf), while obesity was considered as a $WC > 88 \text{ cm}$. DAO was the combination of both aforementioned criteria. Therefore, volunteers were divided into 4 groups: Eutrophic, Dynapenic, Obese, and DAO. Participants were tracked by phone calls for ascertainment of falls during a follow-up period of 18 months. Chi-square and modified Poisson regressions were conducted.

RESULTS: Proportions of each classification were 17.6%, 46.8%, 13.3%, and 22.3% for eutrophic, obese, dynapenic, and DAO, respectively. The incidence of falls over 18-month follow-up period was 24.5%. Thus, the proportion of fallers regarding each classification were 12.1%, 12%, 25%, and 40.5% for eutrophic, dynapenic, obese, and DAO, respectively ($X^2 = 10.662$; $p = 0.014$). Noteworthy, only DAO was consistently associated with a higher risk of falls (relative risk: 3.339; 95% CI: 1.242-8.979), even after adjustments for age, body mass index, physical activity level, regular use of four or more medications, reduced peripheral sensation, presence of two or more chronic diseases, and history of lower-limbs pain.

CONCLUSIONS: These results provide support for the concept that the combination of abdominal obesity and dynapenia has clinical implications and might be an useful supplement to other routine falls risk assessment tools. These relationships were stronger than obesity or dynapenia alone.

D-09 Thematic Poster - Physical Activity & Behavioral Science during Pregnancy and Motherhood

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
 Room: CC-102B

- 1595** Chair: Sofiya Alhassan, FACSM. University of Massachusetts, Amherst, MA.
 (No relevant relationships reported)

- 1596** Board #1 May 30 1:30 PM - 3:30 PM
Baseline Correlates Of Sedentary Behavior In The Health In Pregnancy And Postpartum (HIPP) Study
 Sara Wilcox, FACSM¹, Jihong Liu¹, Brent Hutto¹, Ellen Wingard¹, Gabrielle Turner-McGrievy¹, Judith Burgis², Alycia Boutté¹, Lara Schneider¹. ¹University of South Carolina, Columbia, SC. ²University of South Carolina School of Medicine, Columbia, SC.
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 (No relevant relationships reported)

Despite the benefits of physical activity and the potential risks of sedentary behavior (SB), few studies have examined sensor-measured SB in pregnant women.

PURPOSE: To report SB in a sample of women in early pregnancy and examine associations with sociodemographic and psychological variables.

METHODS: We analyzed baseline data from the HIPP trial, a RCT enrolling SC women who are <16 wks gestation, overweight or obese, white or African American, 18 to 44 yrs old, and without exercise contraindications. Participants wore a SenseWear armband ≥ 20 hrs/d for ≥ 5 days (including ≥ 1 weekend day). SB was defined as MET values < 1.5 . Total time in non-sleep SB, # of SB bouts ≥ 30 min, and total time in SB bouts ≥ 30 min were calculated. Differences in SB by parity, race, education, marital status, and employment (t-tests), as well as BMI, age, depressive symptoms, perceived stress, and satisfaction with body function and appearance (Pearson rs) were tested.

RESULTS: To date, participants ($n=202$) randomized with usable armband data are 12 ± 2 wks gestation, 42% nulliparous, 30 ± 5 yrs old, 45% African American, 53% obese, 59% college educated, 67% married, and 61% employed full-time. On average, participants spent 12.0 ± 1.7 hrs/d in non-sleep SB, representing 51% of total wear time and 75% of wake time. They averaged 6.2 ± 1.9 SB bouts/d that were ≥ 30 min and spent 5.7 ± 2.3 hrs/d in these bouts. Total SB time, SB time in ≥ 30 min bouts, and # of SB bouts ≥ 30 min were greater in African American ($p < .0001$), obese ($p < .0001$), and unmarried ($p < .01$) women, and in those without a college degree (total time & # bouts, $p < .05$). All three SB variables were strongly and positively associated with BMI ($rs = .48$ to $.53$, $p < .0001$). SB time in ≥ 30 min bouts and # of SB bouts ≥ 30 min were positively associated with depressive symptoms ($rs = .15$, $p < .05$) and negatively associated with satisfaction with body function ($rs = -.17$, $p < .05$). SB variables did not differ by parity, employment, age, perceived stress, or satisfaction with body appearance.

CONCLUSIONS: Total SB time, SB time in ≥ 30 min bouts, and # of SB bouts ≥ 30 min appear to be high in early pregnancy, with these behaviors of particular concern in several demographic subgroups. SB was also related to more negative psychological experiences. Interventions to target SB could benefit pregnant women. Funded by NIH/NICHD.

- 1597** Board #2 May 30 1:30 PM - 3:30 PM
Sensor-measured Physical Activity In Overweight And Obese Women In Early Pregnancy
 Jihong Liu¹, Sara Wilcox, FACSM¹, Ellen Wingard¹, Brent Hutto¹, Gabrielle Turner-McGrievy¹, Judith T. Burgis², Alycia Boutté¹, Lara Schneider¹. ¹University of South Carolina, Columbia, SC. ²University of South Carolina's School of Medicine, Columbia, SC.
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 (No relevant relationships reported)

Overweight and obese pregnant women may benefit from physical activity (PA) in pregnancy, yet few studies have examined sensor-measured PA in pregnancy.

PURPOSE: To evaluate sensor-measured PA in overweight and obese pregnant women and its sociodemographic and psychological correlates.

METHODS: We analyzed baseline data from an ongoing behavioral lifestyle intervention trial in Columbia, SC ($n=202$). PA was measured with the SenseWear Armband; compliance was set at wearing for $20+$ hrs/d, $5+$ days (including $1+$ weekend day). PA measures were daily duration of light PA (LPA), moderate to

vigorous PA (MVPA), daily steps, and meeting MVPA guidelines (≥ 150 min/wk of MVPA in ≥ 10 min bouts). PA was presented as median (interquartile range). Subgroup differences in medians were examined with quantile regression models. Correlations of PA measures with perceived stress, depressive symptoms, PA social support, PA self-efficacy, and PA self-regulation were studied. A logistic regression model was used to examine correlates of meeting MVPA guidelines.

RESULTS: Participants (mean of 12.4 weeks gestation) had a median of 203 (154, 258) min/d LPA, 34 (20, 49) min/d MVPA, and 4,870 (3768, 6590) steps/d. LPA, MVPA, and steps were lower in African American and obese women ($p < .05$). LPA was lower in nulliparous women ($p < .05$). Participants with less than college education had lower MVPA and steps ($p < .05$). Further, LPA, MVPA, and steps were positively associated with PA self-efficacy (r 's ranging from 0.13 to 0.16, $p \leq .05$) and PA goal setting (r 's ranging from 0.16 to 0.21, $p < .05$). MVPA was positively associated with PA planning ($r = 0.16$, $p < .05$). Only 10.4% of participants met MVPA guidelines, which was more prevalent in white (17.1%) vs African American (2.2%) women and in overweight (17.9%) vs obese women (3.7%) ($p < .05$). After adjusting for age, parity, and marital status, white women and overweight women had higher odds of meeting MVPA recommendation than their counterparts: white: 5.8 (1.2-28.6); overweight: 5.2 (1.6, 16.9).

CONCLUSION: Sensor-measured PA was low in overweight and obese pregnant women in early pregnancy with significant differences by race, education, parity, and pre-pregnancy weight status. Programs targeting PA are needed for this population. Funded by NIH/NICHD.

1598 Board #3 May 30 1:30 PM - 3:30 PM
The Association Between Type and Intensity of Physical Activity on Cortisol Levels Among Low-Income, Ethnic-Minority Mothers

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(No relevant relationships reported)

Physical activity has been linked to many health benefits such as reduced cardiovascular disease risk. Furthermore, the health benefits of intensity and type of activity varies (e.g., vigorous aerobic activity reducing cardiovascular risk more than moderate). During parenthood, mothers can experience increased levels of stress, such as the stress hormone cortisol, and are also less likely to engage in physical activity compared to other populations. However, few studies have focused on mothers and on the impact of type and intensity of physical activity on their cortisol levels.

PURPOSE: The current pilot study examined whether different types and intensities of physical activity (walking, housework, fitness, recreational, occupational, and miscellaneous activity; moderate and vigorous activity) were associated with cortisol patterns among 30 low-income, ethnic-minority mothers (57% average annual income $< \$20,000$; 53% Latina) and whether this association varied by the number of children the mothers had. **METHODS:** The majority of our sample were sedentary with only 3% meeting the national recommendations of daily aerobic activity (> 30 minutes or more of moderate to vigorous aerobic activity). Mothers completed an activity log of their physical activity over three days. During this three-day period, mothers also collected their saliva at four times on one collection day (upon waking time, 30 minutes after waking, 4pm, and 8pm) to assess for cortisol levels. **RESULTS:** Multiple regression analyses found that mothers who engaged in greater minutes of vigorous recreational activity had higher cortisol levels, but only among mothers with more children ($\beta = 1.65$, $t(21) = 2.40$, $p = 0.03$). Additionally, mothers who engaged in greater minutes of moderate or vigorous miscellaneous (e.g., heavy lifting) activity had higher cortisol levels, but only among mothers with more children ($\beta = 6.93$, $t(21) = 3.12$, $p = 0.01$). No significant association was found with other types of activity. **CONCLUSION:** Despite the benefits of physical activity, results suggest that low-income, ethnic minority mothers with more children are not receiving these benefits and that number of children may be a stressor. Future research should consider family size when designing and implementing physical activity interventions in this population.

1599 Board #4 May 30 1:30 PM - 3:30 PM
Self-regulation Capacity Of Low-income Mothers In Community-based Nutrition Program

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(No relevant relationships reported)

Diet is strongly associated with many risk factors for chronic disease. Educational programs such as the Expanded Food and Nutrition Education Program (EFNEP) are designed to improve dietary behaviors among low-income populations. Although EFNEP has seen improvements, they do not yet meet recommendations. Self-

regulation is the process of guiding thoughts, feelings, and behaviors to stay in line with perceived goals. Previous studies have been successful in eliciting behavior change when improving self-regulation in conjunction with dietary education.

PURPOSE: The purpose of this study was to examine self-regulation in EFNEP participants and its relationship to participants change in dietary behavior.

METHODS: All participants were currently enrolled in EFNEP and were asked to complete an additional self-regulation survey. This survey included five questions on a Likert scale from 1-5, with 5 indicating high self-regulation. These were averaged to assess overall self-regulation capacity pre- and post-program. Fruit and vegetable intake were measured using EFNEP's current diet-recall survey.

RESULTS: On average, the participants had low levels of self-regulation both pre- and post-intervention (2.74 ± 0.71 and 2.59 ± 0.78 , respectively). Regarding vegetable intake, there was no statistically significant change from pre- to post-program (1.51 ± 1.36 and 1.42 ± 1.32 cups, respectively). However, there was a statistically significant different regarding fruit intake, increasing from 0.86 ± 0.94 to 1.39 ± 1.39 cups per day. Neither fruit nor vegetables increased to MyPlate recommendations.

CONCLUSIONS: Participants self-regulation capacity was on average low, and did not increase from pre- to post-program. Results also indicate that fruit and vegetable intake did not reach MyPlate recommendations. From these results, we can conclude that self-regulation training may be a necessary supplement to the program to see improvements in the participants dietary behavior.

1600 Board #5 May 30 1:30 PM - 3:30 PM
Physical Activity Does Not Moderate the Relationship Between Postpartum Body Satisfaction and Depressive Symptoms

Faith C. LaFramboise, Rebecca A. Schlaff, Samantha J. Deere, Meghan Baruth. *Saginaw Valley State University, University Center, MI.*

(No relevant relationships reported)

Postpartum depressive symptoms (PDS) are common among U.S. women and may be related to postpartum body image satisfaction (BIS). The effect of postpartum moderate to vigorous intensity physical activity (MVPA) on this relationship is less studied. **PURPOSE:** To examine the relationship between postpartum BIS and PDS, and to examine whether MVPA moderates this relationship. **METHODS:** Non-pregnant women who were ≤ 12 months postpartum and ≥ 18 years of age completed an online survey. Participants ($n=256$) self-reported 1) demographics, 2) pre-pregnancy height and weight, 3) current BIS via Body Attitudes Questionnaire (BAQ; six subscales: attractiveness, feeling fat, disparagement, strength and fitness, salience of weight/shape, and lower body fat), 4) PDS via the 10-item Center for Epidemiologic Depression Scale (CES-D), and 5) postpartum MVPA. Relationships between BAQ subscales and PDS were examined using linear regression, controlling for months postpartum. MVPA and the BAQ x MVPA interaction were added to the model to examine the moderating effects of MVPA on the relationship between postpartum BIS and PDS. An alpha level of 0.05 was used to determine statistical significance. **RESULTS:** On average, participants were 30.3 ± 3.9 years of age and 5.6 ± 3.8 months postpartum. A majority of the sample were Caucasian (96.1%), married (89.9%), and college graduates (75.2%). Four BAQ subscales were positively related to PDS (disparagement: $p < 0.0001$, feeling fat: $p < 0.0001$, salience: $p < 0.0001$ and lower body fatness: $p = 0.005$); two were inversely related (attractiveness: $p = 0.0007$ and strength and fitness: $p = 0.003$). MVPA did not moderate the relationship between BIS and PDS (BAQ subscale x MVPA interactions: attractiveness: $p = 0.7998$, disparagement: $p = 0.8842$, feeling fat: $p = 0.4515$, salience: $p = 0.1311$, lower body fatness: $p = 0.9376$, and strength and fitness: $p = 0.7429$). **CONCLUSION:** Postpartum BIS may be a significant factor that predicts PDS; however, our findings indicate that MVPA may not moderate this relationship. Future intervention research should include strategies that promote positive body image during the postpartum period. Although not a moderator, efforts aimed at promoting PA should continue, as it has numerous other benefits to pregnant and postpartum women.

1601 Board #6 May 30 1:30 PM - 3:30 PM
Impact of Weight Related Variables on Postpartum Depressive Symptoms

Samantha J. Deere, Meghan Baruth, Rebecca A. Schlaff. *Saginaw Valley State University, University Center, MI.*

(No relevant relationships reported)

Postpartum mental health issues are common, yet predictors are less understood. Pre-pregnancy weight and weight change during pregnancy through the postpartum period may be associated with postpartum mental health issues. **PURPOSE:** To investigate the associations between postpartum depressive symptoms and 1) pre-pregnancy body mass index (BMI), 2) weight gain during pregnancy, 3) weight loss at 6 months postpartum, and 4) postpartum weight retention (PPWR). **METHODS:** Women ($n=323$) who gave birth within the past 12 months completed an online survey assessing demographics, self-reported pre-pregnancy weight and height (to calculate pre-pregnancy BMI), weight gain during pregnancy, weight loss at 6 months

postpartum (to calculate weight retention at 6 months), and current weight (to calculate PPWR). The 10-item Centers for Epidemiological Studies Depression Scale (CES-D 10) measured postpartum depressive symptoms. Regression models examined the relationship between postpartum depressive symptoms and 1) pre-pregnancy BMI, 2) weight gain during pregnancy (controlling for pre-pregnancy BMI), 3) weight loss at 6 months postpartum (controlling for weight gain), and 4) PPWR (controlling for months postpartum). **RESULTS:** On average, women were 30.1 ± 3.9 years of age and 5.5 ± 3.7 months postpartum. Mean pre-pregnancy BMI was 27.5 ± 6.8 kg/m², and weight gain was 29.8 ± 14.1 pounds. A majority were Caucasian (97%), married (88%), and college graduates (77%). Results showed a significant, positive relationship between postpartum depressive symptoms and 1) pre-pregnancy BMI ($p=0.04$) and 2) PPWR ($p=0.04$). A significant negative relationship was identified between postpartum depressive symptoms and weight loss at 6 months ($p=0.01$). There was no significant relationship between postpartum depressive symptoms and weight gain during pregnancy ($p=0.93$). **CONCLUSION:** Women with a higher pre-pregnancy BMI, higher PPWR, and lower weight lost at 6 months postpartum, may be at a greater risk for postpartum depressive symptoms; weight gain during pregnancy was not associated with postpartum depressive symptoms. Understanding factors associated with postpartum depressive symptoms can help develop and implement appropriate screenings/follow-ups and interventions among those at greatest risk.

1602 Board #7 May 30 1:30 PM - 3:30 PM
Joint Influence Of Physical Activity And Quality Of Sleep On Pregnancy - Related Anxiety

Emma K. Wilsie¹, Christopher P. Connolly¹, Zoe Wright Osborn¹, Maria Gartstein¹, Sara Waters². ¹Washington State University, Pullman, WA. ²Washington State University, Vancouver, WA.

(No relevant relationships reported)

Pregnancy-related anxiety (PRA) is experienced by many women, given the physical and psychosocial challenges common during pregnancy and the prospect of childbirth. Some health behaviors, such as physical activity and quality of sleep (QS), are related to decreased PRA, but their joint influence is unclear. **PURPOSE:** We examined the individual and joint influences of physical activity behaviors and QS on PRA among pregnant women at two locations. **METHODS:** Third-trimester pregnant women ($N=33$) participated in a series of measurements between 28-36 weeks gestational age. Participants answered questions recalling their moderate and vigorous physical activity (min/wk) for pre-pregnancy, in the first and second trimesters, and concurrently. Moderate to vigorous physical activity (MVPA) was calculated for pre-pregnancy and for each trimester. Participants also wore a validated physical activity monitor (Modus StepWatch) for one week, and average steps/day were calculated. QS was evaluated with the Pittsburgh Sleep Quality Index (PSQI), calculating a global score. The Pregnancy Related Anxiety Questionnaire (PRAQ-R) was used to assess women's anxiety regarding childbirth and the health of the baby. Median split was used to categorize PRA as "high" [≥ 15.0 PRA scale] or "low" [< 15.0]. Mann-Whitney U-tests were used to compare the distribution of MVPA for all timepoints, steps/day, and also QS between high and low PRA participants. Hierarchical logistic regression determined the joint influence of MVPA and quality of sleep on PRA. **RESULTS:** Mann-Whitney U-tests showed lower PRA participants had significantly superior third trimester global QS scores [$p=0.048$]. Likewise, global QS scores were related to increased odds of high PRA [$\beta=1.34$, 95% CI: 0.99-1.80]. Average steps/day and self-reported MVPA prior to pregnancy and at all pregnancy timepoints were not related to PRA. Hierarchical analyses did not reveal an interactive effect of steps/day and QS or MVPA and QS on PRA as hypothesized. **CONCLUSIONS:** Lower QS is related to higher PRA during the third trimester of pregnancy. Physical activity was not related to PRA and interactive effects with QS on PRA were not found. Larger samples are needed to confirm these findings.

D-10 Thematic Poster - Physical Activity Interventions in the Modern Age

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
 Room: CC-102A

1603 Chair: Jeremy Loenneke, FACSM. The University of Mississippi, University, MS.

(No relevant relationships reported)

1604 Board #1 May 30 1:30 PM - 3:30 PM
Effects of Four Types of Physical Activity Courses on College Students' Perceived Stress, Well-Being, and Social Support

Zhonghui He¹, SenLin Chen², Weiyun Chen³, Linchen Kong⁴. ¹Peking University, Beijing, China. ²Louisiana State University, Baton Rouge, LA. ³University of Michigan, Ann Arbor, MI. ⁴University of Virginia, Charlottesville, VA.
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(No relevant relationships reported)

PURPOSE: Physical activity participation is associated with mental health benefits. The primary purpose of this study was to examine the effects of four types of physical activity classes on college students' perceived stress, well-being, and social support. The secondary purpose was to compare effects by gender and year of study. **METHODS:** The sample consisted of 548 college students (Males: $n=294$; Age: $M=20.72$ years old) who were voluntarily enrolled in the four types of courses in an academically prestigious university: fitness, team sports, net and individual sports, and Tai-Chi. They responded to validated scales to assess perceived stress (Sheldon Cohen, 1983), well-being (Diener & Biswas-Diener, 2009), and social support (Zimet, Dahlem et al., 1988) at three weeks prior to the start and then in the 15th week of the semester. **RESULTS:** Significant decreases were observed for perceived stress in all groups: fitness group ($\Delta M=-0.79$, $p<0.01$), team sports group ($\Delta M=-0.76$, $p<0.01$), net and individual sports group ($\Delta M=-0.77$, $p<0.01$) and Tai-Chi group ($\Delta M=-0.57$, $p<0.01$). Females experienced a greater drop in perceived stress than males ($\Delta M=0.08$, $p<0.01$). Significant increase in well-being was observed in three types of courses led by team sports group ($\Delta M=1.55$, $p<0.01$) followed by fitness group ($\Delta M=1.54$, $p<0.01$), and net and individual sports group ($\Delta M=1.34$, $p<0.01$). Senior students showed greater increase in well-being ($\Delta M=2.05$, $p<0.01$) than younger students ($\Delta M=1.16$, 1.07 and 0.85, respectively). The net and individual sports groups showed decreased perceived social support by 0.22 ($p<0.01$), while no changes were observed in other groups. **CONCLUSIONS:** All four types of physical activity courses showed significant effects on perceived stress reduction (especially in female students), while three types of courses showed increase in well-being (especially in seniors). Instructors of net and individual sports courses should increase social processing to increase perceived social support.

1605 Board #2 May 30 1:30 PM - 3:30 PM
The Effects of Peer Health Coaching for Lifestyle Behavior Change Among College Students

Kathryn J. DeShaw, Gregory J. Welk, FACSM. Iowa State University, Ames, IA. (Sponsor: Gregory J. Welk, FACSM)

(No relevant relationships reported)

PURPOSE: The transition from high school to college often leads to poor health decisions such as insufficient physical activity (PA) and poor eating habits. Health coaching (HC) may be an effective strategy to promote adoption and adherence to healthy lifestyle behaviors as well as aiding in accountability for behavior change among new college students.

METHODS: A sample of 69 Freshmen and Sophomore undergraduate students were recruited from a college campus to receive peer HC sessions (79% female; age $18.6 \pm .9$; BMI 25.1 ± 5.7). Participants received 4 HC sessions in an 8-week period and were encouraged through motivational interviewing (MI) techniques to work toward self-selected goals focused on either PA, healthy dietary habits (Diet), or stress management (Stress). Changes in each lifestyle outcome were assessed pre and post using established tools (PA with the International Physical Activity Questionnaire Short-Form, diet with the Eating Habits Confidence Survey, and stress levels via the Perceived Stress Scale).

RESULTS: Three group x time repeated measures ANOVAs were conducted to investigate differences in lifestyle behavior changes based on the selected goal. It was hypothesized that changes would be greatest in students based on the targeted goal (PA: $n=37$, Diet: $n=15$, Stress: $n=17$). Significant main effects of time were observed for all three behaviors with participants having a 21.1% gain in PA ($p=0.02$), 15.3%

decline in dietary habit ($p=0.01$), and 20.4% decline in stress levels ($p=0.01$). There were no significant group by time interactions, indicating that students had similar outcomes regardless of what behavior they were targeting.

CONCLUSIONS: HC seems to be an effective strategy for promoting healthy lifestyles in college students. Students had similar gains in PA and similar declines in stress, regardless of the behavior they reported focusing on. It is not clear why confidence in sticking with dietary changes decreased over time, but this may be due to participants possibly becoming more sensitized to their dietary habits through the HC sessions. Additional research is needed to understand student reactions to peer-led HC in college settings.

1606 Board #3 May 30 1:30 PM - 3:30 PM
Per-protocol Analysis Of BILAMOS™ Dance Program On Self-reported And Device-assessed Physical Activity In Older Latinos

Guilherme M. Balbim¹, Susan Aguiñaga², Priscilla Vazquez³, Isabela G. Marques⁴, Jaqueline Guzman², Deborah Salvo⁵, David X. Marquez, FACSM¹. ¹University of Illinois at Chicago, Chicago, IL. ²University of Illinois at Urbana-Champaign, Champaign, IL. ³University of California San Diego, San Diego, CA. ⁴University of Victoria, Victoria, BC, Canada. ⁵Washington University in St. Louis, St. Louis, MO. (Sponsor: David X. Marquez, FACSM)
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 (No relevant relationships reported)

PURPOSE: Test the impact of the BILAMOS™ dance program on PA levels in older Latinos.

METHODS: Older Latino adults ($n=333$; $M_{age}=64.89\pm7.08$) were randomized into a dance ($n=167$) or health education (HE) ($n=166$) group. For purposes of per-protocol analysis, participants with attendance $\geq 75\%$ in dance and HE classes, respectively, were included. The final analytic sample was 145 participants (dance = 63, HE = 82). The dance group participated in four months of Latin dancing, two times per week for one hour per session. The HE group participated in classes once per week for two hours per session for four months. Participants completed the CHAMPS PA Questionnaire and wore an ActiGraph™ GT3X+ accelerometer for seven consecutive days on their non-dominant wrist. Data was used if the participant wore for it at least 10 hours/day over three days. Wrist cut-points utilized were proposed by Kamada (2016) (moderate-to-vigorous PA (MVPA) ≥ 7500 counts per minute). We performed a fixed-intercept mixed model ($p < .05$), adjusting for baseline covariates of age, sex, education, income, and health status. Cohen's d effect sizes were computed.

RESULTS: Self-reported MVPA (minutes) increased significantly ($t(1, 120)=3.2$, $p=0.002$) from baseline (Dance: $M=140.81\pm211.35$; HE: $M=115.48\pm182.65$) to month-4 (Dance: $M=29.11\pm20.45$; HE: $M=23.21\pm18.27$), but no group*time interaction was demonstrated ($t(1, 121)=1.33$, $p=0.19$, $d=0.22$). Total leisure-time PA (LTPA) (minutes) increased significantly from baseline (Dance: $M=280.50\pm285.35$; HE: $M=360.71\pm361.05$) to month-4 (Dance: $M=579.72\pm346.10$; HE: $M=500.34\pm483.04$), with significant group*time interaction ($t(1, 121)=2.16$, $p=0.03$, $d=0.33$). Accelerometer-assessed MVPA did not increase significantly from baseline (Dance: $M=24.43\pm22.67$; HE: $M=22.51\pm17.91$) to month-4 (Dance: $M=29.11\pm20.45$; HE: $M=23.21\pm18.27$) and there was no group*time interaction ($t(1, 112)=1.53$, $p=0.13$, $d=0.43$).

CONCLUSIONS: The BILAMOS® dance program showed a positive impact on self-reported LTPA. This impact was not observed in device-assessed PA, however, there was a moderate effect. Supported by NIH Grant 1R01NR013151-01.

1607 Board #4 May 30 1:30 PM - 3:30 PM
Reducing the Uncertain Geographic Context Problem in Physical Activity Research: The Houston TRAIN Study

Deborah Salvo¹, Casey P. Durand², Erin E. Dooley³, Ashleigh M. Johnson³, Abiodun Oluyomi⁴, Kelley P. Gabriel, FACSM³, Alexandra E. van den Berg³, Adriana Perez³, Harold W. Kohl III, FACSM³. ¹Washington University in St. Louis, Saint Louis, MO. ²The University of Texas Health Science Center at Houston, Houston, TX. ³The University of Texas Health Science Center at Houston, Austin, TX. ⁴Baylor College of Medicine, Houston, TX. Email: dsalvo@wustl.edu
 (No relevant relationships reported)

PURPOSE: The Uncertain Geographic Context Problem (UGCP) arises when studying the effect of static area-level factors (e.g. parks within walking distance from home) on individual-level outcomes, like physical activity. The UGCP is largely due to temporal uncertainty, as people may spend significant portions of the day outside of

the geographic area captured by static spatial measures. The aim of this study was to determine if spatial exposure indicators for physical activity research are improved by including measures of both the home and work neighborhood environments.

METHODS: Baseline data from the Houston TRAIN Study were used ($n=153$). Participant home and work addresses were geocoded, and two spatial exposure indicators were built per location: transit stops within 1.25 Km, and parks within 2.25 Km (counts). A categorical variable was built for each feature, with four levels based on median splits: high access at home & work, high access at home & low access at work, low access at home & high access at work, and low access at both locations. Weekly minutes of moderate to vigorous physical activity (MVPA) were measured with wGT3X-BT Actigraph monitors using Freedson cut-points. Linear regressions estimated the association between the combined 'home plus work' access variables and MVPA. Models were adjusted for sex, age, education, and race/ethnicity.

RESULTS: Relative to the 'low-low' group, having high access to transit in both the home and work neighborhood was associated with 3.7 ± 1.2 additional weekly minutes of MVPA ($p=0.039$). Similarly, those having high access to parks both in their home and work neighborhood had 2.5 ± 1.9 ($p=0.044$) more weekly minutes of MVPA than those with low access in both locations. Having high transit or park access only in one of the two studied neighborhood locations was not significantly associated with MVPA ($p>0.05$).

CONCLUSIONS: When examining the effect of both transport and leisure related urban infrastructure on MVPA, the UGCP is improved by incorporating measures of both the home and work environment. Pending confirmatory studies, our results suggest that approaches exclusively focused on improving the built environment of residential neighborhoods may have limited impact on physical activity. A citywide, systems level approach may be warranted. Supported by NIH R01DK101593

1608 Board #5 May 30 1:30 PM - 3:30 PM
Developing a National Network of Physical Activity Promotion: The Case of Germany

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 Email: stefan.peters@dvgs.de

Reported Relationships: S. Peters: Salary; Stefan Peters works for the DVGS, which is one of the actors in physical activity promotion that have been a central part of the presented research.

PURPOSE: Physical activity supports the health of human beings of every age group in various ways. However, the worldwide prevalence of physical inactivity is high and many people do not reach the amount of physical activity that is recommended by physical activity guidelines. National Action Plans (NAPS) and Initiatives try to counteract this situation but have not always been successful. To support targeted measures in such NAPs, it is necessary to gain knowledge of relevant actors, professionals groups and multipliers as well as their structural connection. In Germany, an explorative study addressed 2 goals accordingly: (1) the identification of relevant actors, professional groups and multipliers of physical activity promotion, and (2) the analysis of structural relations among these actors as well as the formulation of recommendations for the sustainable development of a national network of physical activity promotion.

METHODS: Qualitative expert interviews, a subsequent network visualization and an analysis for network development were carried out.

RESULTS: It became apparent that the field of actors in the area of physical activity promotion is very heterogeneous and extensive with regard to different forms of actors, sectors of society and administrative levels. Overall, 128 actors were identified, of which 22 actors are considered to hold key positions. Concerning the multipliers, 19 current and 17 potential ones were identified. Structural relations among actors are sparse.

CONCLUSIONS: For carrying out a network development of physical activity promotion, various prerequisites, benefits, and barriers were revealed. Subsequently, recommendations that contribute to the development and effective governance are presented. The study provides a first detailed consideration of the structure of physical activity promotion in Germany and thereby offers a perspective, which can also inform NAPS around the globe.

1609 Board #6 May 30 1:30 PM - 3:30 PM
Exercise Interventions Improve Drug Abstinence at an In-Patient Rehabilitation Center

Emily L. Roessel¹, J. Mark VanNess¹, Mercedes K. Steidley¹, Ryan C. Bain², Courtney D. Jensen¹. ¹University of the Pacific, Stockton, CA. ²Tree House Rehabilitation, Orange County, CA.
 (No relevant relationships reported)

Exercise training likely enhances coping skills and sobriety among patients with substance use disorder. Better examination of the mechanisms producing these changes may help identify more effective interventions. **PURPOSE:** To test the effect

of a vigorous exercise prescription on drug abstinence in voluntary rehabilitation patients. **METHODS:** 25 male subjects in a drug treatment program underwent a 12-week intervention, which included cardiovascular exercise, resistance training, and supportive psychotherapy. Five days a week, subjects were asked to participate in either yoga with mindfulness practices or action-based induction therapy lasting two hours; there was also a 90-minute exercise boot camp. Data collected were exercise adherence, exercise performance, sobriety and relapse rates, and an assessment of emotional coping skills. Chi-squared tests and t-tests compared exercisers to non-exercisers; logistic and linear regressions tested the effect of exercise behavior on measurements of coping and sobriety. **RESULTS:** Subjects had experienced frequent relapse (5 ± 8 episodes) prior to the current admission. Across the sample, 84% were sober on completion of the program, 8% relapsed during treatment, and 36% relapsed after treatment. During the program, 84% exercised regularly, 68% practiced yoga, and 60% followed a disciplined diet. Bench press max improved over the program (39%; $p < 0.001$), as did squat max (55%; $p < 0.001$) and deadlift max (70%; $p < 0.001$). Among patients who exercised regularly, 91% were sober on completion compared to 50% of patients who did not engage in regular exercise ($p = 0.043$). Owing to a small sample of patients who relapsed during treatment ($N = 2$), the difference in exercisers who relapsed during treatment (5%) and non-exercisers who relapsed (25%) was not significant ($p = 0.171$). Following treatment, 29% of exercisers and 75% of non-exercisers relapsed ($p = 0.076$). The odds of successfully managing adverse emotional states when they arose increased 20-fold in subjects who exercised regularly ($p = 0.036$). Each additional session of yoga per week predicted a 20-day increase in the longest duration of sobriety ($p = 0.016$). **CONCLUSION:** Exercise appears to exert a positive effect on drug and alcohol sobriety and coping skills in a population that struggles with frequent relapse.

1610 Board #7 May 30 1:30 PM - 3:30 PM
Effectiveness Of Aerobic Exercise Programs For Health Promotion In Metabolic Syndrome

Felix Morales Palomo, Miguel Ramirez-Jimenez, Juan Fernando Ortega, Ricardo Mora-Rodriguez. *UCLM, Toledo, Spain.*
(No relevant relationships reported)

The effects of different modalities of aerobic training on cardiorespiratory fitness (CRF) and metabolic syndrome (MetS Z-Score) have been previously studied in patients with different cardiometabolic diseases. Continuous (Jonhson et al., 2007) and interval (Mora-Rodriguez et al., 2014) training have been shown to be effective to improve MetS Z-Score. On the other hand, a recent metanalysis suggest that high-intensity interval training (HIIT) may be superior to traditional moderate intensity continuous training (MICT) to improve CRF (Milanovic et al., 2015) even when programs were matched by total work performed. However, to our knowledge no study has compared the capacity of three training modalities on improving MetS Z-Score and CRF in middle-aged MetS patients with low initial levels of CRF.

PURPOSE: To compare the improvement in CRF and MetS- Z-score of 3 modalities of aerobic exercise. **METHODS:** One hundred and twenty-one MetS patients (age, 57 ± 8 yr; weight, 92 ± 15 kg and MetS factors, 4 ± 1 components) with low initial CRF (VO_{2PEAK} , 24.0 ± 5.5 mL·kg⁻¹·min⁻¹) were randomized to undergo one of the following 16 week exercise program: a) 4x4-min high-intensity interval training at 90% of HR_{MAX} (4HIIT group; $n = 32$), b) 50-min moderate-intensity continuous training at 70% of HR_{MAX} (MICT group; $n = 35$), c) 10x1-min HIIT at 100% of HR_{MAX} (1HIIT group; $n = 32$) or d) no exercise control group (CONT; $n = 22$). We measured the evolution of all five MetS components (i.e., MetS Z-Score) and CRF (assessed by VO_{2PEAK}) before and after intervention. **RESULTS:** MetS Z-score decreased -41% after 4HIIT and -52% in MICT (both $P < 0.01$) whereas it did not change in 1HIIT and CONT group (-24%; $P = 0.21$ and 20%; $P = 0.22$, respectively). However, the three exercise groups improved similarly their VO_{2PEAK} (4HIIT 11%; MICT 12% and 1HIIT 14%; all $P < 0.001$). **CONCLUSION:** Our findings suggest that in sedentary individuals with MetS and low initial CRF level any of the three aerobic training modalities which were compared, provide sufficient stimulus to raise CRF. However, the more intense but shorter 1HIIT training program is not effective on improving MetS Z-Score and thus, its recommendation for health promotion purposes in this population should be done with caution.

1611 Board #8 May 30 1:30 PM - 3:30 PM
Use Of A Smartphone App To Improve Physical Activity In Insufficiently Active Adults: A Feasibility Sequential Multiple Assignment Randomized Trial (SMART)

Victor Z. Dourado¹, Bárbara Gonze¹, Maria do Socorro Simões¹, Neli Proença¹, Evandro Sperandio¹, Wesley Vieira¹, Vinícius Lauria¹, Marcello Romiti², Antônio Gagliardi², Rodolfo Arantes², Ricardo Padovani¹. ¹Federal University of Sao Paulo (UNIFESP), Santos, Brazil. ²Angiocorpore Institute of Cardiovascular Medicine, Santos, Brazil.
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(No relevant relationships reported)

The SMART design allows changes in the intervention during the research period. Despite its potential and feasibility for defining the best sequence of interventions, so far it has been utilized in a smartphone/gamified intervention for physical activity. **PURPOSE:** To investigate the effects of a SMART design on the behavior of the average number of steps/day in a smartphone app intervention for physical activity in insufficiently active adults. **METHODS:** We conducted a feasibility 24-week/2-stage SMART in which 18 insufficiently active participants (< 10000 steps/day) were first randomized to Group 1 (smartphone app only), Group 2 (smartphone app + tailored messages) and a control group. Participants were asked to increase at least 2000 steps/day on average each week. Based on the 12-week intermediate outcome, responders kept their interventions and non-responders were rerandomized to a subsequent treatment. In group 3 (Smartphone app + gamification), participants were instructed to form groups to use several game elements available in the chosen application (Pacer®). We fit linear regressions for each participant with the relationship between weeks and steps/day. We considered responders those with any positive slope at the end of the 1st stage intervention. We compared the accelerometer-based steps/day before and after the intervention as well as the slopes of the app-based steps/day between the 1st and second stages of treatment. **RESULTS:** Twelve participants, five controls, finished the intervention. We identified two responders in group 1. We did not observe significant changes in the steps/day neither throughout the intervention nor compared to the control group. However, the rerandomization of the five non-responders was able to change the slope of the steps/day of a median, -198 steps/day (interquartile range, -279 to -103) to 20 steps/day (-204 to 145), $p = 0.079$. Finally, we observed in three participants in the group 2 an increase in the number of steps/day up to the sixth week and then an inflection to the baseline values or even lower (i.e., a quadratic relationship). **CONCLUSIONS:** The SMART design was feasible and changed the behavior of the steps/day after rerandomization. Our results suggest that the rerandomization should be implemented earlier to take advantage of the tailored messages.

D-11 Thematic Poster - Running Injuries

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
 Room: CC-101B

1612 Chair: Allison H. Gruber. Indiana University Bloomington, Bloomington, IN.

(No relevant relationships reported)

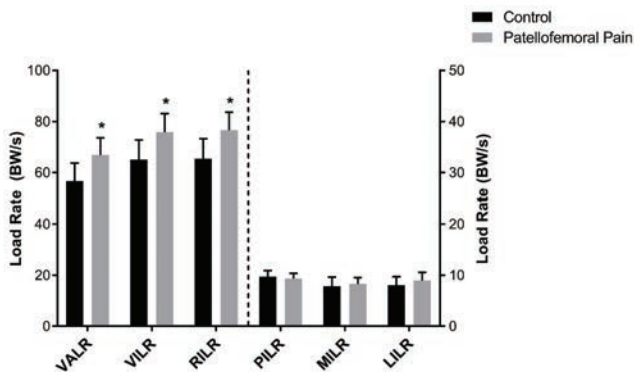
1613 Board #1 May 30 1:30 PM - 3:30 PM
Increased Ground Reaction Force Load Rates In Runners With Active Patellofemoral Pain

Caleb D. Johnson, Jereme Outerleys, Julia M. Reilly, Adam S. Tenforde, Irene S. Davis, FACSM. *Harvard University, Cambridge, MA.* (Sponsor: Dr. Irene Davis, FACSM)
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(No relevant relationships reported)

Increased vertical ground reaction force load rates have been associated with running injuries, and specifically with tibial stress fractures and plantar fasciitis. Inconsistent findings have been reported regarding the role of load rates in runners with patellofemoral pain (PFP), one of the most common injuries in runners. Limited studies in this patient population have been performed and prior investigators did not examine components of load rates beyond the vertical component. **PURPOSE:** To compare vertical, resultant, posterior, medial and lateral load rates, and peak vertical forces in runners with active PFP to healthy controls. **METHODS:** 30 runners with active PFP (16F, 14M, 40.2 ± 12.8 yrs, 67.5 ± 10.0 kg) and 30 healthy controls (CON) (18F, 12M, 34.8 ± 10.9 yrs, 70.4 ± 14.0 kg), all habitual rearfoot strikers, completed an instrumented treadmill assessment at a self-selected speed. Controls were matched for speed (PFP = 2.50 m/s, CON = 2.51 m/s). Load rates (vertical average and instantaneous

(VALR, VILR), resultant instantaneous (RILR), posterior instantaneous (PILR), medial instantaneous (MILR) and lateral instantaneous (LILR)) over the first 25% of stance and normalized to bodyweights. Peak vertical ground reaction forces (vGRF) were calculated over all of stance. Values were averaged across 10 consecutive strides. The injured leg was analyzed for the PFP group, and the right/left leg was randomly selected and counterbalanced for CON. **RESULTS:** Runners in the PFP group showed significantly higher mean VALR ($p=0.036$, $d=0.56$), VILR ($p=0.040$, $d=0.54$) and RILR ($p=0.036$, $d=0.55$) than CON. No differences were found in PILR ($p=0.668$), MILR ($p=0.193$), and LILR ($p=0.367$) (Figure 1), or in peak vGRF (Mean difference=0.03 BW, $p=0.458$). **CONCLUSION:** Runners with active PFP exhibit higher vertical and resultant load rates.

Figure 1. Mean load rates between patellofemoral pain and control groups



- VALR, VILR, RILR plotted on left axis; PILR, MILR, and LILR plotted on right

1614 Board #2 May 30 1:30 PM - 3:30 PM
Effects Of Running Biomechanics On The Occurrence Of Iliotibial Band Syndrome- A Prospective Study

Qipeng Song, Peixin Shen. *Shandong Sport University, Jinan, China.*

(No relevant relationships reported)

Iliotibial band syndrome (ITBS) is the second most common running injury, accounts for 1.6%-12% of all running-related injuries. The exact etiology of ITBS is unclear, but gait and posture are considered one of the factors. Most of studies on ITBS were retrospective cross-sectional in design and could not elaborate on the pathogenesis of ITBS.

PURPOSE: This prospective study aimed to determine the gait characteristics that easily induce ITBS and explore the posture changes after the occurrence of ITBS. **METHODS:** 15 ITBS-stricken runners (I group) and matched 15 healthy runners (C group). All participants underwent two gait trials, namely, before the first day of running (trial1) and after 8-week running (trial2). An eight-camera motion capture system was used to collect kinematic data. Sub-group comparisons were assessed via respective 95% confidence intervals of mean difference.

RESULTS: In trial2, the ITBS group exhibited greater peak anterior pelvic tilt and hip flexion angle than the control group (Fig1a). The ITBS group showed increased peak trunk inclination angle, whereas the control group demonstrated lower peak hip flexion (Fig1b) and peak hip adduction than those at trial1 (Fig1c).

Fig1. Comparison of joint activity between the two groups

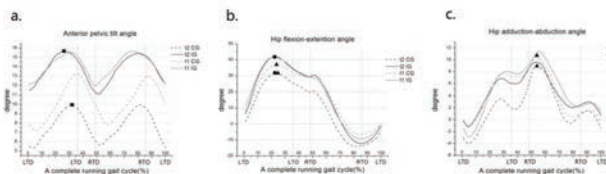
■ ■ Represent significant differences between the two groups in trial 2.

▲ ▲ Significant differences in the control group compared with trial 1.

Abbreviation: t1: trial1; t2: trial2; LTD=left foot touch down; LTO=left foot take off; RTD=right foot touch down; RTO=right foot take off;

CONCLUSION: Decreasing the peak hip flexion and peak hip adduction angle may be a reasonable strategy to avoid the occurrence of ITBS. Occurrence of ITBS may be due to the lack of timely gait adjustment. The posture of excessive trunk inclination and anterior pelvic tilt may be a risk factor in the development of ITBS during running.

This work was supported by the Project of Shandong Science & Technology Department (2017G006044).



1615 Board #3 May 30 1:30 PM - 3:30 PM
Achilles Tendon Loading Patterns During A 30-minute Steady-state Run In Patients With Achilles Tendinopathy

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(No relevant relationships reported)

Achilles tendinopathy is an overuse injury that commonly sidelines runners. During rehabilitation, return-to-sport (RTS) decisions are made with minimal guiding evidence. With reinjury rates as high as 44%, evidence is needed to improve clinical decisions. Aberrant loading patterns while running may partially explain reinjury rates.

PURPOSE: To determine if Achilles tendon loading patterns change during a 30-minute steady-state run in patients with Achilles tendinopathy and explore relationships between loading patterns and kinesiophobia.

METHODS: 12 runners (7M) with Achilles tendinopathy were included (age: 44 ± 11 y; height: 171 ± 10 cm; mass: 70 ± 12 kg; VISA-A score: 71 ± 10 ; current mileage: 40 ± 29 km/wk). Participants ran for 30 minutes at their endurance pace (2.9 ± 0.3 m/s) on an instrumented treadmill with retroreflective markers affixed to their lower limbs and feet. After a 6-minute familiarization period, marker trajectories and ground reaction forces were sampled during the 7th and 29th minute. Data was reduced to 10 gait cycles bilaterally. Sagittal plane ankle joint angles, moments and powers were calculated and a previously described musculoskeletal model was used to estimate Achilles tendon loads. Tampa Scale for Kinesiophobia (TSK) quantified the degree of kinesiophobia.

RESULTS: On the injured side, there was a significant decrease in peak concentric ankle power (7th min: 4.9 ± 1.0 W/kg·m; 29th min: 4.7 ± 1.1 W/kg·m; $p=0.02$) and peak dorsiflexion (7th min: $23.4 \pm 3.9^\circ$; 29th min: $22.7 \pm 3.7^\circ$; $p=0.02$), but no changes in peak plantarflexion moment, peak eccentric power, Achilles tendon peak load, loading rate or impulse ($p=0.12-0.65$). No changes occurred on the uninjured side ($p=0.17-0.90$). There were significant relationships between the TSK scores (32 ± 7) and changes in Achilles tendon impulse, peak concentric ankle power, and peak plantarflexion moment ($r=-0.66-0.60$; $p=0.02-0.04$), indicating increased unloading of the injured side during the run in patients with higher degree of kinesiophobia.

CONCLUSIONS: Ankle joint power and motion change during a 30-minute steady-state run in patients with Achilles tendinopathy. Additionally, changes in loading patterns are associated with kinesiophobia.

1616 Board #4 May 30 1:30 PM - 3:30 PM
Flexor Hallucis Brevis Morphology is Associated with Visual Reliance While Balancing in Previously Injured Runners

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(No relevant relationships reported)

Running related injuries to the foot and lower leg are pervasive and thought to be due to poor plantar intrinsic muscle (foot core) function. Previously injured runners have decreased cross sectional area (CSA) and thickness of the flexor hallucis brevis (FHB) and increased reliance on visual information while balancing relative to uninjured runners. However, it remains unknown if FHB morphology is associated with an increased reliance on visual information. **PURPOSE:** To determine if visual reliance while balancing is associated with FHB morphology in those with a history of running related injuries. **METHODS:** Twenty-four runners with foot and/or leg running injuries within the past three years but were currently asymptomatic (age: 21.66 ± 2.44 years, mass: 66.84 ± 10.03 kg, height: 169.21 ± 19.34 cm, runs per week: 4.37 ± 1.30 , miles per week: 14.16 ± 8.88) volunteered. Three, 10-second eyes open and eyes closed single leg stance trials on the injured limb were recorded. Center of pressure velocity (cm/s) for each condition was used to calculate %-modulation (%-modulation = [(eyes open eyes closed)/eyes open]. Larger negative scores indicates greater reliance on visual information. While standing in a weight-bearing, subtalar neutral position, diagnostic ultrasound was used to image the FHB in a relaxed state and contracted state (while holding a short foot contraction). Images were processed to calculate CSA and FHB thickness. CSA was defined as the area (cm²) within the fascial borders of the muscle. Thickness was the distance (cm) between superior to inferior fascia perpendicular to the muscle fibers. Pearson product moment correlations determined the strength of associations and an a priori alpha level of 0.05 was used for all analyses. **RESULTS:** Larger negative %-modulation was associated with the less contracted FHB thickness ($r=0.451$, $p=0.027$) and trended towards being associated with less relaxed FHB thickness ($r=0.368$, $p=0.077$). No association was noted with the FHB CSA ($r=0.273$, $p=0.198$). **CONCLUSIONS:** In previously injured runners decreased FHB thickness is associated with an increased reliance on visual information while balancing. Short foot exercises, aimed at increased FHB strength may decrease reliance on visual information but future research is needed to confirm this hypothesis.

- 1617** Board #5 May 30 1:30 PM - 3:30 PM
Joint Moment Contributions During Flat, Incline and Decline Running in Individuals with ACLR
 Hillary H. Holmes, Katie Corona, Randall Fawcett, Jaimie A. Roper. *Auburn University, Auburn, AL*. (Sponsor: Mark Tillman, FACSMM)
(No relevant relationships reported)

PURPOSE: To compare ankle, knee and hip joint moment contributions during flat, incline and decline running between limbs in ACLR individuals.

METHODS: 9 participants (4 males, 5 females, mean age 22 ± 2 yrs) provided consent to participate. Participants ran during flat (0°), incline (10°) and decline (-10°) treadmill conditions, with predetermined speeds of 2.5m/s (0°) and 1.8m/s (10° and -10°). Kinematic and kinetic data were collected during the final 30s of each condition using 17 cameras (Vicon) and an instrumented split-belt treadmill (Bertec). Joint moment contribution percentages at the hip, knee and ankle were determined by dividing the peak, sagittal, external joint moments (N.mm/kg) by the sum of all three joint moments during stance. A 2x3 (limb x condition) ANOVA was used to evaluate interlimb differences across conditions with post-hoc Bonferroni adjustments.

RESULTS: There was no significant limb x condition interaction or main effect of limb, but there was a significant main effect of condition. Knee joint moment contributions were 35% greater in decline running when compared to incline running (50-15%), and 31% greater when compared to flat running (50-19%). Ankle contributions were 39% less in decline running when compared to incline running (24-63%) and 26% less in decline running when compared to flat running (24-50%).

CONCLUSIONS: Knee and ankle joint moment contributions are altered with flat, incline, and decline running in persons with ACLR. Individuals with ACLR did not display asymmetries in joint moment contributions between the involved and uninvolved limb.

- 1618** Board #6 May 30 1:30 PM - 3:30 PM
A Novel Approach to Investigate Running Kinematics in Achilles Tendinopathy Patients Using Inertial Sensors
 Jasper Reenalda¹, Michel Klaassen¹, Marit Zandbergen¹, Jelle Harbers¹, Roland Haalman², Gijs Lentjes², Jaap Buurke¹, Frank Backx². ¹*Roessingh Research and Development, University of Twente, Enschede, Netherlands*. ²*Utrecht University, Utrecht, Netherlands*. (Sponsor: Jos J. De Koning, FACSMM)
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(No relevant relationships reported)

Mid-portion Achilles tendinopathy (AT) is a common injury in runners. Overloading the tendon results in pain, swelling and impaired running performance. Recovery involves rest and a gradual build up. Determining whether patients can resume training is difficult and currently rather qualitative. To provide quantitative data to the physician to assist clinical decision-making, we studied the between leg differences in running kinematics for AT patients using inertial sensors in the clinical setting.

PURPOSE: To investigate lower limb kinematics in AT patients during 5 minute treadmill running in the clinic, using inertial magnetic measurement units (IMUs). **METHODS:** 4 runners diagnosed with mild unilateral AT (4M, 48.8 ± 7.5 yrs, 188.8 ± 11.2 cm, 82.5 ± 11.1 kg) performed a 5 min. treadmill run in the sports medicine clinic, as part of a larger study, with 8 IMU's at the feet, tibia, upper legs, sacrum and sternum. Ankle and knee angles were determined at initial contact (IC) and mid stance (MS). Additional parameters that were calculated were the vertical lower leg angle at IC (VLL), peak tibial impact (PTA), peak sacral impact (PSA), push-off power (POP) (lin. velocity at toe off, TO) and internal rotation (IR) of the tibia (at TO). Parameters were determined for the injured and non-injured leg at 1-min. intervals. An independent Mann-Whitney U-test was used to test for differences within patients between the injured and non-injured leg.

RESULTS:

Table 1

CONCLUSIONS: The injured leg of these AT patients showed significantly different running kinematics. AT strongly affected ankle mechanics, possibly as a compensatory strategy, indicating non-full recovery of the patients. The use of IMUs to determine the recovery of AT patients quantitatively is promising. Using IMUs there is no need for 3d optical motion capture systems or an instrumented treadmill to quantify running kinematics. Future research should follow up on these measurements to identify fully recovered patients.

Table 1 Mean values \pm standard deviation of the selected outcome parameters. Statistical differences were tested for using an independent Mann-Whitney-U-test.

	Ankle (IC) [°]	Ankle (MS) [°]	Knee (IC) [°]	Knee (MS) [°]	VLL [°]	PTA [m/s ²]	PSA [m/s ²]	POP [m/s]	IR [°]
Injured leg	5.6 \pm 3.9	26.3 \pm 3.3	23.4 \pm 3.7	40.8 \pm 4.8	2.5 \pm 3.2	82.0 \pm 18.7	29.5 \pm 4.7	0.5 \pm 0.3	-0.5 \pm 1.1
Non-injured leg	13.2 \pm 2.8	18.5 \pm 4.8	24.3 \pm 3.4	42.9 \pm 3.7	3.6 \pm 3.9	81.7 \pm 10.6	34.2 \pm 4.0	0.3 \pm 0.7	0.0 \pm 1.0
Statistical difference	P<0.05	P<0.05	P=0.05	P<0.05	P=0.05	P=0.05	P<0.05	P=0.05	<0.05

- 1619** Board #7 May 30 1:30 PM - 3:30 PM
Ankle Joint Kinetics in Runners with Medial Tibial Stress Syndrome
 James Becker¹, Louis Osternig, FACSMM², Stanley James³, Li-Shan Chou². ¹*Montana State University, Bozeman, MT*. ²*University of Oregon, Eugene, OR*. ³*Slocum Center for Orthopedics and Sports Medicine, Eugene, OR*. (Sponsor: Louis Osternig, FACSMM)
(No relevant relationships reported)

Medial tibial stress syndrome (MTSS) is a common overuse running injury. While numerous studies have reported abnormal ankle kinematics in runners with MTSS, to date, no studies have evaluated ankle kinetics in this population. **PURPOSE:** To compare ankle kinetics in runners with and without MTSS. **METHODS:** Participants included eight runners with MTSS (sex: 7M/1F; age: 35 ± 11.3 years) and eight matched controls (CON; sex: 7M/1F; age: 35 ± 8.7 years). Kinematics and ground reaction forces were recorded while participants ran overground. Sagittal plane kinetics were calculated about an axis connecting the malleoli while frontal plane kinetics were calculated about an axis approximating the 23° medially deviated and 42° inclined orientation of the subtalar joint. Joint work was calculated by integrating the joint power curves. Paired *t*-tests were used to compare peak moments, powers, and work between MTSS and CON groups. **RESULTS:** Neither peak plantar flexor (MTSS: 2.14 ± 0.53 , CON: 2.24 ± 0.57 Nm/kg) nor peak invertor (MTSS: 1.04 ± 0.34 , CON: 1.16 ± 0.32 Nm/kg) moments were different between groups ($p = .720$, $p = .472$, respectively). There were no differences in sagittal plane powers or work between groups. In the frontal plane, the MTSS group demonstrated lower peak positive power (MTSS: 1.97 ± 0.38 , CON: 3.05 ± 1.12 W/kg, $p = .021$), and performed less negative (MTSS: -0.09 ± 0.02 , CON: -0.16 ± 0.07 J/kg, $p = .032$), positive (MTSS: 0.14 ± 0.03 , CON: 0.22 ± 0.07 J/kg, $p = .039$), and total (MTSS: 0.23 ± 0.06 , CON: 0.37 ± 0.15 J/kg, $p = .032$) work. **CONCLUSIONS:** Compared to healthy individuals, runners with MTSS are not able to generate as much energy to invert their foot during late stance. This may explain why previous studies have observed runners with MTSS have prolonged rearfoot eversion during stance.

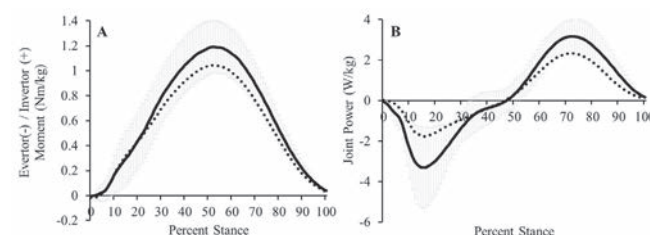


Figure 1. Frontal plane joint moments (A) and powers (B). The solid line represents the CON group and the dotted line represents the MTSS group. Error bars show one standard deviation above and below the mean curve for the CON group.

- 1620** Board #8 May 30 1:30 PM - 3:30 PM
Does Y-Balance Test Performance Predict Injury-Related Running Mechanics?
 Scott Wilson, James Becker. *Montana State University, Bozeman, MT*.
(No relevant relationships reported)

The Y-balance test is commonly used to screen for injury risk in athletic settings. However, much of the research evaluating the predictive ability of this test focuses on multidirectional sports such as football or basketball. To date there is little evidence regarding the utility of the Y balance test for unidirectional sports such as running. **PURPOSE:** Determine whether performance on the Y-balance test predicts running variables previously linked to running injury. **METHODS:** 23 Division-I collegiate distance runners (9M/14F; age: 19.6 ± 1.0 years; weekly mileage: 59.4 ± 14.6 miles) participated in this study. Whole body kinematics during the Y-balance and while running were recorded using 10 and 6 camera motion capture systems, respectively. Ground reaction forces for running were measured using an instrumented treadmill. Maximum reach in the anterior (A), posterior lateral (PL), and posterior medial (PM) directions were used to calculate Y-balance composite scores (CS). Eleven specific kinematic and kinetic running gait variables which have been previously linked to running injuries were calculated (Table 1). Linear regressions were used to determine whether Y-balance CS predicted each running gait variable. **RESULTS:** Mean Y balance CS was $0.87 (\pm 0.09)$ with maximum reach distances of 0.84 ± 0.06 , 0.93 ± 0.11 and 0.84 ± 0.06 % of leg length in the A, PL, and PM directions, respectively. Of all 11 variables, Y balance CS only significantly predicted peak knee flexion during stance phase of running, and even then only accounted for 12% of the variance (Table 1). **CONCLUSION:** Performance on the Y-balance test may not be useful for

predicting injury risk in runners as the test does not predict variables previously linked to running injuries. However, further prospective studies tracking occurrence of actual injuries as well as internal loading at common running injury sites are required to fully clarify whether the Y balance test is suitable for screening runners.

Table 1. Linear regression results comparing Y-balance CS to gait variables previously linked to running injuries, BW = bodyweight (kg), $p < 0.05^*$

Variable	p-value	R ²	Lower 95%	Upper 95%	Coefficient
Hip adduction (°)	0.68	0.004	-14.81	9.79	-2.50
Hip Internal Rotation (°)	0.21	0.035	-33.94	7.97	-12.99
Knee Flexion (°)	0.01*	0.12	3.15	34.44	18.80
Knee Adduction (°)	0.46	0.01	-24.7	11.37	-6.67
Peak Eversion (°)	0.93	0.0001	-13.18	14.31	0.57
Eversion ROM (°)	0.21	0.035	-20.73	4.81	-7.96
Peak Eversion Velocity (m/s)	0.21	0.036	-109.47	476.79	183.66
Vertical loading rate (BW • s ⁻¹)	0.52	0.009	-51.76	101.61	24.92
Hip Abductor Moment (Nm/kg)	0.52	0.009	-0.94	1.81	0.43
Hip Abductor Impulse (Nm/kg • s)	0.96	0.00007	-0.23	0.22	-0.01
Knee Abductor Moment (Nm/kg)	0.13	0.05	-0.35	2.54	1.09
Knee Abductor Impulse (Nm/kg • s)	0.58	0.007	-0.29	0.52	0.11

D-12 Thematic Poster - Soccer

Thursday, May 30, 2019, 1:30 PM - 3:30 PM
Room: CC-101A

1621 Chair: Douglas J. Casa, FACSM. University of Connecticut, Storrs, CT.

(No relevant relationships reported)

1622 Board #1 May 30 1:30 PM - 3:30 PM The Effect Of Acute Chronic Training Load Ratio On Daily Stress, Fatigue, And Soreness Level In A Ncaa Division 1 Soccer Players

Yasuki Sekiguchi¹, Ryan M. Curtis¹, Robert A. Huggins¹, Courtney L. Benjamin¹, William M. Adams², Shawn M. Arent, FACSM³, Rajat K. Jain⁴, John S. Miller⁵, Chris A. West¹, James R. Hale⁵, Douglas J. Casa, FACSM¹. ¹University of Connecticut, Storrs, CT. ²University of North Carolina at Greensboro, Greensboro, NC. ³Rutgers University, New Brunswick, NJ. ⁴Northwestern University, Evanston, IL. ⁵Penn state University, University Park, PA. (Sponsor: Douglas Casa, FACSM)
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(No relevant relationships reported)

PURPOSE: To investigate the effect of acute chronic work load ratio (ACWL) on daily stress, fatigue, and soreness throughout a collegiate men's soccer season. **METHODS:** Sixty-four male collegiate soccer players (mean±SD; age, 20±2y; body mass, 77.3±6.7kg; height, 179.9±6.4cm; VO_{2max}, 53.0±5.0ml•kg⁻¹•min⁻¹) participated in this study, which took place during the 2016 and 2017 NCAA soccer season. During each training session and match, players donned a heart rate and GPS enabled chest strap to measure training impulse (TRIMP). Daily stress, fatigue, and soreness levels were collected using 1 to 10 Likert-scales before each training session and match. ACWL was calculated for TRIMP using the ratio of the previous 7-day average to the previous 28-day average. ACWL values were categorized into three groups: low, ACWL<0.8; medium, 0.8≤ACWL<1.5; high, ACWL≥1.5. Stress, fatigue, soreness levels were transformed to corresponding z-scores to account for individual differences. One-way ANOVA with Tukey pairwise comparison was used to assess stress, fatigue, soreness levels in different ACWL groups. Mean difference (MD), 95% confidence interval (95%CI) and effect size (ES), suggested by Cohen were calculated. **RESULTS:** Stress levels were significantly higher when ACWL was high compared to low (MD=0.47, 95%CI=0.34-0.60, ES=0.44) and medium (MD=0.37, 95%CI=0.25-0.48, ES=0.28) (p=0.001). Fatigue levels were significantly higher when ACWL was high (0.36±1.15) compared to low (MD=0.56, 95%CI=0.42-0.69, ES=0.55) and medium (MD=0.38, 95%CI=0.26-0.49, ES=0.36) (p=0.001). Fatigue levels were also significantly higher when ACWL was medium compared to low (MD=0.18, 95%CI=0.07-0.29, ES=0.20, p=0.001). Soreness level was significantly higher when ACWL was high compared to low (MD=0.51, 95%CI=0.37-0.64, ES=0.49) and medium (MD=0.38, 95%CI=0.26-0.50, ES=0.31) (p=0.001). **CONCLUSIONS:** ACWL could impact daily stress, fatigue, and soreness levels. A large change in ACWL (≥1.5) was associated with moderate to large changes in stress, fatigue, and soreness levels compared to low ACWL. Thus, ACWL may be used to manage athlete's daily stress, fatigue, and soreness levels and optimize periodization. However, other factors should be also considered, such as sleep.

1623

Board #2

May 30 1:30 PM - 3:30 PM

Sleep Quality Effects Mood, Anxiety And Disablement In Division I National Collegiate Athletic Association Men's Soccer Players

Courtney L. Benjamin¹, Ryan M. Curtis¹, Robert A. Huggins¹, Yasuki Sekiguchi¹, William M. Adams², Shawn M. Arent, FACSM³, Rajat K. Jain⁴, John S. Miller⁵, Bruin C. Armwald⁵, Jason M. Pullara⁴, Douglas J. Casa, FACSM¹. ¹Korey Stringer Institute at the University of Connecticut, Storrs, CT. ²University of North Carolina at Greensboro, Greensboro, NC. ³Rutgers University, New Brunswick, NJ. ⁴Northwestern University, Evanston, IL. ⁵Penn State University, University Park, PA. (Sponsor: Douglas Casa, FACSM)
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(No relevant relationships reported)

PURPOSE: To examine differences in mood, anxiety and physical health measurements between individuals who reported good sleep quality and individuals who reported poor sleep quality. **METHODS:** 110 male collegiate soccer players (mean±SD; age, 20±2y; body mass, 77.1±6.7kg; height, 179.9±6.3cm; VO_{2max}, 54.0±4.7ml•kg⁻¹•min⁻¹) participated in this study. During the 2016 and 2017 NCAA soccer seasons, the Pittsburgh Sleep Quality Index (PSQI), Profile of Mood States (POMS), Sports Anxiety Scale (SAS), and Disablement in the Physically Active Scale (DPA) questionnaires were administered at various timepoints throughout the season. Groups were classified as those who reported good sleep quality (PSQI ≤ 4) and those who reported poor sleep quality (PSQI ≥ 5). Multi-level linear mixed models were used to assess differences between a fixed sleep quality factor. Individual and time point were added as random intercepts to account for variance associated with these factors. Statistical significance was set a priori p<0.05. Results are reported as mean difference (MD) and effect size (ES). **RESULTS:** 47.4% of PSQI results yielded scores ≥ 5. Individuals with good sleep quality had significantly lower levels of depression (MD=-2.68, ES=-0.39; p<0.001), tension (MD=-1.36, ES=-0.33; p<0.001), anger (MD=-2.09, ES=-0.33; p<0.001), fatigue (MD=-1.95, ES=-0.56; p<0.001), confusion (MD=-1.26, ES=-0.38; p<0.001) and total mood disturbance (MD=-9.11, ES=-0.39; p<0.001) than those who reported poor sleep quality. Individuals who reported good sleep quality had significantly less concentration disruption (MD=-0.45, ES=-0.25; p=0.01) than those who reported poor sleep quality. Individuals who reported good sleep quality scored significantly lower on the DPA (MD=-2.73, ES=-0.26; p=0.01), indicating improved physical function and well-being, compared to those who reported poor sleep quality. **CONCLUSION:** Poor sleep quality is prevalent (almost 50%) in this sample of collegiate soccer players. Athletes with poor sleep quality appear to have increased negative mental health outcomes and higher ratings on a disablement scale. Establishing student-athlete wellness monitoring programs may provide a tailored approach to improve the collegiate athlete experience.

1624

Board #3

May 30 1:30 PM - 3:30 PM

The Influence of Match Congestion, Load and Wellness on Injury Risk in Collegiate Men's Soccer

Robert A. Huggins¹, Ryan M. Curtis¹, Courtney L. Benjamin¹, Yasuki Sekiguchi¹, Erin B. Wasserman², David A. Klossner³, William M. Adams⁴, Shawn M. Arent, FACSM⁵, Rajat K. Jain⁶, S. John Miller⁷, Matthew J. Armistead⁷, Stephen M. Borchik⁸, Christopher D'Andrea⁵, Andrew P. Landry⁹, Tyler Sylvester⁶, Alan J. Walker⁵, Douglas J. Casa, FACSM¹. ¹Korey Stringer Institute, University of Connecticut, Storrs, CT. ²Datalys Center for Sports Injury Research and Prevention, Indianapolis, IN. ³University of Maryland, College Park, MD. ⁴University of North Carolina at Greensboro, Greensboro, NC. ⁵Rutgers University, New Brunswick, NJ. ⁶Northwestern University, Evanston, IL. ⁷Penn State University, University Park, PA. ⁸University of North Carolina at Greensboro, Greensboro, NC. ⁹University of Connecticut, Storrs, CT. (Sponsor: Douglas J. Casa, FACSM)
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(No relevant relationships reported)

The impact of match congestion, training load (TL), perceived stress, fatigue and soreness on the odds of injury remains unclear. **PURPOSE:** To examine the influence of: 1) days rest between matches on injury rate (IR) and odds of injury and; 2) TL on injury, perceived stress, fatigue and soreness. **METHODS:** A prospective multi-site study tracked daily exposures, TL (distance and duration), injury and perceptual data from six Division I NCAA men's soccer teams in one season. Overall and non-contact (NC) IRs expressed per 1000 athlete exposures (AEs), and odds ratios (OR) were determined by days before and after matches. Associations between injury and changes in both TL and perception were analyzed using a multilevel logistic regression. **RESULTS:** 132 players experienced 116 injuries in 125 matches and 75 injuries in 301 practices. Overall match and practice IRs (per 1000AEs [95%CI]) were 47.9 [39.1,

56.6] and 12.7 [9.8, 15.5], respectively. Match IRs [range = 0.0 to 57.9] were highest 1 to 5 days [range = 1 to 12] from the last match. While insignificant ($p > 0.21$), match IRs were highest 3 days between matches (IR = 57.9 [39.0, 76.8]). Players were at increased odds of being injured in a match with 1 to 5 days since the last match vs. 6+ days (OR [95% CI] = 1.85 [1.10, 3.12]). Practice IRs were highest in the preseason (IR = 26.8 [13.2, 40.3]). Players were at increased odds of being injured in practice 3 and 4 days before vs. 1 day before (OR = 6.19 [3.03, 12.66] and 3.89 [1.92, 7.88]). Players were at increased odds ($p < 0.001$) of feeling fatigue (> 5) (OR = 7.04 [3.75, 13.21]) and soreness (> 5) (OR = 4.00 [2.17, 7.37]) in practice with 1 vs. 6 days since the last game. For each additional 3500m covered on a day, odds of NC injury, stress, soreness and fatigue increased (OR = 1.70 [1.38, 2.10], 1.16 [1.02, 1.31], 1.55 [1.40, 1.72], 1.69 [1.52, 1.89]), respectively. For each additional hour of activity on a day, odds of NC injury, stress, soreness and fatigue increased (1.83 [1.59, 2.12], 1.08 [0.97, 1.20], 1.28 [1.17, 1.39], 1.34 [1.22, 1.47]), respectively. **CONCLUSION:** Days between matches and acute TL increases on a given day had a negative impact on odds of injury and perception. The odds of getting injured in a match were greater with 1 to 5 days vs. 6+ days between matches. These data may be used to inform and guide the NCAA in determining optimal scheduling and recovery.

1625 Board #4 May 30 1:30 PM - 3:30 PM
Effect of Two Regimes of Sled Sprinting on 40m Sprint Performance in Collegiate Soccer Players

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 (No relevant relationships reported)

Speed is one of the most important factors dictating athletic performance especially in field based team sports including soccer. Sports performance coaches continue to design training programs to enhance this ability. In addition to lower body resistance training and plyometrics, one method that is frequently employed is resisted sprinting (RS). However, data concerning the efficacy of RS is equivocal and there is much debate over the proper resistance to prescribe. Previous research has been conducted at loads near 10% of body weight (BW), but recent studies suggest the optimal load for power output in RS is 70 - 80% BW. **Purpose:** The purpose of this study was to compare the effects of two 5wk RS programs varying in load on sprint performance and jumping ability in male collegiate soccer players. **Methods:** At baseline, 20 collegiate male soccer players performed testing of 40m-sprint performance with split times at 10m and 20m and broad jump. They were matched and separated into a heavy RS group ($n=10$) or light RS group ($n=10$). Over a 5 wk period, they performed 10 sessions of progressive RS at 70-80% or 10-20% BW. Athletes simultaneously participated in 3 d/wk of full body resistance training and 2 d/wk of soccer specific conditioning. Sprint and jump testing performance tests were repeated 72 h after the final training session. **Results:** Results showed a significant effect of time for the 20m ($p=0.005$) and 40m distances ($p=0.008$) as well as for the broad jump ($p=0.002$). 10m sprint times remain unchanged ($p > 0.05$) and there was no group \times time interaction for any variable. Very large effects were seen for 20m (2.82 ± 0.1 s to 2.77 ± 0.11 s) and 40m performance (5.02 ± 0.2 s to 4.95 ± 0.2 s) in response to heavy RS training, with a huge effect seen for broad jump. Large effects were seen at the 20m (2.85 ± 0.07 s to 2.81 ± 0.1 s) and 40m (5.02 ± 0.15 s to 4.97 ± 0.2 s) distances after light RS training, with medium effects seen in 10m sprint times and broad jump. **Conclusion:** A 5-week RS intervention significantly improves sprinting performance and broad jump in collegiate soccer players irrespective of magnitude of resistance, which suggests that both light and heavy RS is efficacious to enhance these outcomes.

1626 Board #5 May 30 1:30 PM - 3:30 PM
The Dose-Response Relationship of Neuromuscular Training to Prevent Lower Extremity Injuries in Young Soccer Players. A Cluster Randomised Controlled Trial

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 (No relevant relationships reported)

The regular execution of neuromuscular training has been shown to reduce injuries of the lower extremities in youth athletes. However, to date there are inconsistent results on the dose-response relationship of neuromuscular training. **Purpose:** The aim of this study was to evaluate the optimal duration of neuromuscular training to prevent injuries of the lower extremities in young soccer players. **Methods:** 342 (15.4 \pm 1.7 years) male soccer players were included in the study, and cluster-randomized into two intervention groups. Both groups completed the same soccer specific warm-up program (FIFA 11+) twice a week, but for a different duration: one intervention group (INT10, $n=175$) twice a week for 10 minutes, the other (INT20, $n=167$) twice a week for 20 minutes. The player exposure hours (hrs) were collected monthly over six months during one soccer season. Primary outcome was the incidence of lower extremity (LE) injuries. Secondary outcomes were injury type, severity, mechanism and compliance to

the intervention. **Results:** During the entire season 123 young soccer players sustained a total of 145 lower extremity injuries (INT 10: 55; INT 20: 90). (INT 10: 55; INT 20: 90). No significant group difference was found between INT10 (6.37 per 1000 hrs) and INT20 (7.20 per 1000 hrs) for the relative risk of injuries of the lower extremities (RR= 1.03, 95 % confidence interval 0.59, 1.79), nor for the distribution of injury location, type, severity, mechanism or conditions. **Conclusion:** The results suggest that performing preventive exercises for 10 minutes is just as effective as a performance of 20 minutes. Consequently, the implementation of a neuromuscular training for 10 minutes twice a week seems to be sufficient to reduce injuries of the lower extremities in young male football players.

1627 Board #6 May 30 1:30 PM - 3:30 PM
Importance of Position in Highly Talented Soccer Players: Peripheral Perception, Selective Attention and Reaction Abilities

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The importance of sports-specific cognitive and perceptual skills in soccer has already been examined in various studies (Ward & Williams, 2003). However, the role of general perceptual-cognitive abilities and the relation of position is not clarified in detail (Schumacher et al., 2018).

PURPOSE: To analyze the relation of position to peripheral perception, selective attention and reaction abilities in highly talented soccer players.

METHODS: 147 highly talented male soccer players (14.8 ± 2.6 yrs, age range 11 to 23 years) were involved. The subjects performed computer-based selective attention, peripheral perception and reaction tests (using Vienna Test System). In the peripheral perception test stimuli were presented left and right sided. The soccer players were subdivided into offensive player group (OPG: striker, midfielder) and defensive player group (DPG: goalkeeper, defender). They were recruited from a youth academy of a professional soccer club and played at the highest and 2nd highest national soccer competition for their age. Group differences were tested using the student t-test.

RESULTS: Significant differences for position groups were observed, with regard to correct answers (OPG: 216.1 ± 32.0 ; DPG: 231.3 ± 26.0) in selective attention test ($t(140) = 3.05$, $p < 0.01$) and peripheral reaction time left (OPG: 0.71 ± 0.09 sec; DPG: $.67 \pm 0.10$ sec) in peripheral perception test ($t(141) = 2.32$, $p < 0.01$). No differences were found for variables in the reaction test.

CONCLUSIONS: Our results indicate that defender and goalkeeper outperform striker and midfielder in general selective attention tasks and in peripheral reaction tasks left sided. Additional research is needed to further clarify position-specific differences between left and right peripheral reaction time of highly talented soccer players.

1628 Board #7 May 30 1:30 PM - 3:30 PM
NCAA Preseason Demonstrates Greatest Impact on Heart Rate Variability, Training Load and Sleep In Men's Soccer

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PURPOSE: The purpose of this study was to compare training load (TL), sleep, heart rate variability (HRV) and resting (RHR) by season phase over a full NCAA collegiate men's soccer season. **METHODS:** Daily TLs (duration [min], distance covered [m], time spent in heart rate $> 80\%$ of the individual's max [min], number of sprints [n], and distance covered while running > 14.4 km \cdot h $^{-1}$ [m]) were monitored in 31 male NCAA Division 1 male soccer athletes (mean \pm SD; age, 20 ± 2 y; body mass, 79.92 ± 6.69 kg; height, 181.48 ± 6.35 cm; $\dot{V}O_{2max}$, 50.87 ± 4.38 ml \cdot kg $^{-1}\cdot$ min $^{-1}$) using GPS-enabled player tracking devices during the Fall 2016 soccer preseason (PRE), regular season (REG), and post-season (POST). Sleep duration (min), sleep efficiency (%), and RHR and HRV z-scores (SD) were tracked using a multi-sensor wrist-worn device and a validated self-reported sleep questionnaire (Karolinska Sleep Diary). Linear mixed effects models with a fixed factor of season phase and a random factor of participant was used. Mean differences (MD) were assessed post-hoc with a Tukey HSD, with alpha set at 0.05 for all analysis. **RESULTS:** During PRE, participants experienced an increased distance (1527 ± 177 m), time (31 ± 3 min) and sprints (8 ± 1) (all $p < 0.001$) per session vs. REG, and increased distance (1793 ± 312 m), time (39 ± 6 min) and sprints (9 ± 1) per session vs. POST (all $p < 0.001$). A decrease in sleep efficiency was observed during PRE vs. REG (MD = $-2.00 \pm 0.05\%$; $p = 0.004$). Self-reported sleep duration during REG was longer vs. PRE (MD = 45 ± 8 min; $p < 0.001$) and POST (MD = 32 ± 12 min; $p = 0.01$). No differences were observed for objective sleep duration or RHR at any point throughout the season ($p > 0.05$). RHR was found to be lower during PRE vs. REG (MD = -0.16 ± 0.06 SD; $p = 0.02$). Finally, HRV during

REG was reduced vs. PRE (MD = -0.14 ± 0.06 SD; $p = 0.05$). **CONCLUSION:** This study indicates higher HRV, greater physical and physiological loading, decreased self-reported sleep and decreased sleep efficiency during PRE compared to REG. In this men's soccer team, PRE training was associated with significantly increased physical stress, adverse sleep characteristics and increased HRV. These responses should be considered when designing and implementing optimal training and recovery strategies.

1629 Board #8 May 30 1:30 PM - 3:30 PM
Relationship between the Different Energy Substrates and Skin Temperature Response in Professional Soccer Players

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(No relevant relationships reported)

Elite professional soccer players have high aerobic requirements throughout a game and extensive anaerobic demands during periods of a match leading to major metabolic and thermodynamic changes. Assessing skin temperature (Tsk); blood lactate concentration [La^-], fat and carbohydrate oxidation (FATox; CHOox) might provide an indirect method to assess metabolic flexibility and oxidative capacity during exercise. **Purpose:** To study the relationship between Tsk; [La^-] and substrate oxidation patterns. **Methods:** We used indirect calorimetry and [La^-] measurements, and monitored the Tsk to study the metabolic and thermodynamic response to exercise in twenty professional male soccer players (age 24.5 ± 3.4 yrs.; VO_2peak 53.2 ± 4 ml/kg/min) during a maximal incremental treadmill test. **Results:** The maximal FATox rate was 0.47 ± 0.16 g·min⁻¹, reached at $62.5 \pm 6.5\%$ of the VO_2peak . A significant inverse correlation was found between average FATox rates and average blood [La^-] ($p < 0.005$). A significant correlation was found between the average values of Tsk and FATox rates ($p < 0.006$). Maximal values reached of FATox and CHOox rates were 0.80 and 6.82 g·min⁻¹ respectively. **Conclusion:** These results indicate that FATox rates are inversely associated with blood lactate production; which may be due to a higher adrenergic activation that limits the increase of Tsk and the FATox capacity. Our data also show relationships between the Tsk and FATox rates, which may be associated to an increase of tissue blood flow. More research is required to determine how the thermodynamic and metabolic responses to affect performance in soccer.

Variables	Age (years)	Height (cm)	Weight (kg)	BMI (%)	Body fat (%)	Fat free mass (%)	Max speed (km/h)
n=20	24.5±3.4	180.6±5.5	76.7±6.2	23.54±1.54	10.29±1.85	46.58±2.14	16±1

VO_2 peak (ml/min/kg)	HR peak (bpm)	RER	VE (L/min)	FATox peak (g/min)	CHOox peak (g/min)	Tsk peak (°C)	[La^-] (mmol·L ⁻¹)
53.25±3.98	180.3±7.9	1.06±0.05	145.53±24.13	0.47±0.16	4.97±0.62	37.12±0.69	6.6±1.7

Load (km/h)	FATox (g/min)	CHOox (g/min)	[La^-] (mmol·L ⁻¹)	Tsk (°C)	VO_2 (ml/min/kg)
0	0.21±0.10	1.14±0.27	1.22±0.37	34.87±0.95	6.87±1.87
9	0.47±0.16	4.04±0.41	1.25±0.30	35.18±0.92	30.88±2.66
10	0.38±0.18	4.26±0.46	1.32±0.30	35.54±0.98	34.53±2.16
11	0.34±0.17	4.53±0.43	1.59±0.54	36.07±0.95	38.12±2.47
12	0.25±0.19	4.67±0.53	1.88±0.91	36.48±0.86	41.30±2.19
13	0.20±0.19	4.79±0.53	2.65±1.32	36.78±0.70	44.15±2.39
14	0.14±0.19	4.81±0.64	3.76±1.64	36.93±0.65	47.19±2.59
15	0.08±0.13	4.75±0.66	4.80±1.87	37.13±0.62	49.58±2.38
16	0.06±0.12	4.80±0.74	5.53±1.89	37.13±0.56	52.64±2.38
17	0.03±0.10	4.85±0.80	6.52±1.57	37.25±0.56	54.13±3.93

Values are mean ± standard deviation.

Abbreviations: BMI (body mass index); Max speed (maximal speed); VO_2 peak (peak oxygen consumption); HR (heart rate); RER (respiratory exchange ratio); VE (ventilation); FATox peak (peak fat oxidation); CHOox peak (peak carbohydrate oxidation); Tsk peak (peak skin temperature)

D-13 Free Communication/Slide - Physical Activity Epidemiology: New Insights

Thursday, May 30, 2019, 1:30 PM - 3:30 PM

Room: CC-202C

1630 Chair: I-Min Lee, FACSM. Harvard Medical School, Boston, MA.

(No relevant relationships reported)

1631 May 30 1:30 PM - 1:45 PM
Composition of Movement Behaviors and Risk of Weight Gain

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(No relevant relationships reported)

Physical activity, sedentary behavior, and sleep are three movement behaviors that are mutually exclusive parts of a whole (i.e., a 24-hour day) and therefore may be related to weight in a co-dependent manner. Compositional data analyses (CoDA) provide the opportunity to analyze associations between constrained behaviors and health outcomes without violating statistical assumptions involving collinearity.

PURPOSE: To use CoDA to investigate the relationships between the composition of four movement behaviors (objectively-measured sedentary time [SED], light intensity physical activity [LPA], moderate-vigorous intensity physical activity [MVPA] and self-reported sleep duration) and one-year changes in body mass index (BMI) and waist circumference (WC).

METHODS: Participants were 716 adults from the Cancer Prevention Study-3 (mean age 52.2 [SD 9.9] years, 59% female, 66% white, 40% normal BMI). Self-reported weight, height, and self-measured WC were captured one year apart. Participants wore an accelerometer (Actigraph GT3x) for a minimum of 14 hours/day for three days and self-reported sleep duration via 24-hour diaries. CoDA was used to examine associations between all movement behaviors and change in BMI or change in WC. CoDA isotemporal substitution models estimated associations for the replacement of 30 minutes of SED for other behaviors in the composition. Models were stratified by sex and adjusted for age, race/ethnicity, smoking status, and average daily caloric intake.

RESULTS: Participants spent most of their time SED (mean proportion of time SED = 0.414), followed by sleeping (0.344), in LPA (0.195), and in MVPA (0.047). The overall composition of movement behaviors was associated with a one-year change in BMI ($p = 0.003$) and WC ($p = 0.048$) among men, but not among women ($p = 0.19$ and $p = 0.43$). Among men, compositional isotemporal substitution models suggested that replacing 30 minutes of SED with 30 minutes of MVPA while holding LPA and

sleep constant was associated with a one-year BMI decrease of 0.26 kg/m², while the replacement of SED with LPA and sleep were associated with smaller decreases in BMI (0.06 kg/m² and 0.12 kg/m², respectively).

CONCLUSION: Findings suggest that targeting all movement behaviors throughout the day may be an effective approach for weight loss, especially among men.

1632 May 30 1:45 PM - 2:00 PM

Cardiorespiratory Fitness and Years Lived Free of Cardiovascular Disease: Cardiovascular Lifetime Risk Pooling Project

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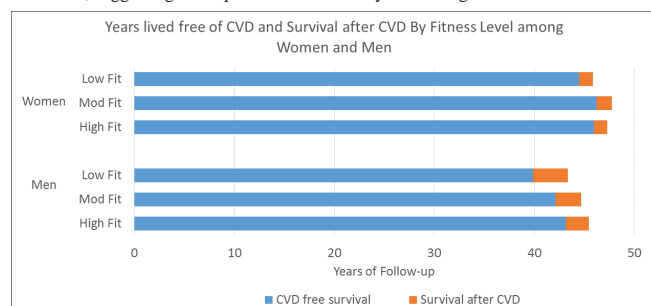
(No relevant relationships reported)

PURPOSE: Quantifying cardiorespiratory fitness (CRF) with years lived free of cardiovascular disease (CVD) allows for contextualization of the population burden of CVD and provides a metric for clinician-patient communication.

METHODS: CRF was measured with graded exercise treadmill tests in 8,129 adults in the Coronary Artery Risk Development in Young Adults and Framingham Offspring studies. Individual-level data were pooled. Cohort-specific z-scores for CRF were categorized into sex- and age- specific quintiles. We defined low fit as quintile 1, moderate (mod) fit as quintiles 2-3, and high fit as quintiles 4-5. Rates (person-years) of incident CVD and death were summed for participants up to age 85 years, or the oldest age of observation. Irwin's restricted mean was used to calculate years lived free from CVD and overall survival stratified by sex.

RESULTS: At baseline the mean age was 32.5±11.6 years, 43.6% women, and 30.8% black. Over 219,812 person-years of follow-up, 762 CVD events were observed. For total survival time, high fit men lived 2.1 years longer and mod fit men lived 1.4 years longer vs low fit men. Additionally, high fit men lived 3.3 more healthy years and mod fit men lived 2.3 more healthy years free of CVD vs the low fit group. Among men, relative follow up time spent with CVD was 5.0% for high fit, 5.7% for mod fit, and 8.0% for low fit groups. While high and mod fit women were similar, both had greater longevity and health span than low fit women. Mod fit women lived 1.9 total years longer and lived 1.7 more healthy years CVD-free vs the low fit women. Time spent with CVD was similar across fitness groups in women, ranging from 2.8-3.2% of follow-up time.

CONCLUSIONS: The benefits of higher fitness appear to extend multiple decades into older ages. Higher fitness in early adulthood is associated with longer overall and CVD-free survival. Men with higher fitness levels as young adults live less of their life with CVD, suggesting a compression of morbidity at older ages.



Low fit defined as quintile 1 (bottom 20%); Mod Fit defined as quintile 2-3 (middle 40%); High Fit defined as quintile 4-5 (upper 40%)
CARDIA measured fitness at baseline/year 0 exam (1985-86) using a maximal treadmill test using a modified Balke protocol.
FOS measured fitness at exam cycle 2 (1979-83) using a submaximal treadmill test (85% of age- and sex- predicted max heart rate) using a modified Bruce protocol

1633 May 30 2:00 PM - 2:15 PM

Leisure-time Physical Activity And TV Viewing Associations With Life Expectancy With And Without Cardiovascular Disease

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(No relevant relationships reported)

PURPOSE: Although high levels of physical activity are associated with longer overall and cardiovascular disease (CVD) free life expectancy (years lived without

CVD) research has been limited and sedentary behavior has not been considered.

Therefore, we examined associations between leisure-time moderate-to-vigorous physical activity (LTPA) and television (TV) viewing with life expectancy overall and with and without three types of CVD.

METHODS: We included 13,534 participants from the Atherosclerosis Risk in Communities Study prospective cohort. LTPA in the past year (no LTPA, ≤ median (13.2 MET hours/week), > median) and TV viewing (often/very often, sometimes, seldom/rarely) were self-reported. Outcomes included all-cause mortality, and incident nonfatal coronary heart disease (CHD), stroke, and heart failure (HF). We used a multistate survival model to estimate associations of LTPA and TV viewing with life expectancy (95% confidence interval (CI)) with and without nonfatal CHD, stroke, and HF at age 50 separately for men and women. Models were adjusted for time-varying covariates (age, gender, race by study center, education, smoking, ethanol intake). Missing data were imputed with multiple imputation.

RESULTS: Over a median of 27 years of follow-up, the average life expectancy at age 50 was 26 years. Compared to participants who engaged in no LTPA, participants who engaged in LTPA above the median had greater overall life expectancy (1.8 years each for men and women), greater nonfatal CHD-free life expectancy (men 1.5 years (95% CI 1.0, 2.0), women 1.6 years (95% CI 1.1, 2.2)), greater nonfatal stroke-free life expectancy (men 1.8 years (95% CI 1.2, 2.3), women 1.8 years (95% CI 1.3, 2.3)), and greater nonfatal HF-free life expectancy (men 1.6 years (95% CI 1.1, 2.1), women 1.7 years (95% CI 1.2, 2.2)). For each type of CVD, life expectancy with disease was similar across three levels of LTPA. Watching less TV compared to more viewing was associated with longer overall and disease-free life expectancy of 0.8 years each. These findings were similar for CHD, stroke, and HF.

CONCLUSIONS: Engaging in more LTPA and less TV viewing were associated with longer overall and nonfatal CVD-free life expectancy. Increasing LTPA levels and limiting TV viewing could potentially increase longevity and years lived CVD-free.

1634 May 30 2:15 PM - 2:30 PM

Cardiorespiratory Fitness Incidence and Mortality from Lung Cancer in Male Smokers

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(No relevant relationships reported)

Cardiorespiratory fitness (CRF) is an established prognostic marker for many chronic diseases including lung cancer but, this association has not been assessed among smokers. **PURPOSE:** To evaluate the association between CRF, lung cancer incidence and cancer mortality in former and current male smokers. **METHODS:** Maximal treadmill exercise testing was performed in 2,979 men [former smokers (n=1,602), 39.6±25 pack/years and current smokers (n=1,377), 43±27 pack/years] aged 59.2±17.3 years, who were free from malignancy at baseline. Cox hazard models adjusted for cancer risk factors were analyzed. Population attributable risks (PARs%) of low CRF (<5 METs) for lung cancer outcomes were also determined. **RESULTS:** During 11.6±7 years follow-up, 99 lung cancers were diagnosed [46 (2.9%) among former smokers and 53 (3.8%) among current smokers]. Seventy-nine of those died from cancer (40 in former and 39 in current smokers) after 3.6±4.6 years from diagnosis. Among former smokers each 1-MET increase and categories of moderate and high CRF were associated with 16% (p=0.002), 60% and 83% (p trend=0.001) reductions in lung cancer incidence, respectively. Among current smokers who were later diagnosed with lung cancer, 1-MET increase and categories of moderate and high CRF were associated with 18% (p=0.008), 81% and 82% (p trend <0.001) reductions in cancer mortality, respectively. The PAR% for lung cancer incidence was 12.5% among former smokers and 21.5% for cancer mortality among current smokers. **CONCLUSIONS:** Higher CRF is associated with lower lung cancer incidence in former smokers. Current smokers who were diagnosed with lung cancer and were more fit exhibited reduced cancer mortality. These results suggest potential protective benefits of higher CRF for prevention of lung cancer outcomes among both former and current smokers. Eliminating low CRF as a risk factor could potentially reduce considerable lung cancer morbidity and mortality.

1635 May 30 2:30 PM - 2:45 PM

Is Leisure-time Physical Activity Before Pregnancy Associated With Risk Of Hyperemesis Gravidarum During Pregnancy?

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(No relevant relationships reported)

Hyperemesis gravidarum (HG) is characterised by excessive nausea and vomiting often leading to maternal weight loss, dehydration, electrolyte imbalance, and vitamin deficiencies. HG is the most common reason for hospitalisation in the first half of pregnancy and its prevalence varies depending on maternal country of birth. Women who experience excessive nausea and vomiting in early pregnancy are less likely to participate in leisure-time physical activity (LTPA) during pregnancy. Whether LTPA before pregnancy is associated with hyperemesis gravidarum has not yet been studied. Prepregnancy LTPA may lessen the risk of gestational diabetes, pelvic girdle pain, and hypertensive disorders including preeclampsia, all of which are associated with HG.

PURPOSE: To estimate associations between prepregnancy LTPA and HG in pregnancy.

METHODS: We present data from 37 442 primiparous women with singleton pregnancies enrolled in The Norwegian Mother and Child Cohort Study. Prepregnancy LTPA was self-reported by questionnaire in pregnancy week 17. HG was defined as prolonged nausea and vomiting in pregnancy requiring hospitalisation before the 25th gestational week. We estimated the crude and adjusted associations between LTPA and HG using multiple logistic regression. We assessed effect modification by prepregnancy BMI or smoking by stratified analysis and interaction terms.

RESULTS: A total of 398 (1.1%) women developed HG. Before pregnancy 76.4% conducted LTPA at least 3 times weekly, while only 7.3% of women conducted LTPA less than once a week. Compared to women reporting LTPA 3 to 5 times weekly, no LTPA or a frequency of 1 to 3 times a month had an increased risk of HG (adjusted odds ratio [aOR] 2.58; 95% confidence interval [CI], 1.29 to 5.18, and aOR 1.35; 95% CI, 0.95 to 1.92, respectively). LTPA-HG associations differed by prepregnancy BMI but not by prepregnancy smoking. The increase in risk of HG was more than 4-fold for women with BMI ≥ 25 kg/m² reporting no LTPA prepregnancy (aOR 4.89; 2.13 to 11.22, test for trend, $P=0.45$).

CONCLUSIONS: Lack of LTPA before pregnancy was associated with an increased risk of HG. Inactive women with overweight or obesity before pregnancy may have the highest risk of HG during pregnancy.

1636 May 30 2:45 PM - 3:00 PM

Is Midlife Quadriceps Muscular Strength Protective Against Later Life Osteoarthritis And Subsequent Total Joint Replacement?

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Abstract:

We have previously shown a relationship between cardiorespiratory fitness/physical activity and the likelihood of developing hip/knee osteoarthritis (OA) later in life. Another possible predictor of hip/knee OA is weakness of the quadriceps musculature. Because it is unknown whether or not midlife quadriceps strength predisposes to OA and hip/knee total joint replacement (HKR) later in life, the current study was undertaken.

Purpose: The purpose of this study was to examine the relationship between midlife quadriceps muscle strength and the likelihood of developing OA and undergoing a HKR later in life

Methods: We linked strength and clinical data from 3944 (3431 men and 513 women) participants in the Cooper Center Longitudinal Study from 1981-1989 to Medicare claims from 1999-2009 (13% women, mean age 49 years). Quadriceps muscular strength was measured via 1-repetition maximum (1-RM) leg press assessment and expressed individually relative to body weight. Outcome measures for OA and HKR were obtained using Medicare administrative data. Proportional hazards regression was used to estimate the risk of incident OA and subsequent risk of HKR after developing OA.

Results: During 20,672 person years of Medicare follow up, 1100 OA events (913 events in men, 187 events in women) were observed. After controlling for age, sex and year of muscle strength assessment, a significant relationship was observed between 1-RM leg press and the likelihood of developing OA later in life (HR 0.76, 95% CI 0.59 - 0.98). Among those who developed OA, we observed 293 hip/knee total joint

replacements (244 joint replacements in men, 49 joint replacements in women) during 4947 subsequent person years of observation. When adjusted for the same covariates, higher 1-RM leg press suggested a protective role against HKR, but the findings were not statistically significant (HR 0.80, 95% CI 0.49 - 1.29).

Conclusion: Midlife quadriceps muscular strength may play a protective role against onset of OA later in life. More research is needed to determine if increasing quadriceps muscle strength leads to a reduction in risk of undergoing HKR.

1637 May 30 3:00 PM - 3:15 PM

Measures Of Adiposity And Its Association To Physical Activity In Adults: The Tromsø Study

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PURPOSE: The purpose of this study was to examine the pattern and magnitude of associations between moderate-to-vigorous physical activity (MVPA) and three different methods for assessing adiposity: body mass index (BMI), waist circumference (WC) and dual-energy x-ray absorptiometry (DXA). **METHODS:** In the seventh wave of the Tromsø Study 2015-2016, 6289 women and men aged 40-84 years wore an accelerometer (ActiGraph wGT3X-BT) on the hip for eight consecutive days. Of these, 6125 participants provided valid accelerometer data, of which 5925 participants also provided data on BMI (kg·m⁻²) and WC (cm), and 2741 participants attended DXA measurement, providing data on total body fat (%). MVPA (min·d⁻¹) was estimated from the vector magnitude (the square root of the sum of squared activity counts) of triaxial acceleration counts and defined as >2690 counts per minute. In order to compare the magnitude of the association between MVPA and the three adiposity measures, the associations were considered significantly different if the 95% CI of the standardized β 's overlapped by $<50\%$. **RESULTS:** After adjustment for age, sex, body height, smoking and educational level, for every 10-minute increase in MVPA, BMI decreased with -0.29 kg·m⁻² (95% CI: -0.25 - 0.33 kg·m⁻²), WC decreased with -0.94 cm (95% CI: -0.83 - 1.04 cm) and percentage total body fat decreased with -0.81% (95% CI: -0.72 - 0.90%). The association between MVPA and percentage body fat (standardized $\beta=-0.270$, 95%CI: -0.236 - 0.296) were considered significantly larger than for WC (standardized $\beta=-0.220$, 95%CI: -0.189 - 0.235) and BMI (standardized $\beta=-0.200$, 95%CI: -0.163 - 0.214) ($p<0.05$). MVPA explained 6%, 20%, and 44% of the variance in BMI, WC and percentage total body fat, respectively, after adjustment for potential confounders.

CONCLUSIONS: Adiposity measured with DXA, explained more of the variation in the association with MVPA than WC and BMI, indicating that the association between adiposity and physical activity depends on the accuracy of the measurement. As DXA distinguishes between fat and fat-free mass, whereas BMI and WC acts as proxy measures of adiposity, DXA may be the best choice for expressing adiposity. Due to the cross-sectional design of our analyses, we cannot establish causality in the association between MVPA and adiposity.

1638 May 30 3:15 PM - 3:30 PM

Associations Between Steps Per Day And Mortality In A Representative Sample Of US Adults

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(No relevant relationships reported)

PURPOSE: Walking is the most popular form of physical activity among adults, but it's still unknown how many steps per day are necessary to reduce mortality risk. This study examined the relation between objectively measured steps/day and mortality using NHANES data. **METHODS:** Participants were a representative sample of US adults ($n=4,840$ adults; ≥ 40 years) assessed for physical activity in 2003-06 using an accelerometer device and followed through 2015 for mortality status and cause of death using ICD-10 codes. Accelerometer-derived steps/day were modelled against all-cause, cardiovascular disease (CVD), and cancer mortality using cox proportional hazard models [(Hazard Ratios (HR) and 95% CI)]. Hazard ratios were adjusted for: age, sex, race-ethnicity, education, alcohol consumption, diet quality, smoking, BMI, health status, reduced mobility, and self-reported diagnosis of diabetes, coronary heart disease, stroke, and cancer. The 10th percentile for steps/day (~ 4000 steps/day) was defined as the referent group. We conducted sensitivity analyses excluding participants

with reduced mobility, poor/very poor health condition, and excluding the first two years of follow-up. NHANES population sample weights and adjustments for the complex survey design were employed.

RESULTS: A total of 1,165 deaths occurred during follow-up (406 from CVD, and 283 from cancer). The relation between steps/day and mortality was non-linear ($p < .01$). When compared to our reference ~4000 steps/day, an increase of 2,000 steps/day was associated with 36% lower risk for all-cause mortality (HR=0.64, 95% CI: 0.59, 0.70), 46% lower CVD mortality (HR=0.54, 95% CI: 0.20, 1.43), and 21% lower cancer mortality (HR=0.79, 95% CI: 0.69, 0.91). There were negligible reductions in risk beyond 10,000-12,000 steps/day. Results from sensitivity analyses did not alter the activity-mortality associations. **CONCLUSIONS:** Modest increases in steps/day (2000 steps/day) are associated with reduced risk for mortality with no extended benefits beyond 10,000-12,000 steps/day. The steps/day-mortality associations described here can help setting public health/clinical goals.

D-14 Free Communication/Slide - Physical Activity/Exercise in Clinical Populations

Thursday, May 30, 2019, 1:30 PM - 3:15 PM
Room: CC-105B

1639 Chair: Cemal Ozemek, FACSM. *University of Illinois Chicago, Chicago, IL.*

(No relevant relationships reported)

1640 May 30 1:30 PM - 1:45 PM
Examining the Impact of Obesity on Ventilatory Responses During Acute Exercise in Patients with HFpEF

Brittany L. Christensen¹, Peter H. Brubaker, FACSM¹, Georgina Tiarks¹, J Thomas Becton², Dalane Kitzman². ¹Wake Forest University, Winston-Salem, NC. ²Wake Forest Baptist Medical Center, Winston-Salem, NC. (Sponsor: Peter Brubaker, FACSM)
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(No relevant relationships reported)

PURPOSE: Heart Failure (HF) is a major cause of morbidity and mortality worldwide. Ventilatory responses to acute exercise have important prognostic value in HF patients. This study examined baseline ventilatory measures to determine if obesity further impacts ventilatory responses in normal subjects and heart failure patients with preserved ejection fraction (HFpEF). **Methods:** All participants performed a cardiopulmonary exercise test to maximal effort to quantify ventilatory responses (tidal volume (TV), breathing frequency (Bf), and minute ventilation (VE)) at submaximal (25 watts) and peak exercise. Ventilation efficiency was determined by assessing VE/VCO₂ at submax and the VE/VCO₂ slope. Obese vs. non-obese HFpEF participants were categorized based on BMI ≥ 30 kg/m². One-way ANOVA was performed to determine if there were significant ($p < 0.05$) differences between groups. **Results:** The obese HFpEF group had higher VE during peak exercise than the non-obese group ($p < 0.05$), which was mainly due to greater Bf ($p = 0.08$) versus TV ($p = 0.24$). The VE/VCO₂ at the submaximal workload and VE/VCO₂ slope were significantly higher in the non-obese HFpEF group. **Conclusion:** As hypothesized, obese HFpEF participants exhibited worse ventilatory function than the non-obese HFpEF patient at similar levels of exercise. However, obese HFpEF participants demonstrate a similar degree of ventilatory inefficiency compared to normal weight HFpEF participants. Since ventilatory efficiency was not abnormal in obese HFpEF it appears that their prognosis is no worse than normal weight HFpEF participants.

1641 May 30 1:45 PM - 2:00 PM
Comparison of Two High-Intensity Interval Training Modalities on Cardiometabolic Health in Overweight/Obese Women

Ozgur Alan, Emily W. Flanagan, Lafayette T. Watson, Andrew N.L. Buskard, Demet Tekin, Arlette Perry, FACSM. *University of Miami, Coral Gables, FL.* (Sponsor: Arlette Perry, FACSM)
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(No relevant relationships reported)

High-intensity interval training (HIIT) has been used to reduce risk factors for diabetes, obesity, cardiovascular diseases and metabolic syndrome (MetS). Few studies have compared resistance-HIIT (R-HIIT) to aerobic-HIIT (A-HIIT) in a worksite wellness program designed to reduce risk factors for the MetS. **PURPOSE:** To compare the effects of A-HIIT and R-HIIT to that of a control group (CON) on

physical characteristics, cardiometabolic health, and self-reported well-being in women employees attending a worksite wellness program. **METHODS:** A total of 48 overweight/obese women possessing one or more MetS risk factors were randomly assigned to one of three groups with 31 women completing all testing and training procedures: A-HIIT (n=10), R-HIIT (n=10), and CON (n=11). A-HIIT and R-HIIT groups trained 3x/wk for 25 minutes in an 8-week program at an average training intensity of $81.0 \pm 1\%$ HR_{max} and $81.9 \pm 1\%$ HR_{max}, respectively. ANCOVA was used to determine differences among groups on all dependent variables at post-testing after adjusting for baseline values. Post-hoc analyses were performed using Bonferroni adjustments. **RESULTS:** Both A-HIIT ($M_{diff} = 23.9$ m, $p = 0.029$) and R-HIIT ($M_{diff} = 23.8$ m, $p = 0.029$) had higher aerobic fitness than CON ($M_{adj} = 190.9$ m SEM= 6.3) using the 2-minute walk test following training. Only R-HIIT ($M_{diff} = 45.3$ W, $p = 0.002$) showed increases in upper body power over CON ($M_{adj} = 94.9$ W SEM= 8.2) while displaying lower fasting insulin ($M_{diff} = -5.6$ μ U/ml, $p = 0.036$) compared to CON ($M_{adj} = 17.4$ μ U/ml, SEM= 1.4). R-HIIT also showed greater reductions in HOMA2-IR ($M_{diff} = -0.7$, $p = 0.046$) than CON ($M_{adj} = 2.2$, SEM= 0.2). Furthermore, HOMA2-%B was lower in R-HIIT compared to both CON ($M_{adj} = 159.3\%$, SEM= 8.8, $M_{diff} = -38.5\%$, $p = 0.017$), and A-HIIT ($M_{adj} = 172.2\%$, SEM= 9.4, $M_{diff} = -51.4\%$, $p = 0.002$). Finally, R-HIIT had significantly higher scores on the physical function domain of Patient Reported Outcome Measurement System (PROMIS[®])-57 well-being questionnaire compared to the CON group ($M_{adj} = 51.8$ SEM= 1.4, $M_{diff} = 5.7$, $p = 0.035$). **CONCLUSIONS:** Our study showed that R-HIIT can be considered as part of a risk reducing worksite-wellness strategy for improving physical characteristics, cardiometabolic health, and well-being in women possessing one or more components of the MetS. Supported by UM Citizens Board Grant

1642 May 30 2:00 PM - 2:15 PM
Short and Long term Effects of Exercise Intensity on Conduit Artery Function in Cardiac Rehabilitation Patients

Jenna Taylor¹, Jeff S. Coombes, FACSM¹, David J. Holland¹, Shelley E. Keating¹, Daniel J. Green², Tom G. Bailey¹. ¹The University of Queensland, Brisbane, Australia. ²The University of Western Australia, Perth, Australia. (Sponsor: Professor Jeff Coombes, FACSM)

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(No relevant relationships reported)

PURPOSE: Patients with coronary artery disease (CAD) commonly present with conduit artery dysfunction characterized by decreased brachial artery flow-mediated dilation (FMD). Reduced FMD of 1% is associated with an 8-13% increased risk of future cardiovascular events¹, and thus interventions designed to improve FMD in patients with CAD are warranted. Short-term supervised exercise training may improve FMD, however whether improvements are maintained longer term following cessation of supervised cardiac rehabilitation (CR), is unclear. We compared the short- and long-term effect of High Intensity Interval Training (HIIT) and Moderate Intensity Continuous Training (MICT) on FMD in patients with CAD commencing a 4-week CR program in a real world hospital-based setting.

METHODS: Patients with angiographically-proven CAD (Age: 64 ± 7 ; 35 males, 3 females) completed 3 sessions per week (2 supervised, 1 home-based) for 4-weeks, randomized to either 1) HIIT (n=21): 4 x 4 minute high intensity intervals at a rating of perceived exertion (RPE) 15-18 interspersed with 3 minute active recovery periods or 2) MICT usual care (n=17): 40 minutes moderate intensity continuous exercise at an RPE 11-13. Patients then continued 3 unsupervised home-based sessions per week of their randomized training for a further 11 months. FMD was measured at baseline, 4 weeks, 3 months, 6 months, and 12 months. Data was analyzed using a linear mixed model with baseline diameter and shear rate as covariates. Data is presented as mean (95% CI).

RESULTS: Baseline FMD was not different between groups [HIIT: 3.1% (2.2 to 4.0); MICT: 2.9% (1.9 to 3.9), $p = 0.657$]. FMD increased from baseline at 4 weeks, 6 months and 12 months in the HIIT group [4 weeks: $+1.8\%$ (0.8 to 2.7), $p < 0.001$; 6-months: $+1.6\%$ (0.7 to 2.6), $p = 0.01$; 12-months: $+1.4\%$ (0.4 to 2.3), $p = 0.007$], with negligible changes in the MICT group [4 weeks: $+0.4\%$ (-1.1 to 1.0), $p = 0.94$; 6 months: $+1.0\%$ (-0.1 to 2.1), $p = 0.063$; 12 months: $+0.3\%$ (-0.7 to 1.3), $p = 0.52$].

CONCLUSIONS: A 4-week CR program of HIIT, but not MICT (usual care), improved conduit artery function in patients with CAD. Improved FMD with HIIT was maintained long-term at 6- and 12 months with home-based training.

¹Ras, R et al. (2013). *Int. J. Cardiology* 168:344-351

Supported by Wesley Medical Research Grant 2015-17 and NHMRC Scholarship APP1133622

1643 May 30 2:15 PM - 2:30 PM

Optimizing Utilization Of A Cardiac Rehabilitation Facility For Chronic Disease Prevention.

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(No relevant relationships reported)

PURPOSE: Cardiac rehabilitation (CR) involves delivery of structured exercise, education and risk reduction, in a cost-effective manner. Despite its benefits, and clinical practice guideline recommendations, CR programs are grossly underused due to multiple barriers. A large study of 2,67,427 patients showed that CR was used in 13.9% of patients hospitalized for AMI and in 31.0% of those who underwent CABG surgery. To help optimize utilization of resources, at our hospital, we utilised our cardiac rehabilitation facility to include other disease groups such as cancer, respiratory and stable cerebrovascular diseases, since the principles of exercise prescription for these disease groups are similar to CR and require similar infrastructure. The purpose was to utilise a cardiac rehabilitation centre as a chronic disease prevention centre for oncology, and pulmonary patients. To also assess the effects of the comprehensive program on physical fitness levels of these patients using the 6-minute walk test. **METHODS:** 319 patients, which included those with cardiac disease (185), pulmonary disease (36) and cancer (98) were assessed as part of this study over a period of 3 years. The program comprised aerobic exercises, resistance training, yoga, and disease specific rehabilitation. The aerobic capacity was assessed before and after one month of rehabilitation by means of the 6 Minute Walk Test (6MWT). **RESULTS:** The 6-minute walk test distance (6MWT) in the cardiovascular group improved from 331.56 (± 99.68) to 413.99 (± 104.43) meters, 24.86% increase from baseline ($p < 0.0001$); pulmonary group improved from 313.17 (± 100.90) to 339.31 (± 116.92) meters, 8.35% increase from baseline ($p = 0.0002$) and oncology group improved from 380.29 (± 97.24) to 431.20 (± 96.44) meters, 13.39% increase from baseline ($p < 0.0001$). **CONCLUSIONS:** A comprehensive CR facility can be successfully used to include other chronic disease group patients. It helps to improve overall aerobic capacity as indicated by significant increase in 6-minute walk test distance in cardiac, pulmonary and oncology patients. This can help hospitals deploy their rehabilitation services in an efficient and cost-effective manner.

1644 May 30 2:30 PM - 2:45 PM

Bidirectional Relationships of Daily Physical Activity and Sleep Among Patients with Heart Failure and Insomnia

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(No relevant relationships reported)

Physical activity is associated with better sleep quality across a wide range of populations, but the causal direction of this relationship is unclear due to lack of longitudinal and experimental studies. Patients with heart failure (HF) bear particular risk of poor sleep and low physical activity.

PURPOSE: Examine the relationships between within-person day-to-day fluctuations in physical activity and sleep quality among patients with stable NYHA Class I-IV HF and insomnia (insomnia severity index > 7).

METHODS: Patients wore a uniaxial wrist accelerometer (Actiwatch) for 14 consecutive days and nights to measure total daytime activity counts, total sleep time, sleep onset latency and sleep continuity (sleep efficiency and wake time after sleep onset (WASO)). Two-level multilevel models with daily and individual variation predicted daytime activity outcomes and sleep outcomes, separately. We adjusted for covariates within (day of the week) and between subjects (age, Charlson Comorbidity Index (CCI), NYHA HF Class, and body mass index (BMI)). Significance $p < 0.05$.

RESULTS: Participants ($n = 114$, $M = 62.4 \pm 12.1$ years, female 43%, black 22%, white 75%, NYHA Class 1.9 ± 0.8) on average obese (BMI 31.4 ± 7.6 kg/m²) with multiple comorbidities (CCI 3.2 ± 2.0). Daytime activity ($177 \pm 82 \times 10^3$ counts/day) was associated with younger age ($\beta = -1.32 \pm 0.50$), fewer comorbidities ($\beta = -10.57 \pm 3.26$), lower NYHA class ($\beta = -17.99 \pm 7.80$), and a tendency for lower BMI ($\beta = -1.58 \pm 0.83$, $p = 0.06$). Comorbidity was associated with poorer sleep efficiency ($\beta = -0.98 \pm 0.48$) and more WASO ($\beta = 5.94 \pm 2.05$). After adjustment for all significant covariates, daytime activity was not associated with sleep characteristics the next night, but every minute less total sleep time ($\beta = -0.075 \pm 0.015$) or WASO ($\beta = -0.114 \pm 0.042$) was associated with $\sim 70 - 100$ more activity counts the next day.

CONCLUSIONS: Similar to studies in other populations, less WASO and less total sleep time both was associated with more activity the next day, but these were not bidirectional relationships since activity the previous day was not associated with sleep characteristics. Future research should confirm these results by polysomnography and hip accelerometry and evaluate mechanisms.

Support: NIH- R01NR016191; Yale Center for Sleep Disturbance in Acute and Chronic Conditions.

1645 May 30 2:45 PM - 3:00 PM

Measuring Physical Activity in People with Heart Failure - An Accelerometer Calibration Study

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(No relevant relationships reported)

PURPOSE: To estimate acceleration values corresponding to light and moderate to vigorous intensity physical activity (PA) in people with heart failure via calibration with oxygen consumption (VO₂). **METHODS:** 21 adults with heart failure undertook a range of typical lifestyle activities (including laying down, and walking at different speeds) whilst wearing three accelerometers (each wrist and the left hip) and a portable gas analyser. Resting metabolic rate (RMR) was established and participants also undertook an incremental shuttle walk test (ISWT) to estimate fitness. Location specific activity intensity thresholds were established via Receiver Operator Characteristic (ROC) curve analysis. **RESULTS:** Participants had an average age of 71.1 ± 14.3 years, the majority were male (24% female) and average BMI was 28.2 ± 4.4 kg/m². Average distance walked during the ISWT was 279 ± 192 m, and average RMR was 0.76 ± 0.19 METS. The measured metabolic cost of slow paced walking (average pace 2.6 kph) was 4.09 ± 1.08 METS - higher than estimates based on standard methods i.e. VO₂/3.5 ml/kg/min (3.03 ± 0.63 METS) or the Compendium of PA (2.0 METS). Similarly, moderate paced walking (average pace 3.5 kph) averaged 4.65 ± 1.08 METS using measured RMR compared to 3.46 ± 0.78 METS via the standard methods and 2.8 METS via the Compendium. ROC curve analysis will be used to estimate acceleration values corresponding to light and moderate to vigorous intensity PA. **CONCLUSIONS:** Using single accelerometer values for estimating PA intensity assumes energy expenditure is the same for specific activities irrespective of fitness level, which risks underestimating the PA levels of low fit populations such as people with heart failure. It may also risk prescribing PA intensities that are too high for this population. Results of this study indicate that the measured metabolic cost of activities such as walking at a light pace are much higher than estimated METs reported in the PA compendium. Population specific accelerometer thresholds for estimating light and moderate to vigorous intensity PA will permit more precise measures of the prevalence of PA in people with heart failure.

1646 May 30 3:00 PM - 3:15 PM

The Effect Of A Personalized Multi-component Lifestyle Intervention Program In Stage 3 & 4 CKD Patients.

Samuel A. Headley, FACS¹, Jasmin Hutchinson¹, Brian Thompson¹, Marissa Ostroff², Courtney Doyle-Campbell³, Allen Cornelius³, Kristen Dempsey¹, Jennifer Siddall¹, Emily Miele¹, Elizabeth Evans¹, Brianna Wood¹, Cherilyn Sirois¹, Brett Winston¹, Michael Germain⁴. ¹Springfield College, Springfield, MA. ²Western New England University, Springfield, MA. ³University of the Rockies, Denver, CO. ⁴Renal and Transplant Associates of New England, Springfield, MA.
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(No relevant relationships reported)

PURPOSE: We studied the effect of a comprehensive lifestyle intervention (nutrition, physical activity, pharmacy, and behavioral counseling) on health related outcomes in 42 stage 3 & 4 (eGFRs 15-59 ml/min/1.73m²) CKD patients (age 60.2 ± 9.2 , BMI 34.5 ± 7.8). **METHODS:** Patients were assigned randomly to a treatment (T, $n = 27$) or usual care (UC, $n = 15$) group, and asked to attend four test sessions: baseline (BL), month 1 (M1), month 3 (M3) and month 6 (M6). Anthropometrics, medication use, three-day nutritional intake, central (cSBP/cDBP) & brachial blood pressures (bSBP/bDBP), augmentation index (AIx@75), Short Physical Performance Battery (SPPB) test, the six-minute walk test (6MWT), leg strength & power, self-efficacy to adhere to diet and physical activity (PA) recommendations, and the KDQOL were assessed at each visit. PA levels and inflammatory markers (IL6 & hsCRP) were assessed at BL and M6. Patients in T received individual counseling at BL, M1, & M3 with biweekly follow-up phone contact. Patients in UC were asked to follow the instructions of their nephrologist. **RESULTS:** All data are presented as means \pm SD. Primary outcome variables were analyzed by 2 x 2 mixed factor ANOVAs. See table for some of the findings:

Variable	BL	M3	M6				
	T	UC	T	UC	T	UC	
bSBP mm Hg T, n=22, UC n=13	137.4±14.3	128.2±23.4	*127.6±13.7	131.7±17.2	132.6±15.0	124.7±19.7	p=.01*
cSBP mm Hg T, n=22, UC n=13	124.2±12.6	116.1±20.1	*115.6±12.4	119.6±14.4	120.7±14.1	112.9±17.3	p=.01*
cDBP mm Hg T, n=22, UC n=13	78.9±10.1	76.7±12.3	*73.7±9.7	77.7±9.7	76.9±12.9	75.3±11.4	p=.02*
Alx@75 T, n=22, UC n=13	27.7±8.0	26.9±11.1	27.6±11.4	26.9±12.7	29.3±12.2	*21.9±9.98	p=.02*
SPPB T, n=23, UC n=14	10±2.1	10±1.4	9.9±2.3	10.3±1.2	9.9±1.8	10.2±1.1	p=.53
Effect of CKD T, n=23, UC n=14	85.3±20.9	88.2±13.9	*88.9±14.1	84.2±17.3	*91.5±14.6	85.3±15.1	p=.02*
Kcals T, n=23, UC n=14	1809.7±571	1630±653	1422.8±628.5	1418.4±460.8	1463.8±594.0	1768.4±515.8	p=.03*

CONCLUSION: In conclusion, this program led to reductions in bSBP, cSBP and cDBP at M3 which were attenuated at M6. Patients in T felt less restricted by their disease than the UC group. This home-based program resulted in no improvements in functional outcomes (SPPB or 6MWT). Supervised, in-center programs are preferred when working with CKD patients.

D-15 Clinical Case Slide - Chest Pain

Thursday, May 30, 2019, 1:30 PM - 3:10 PM
Room: CC-304E

1647 Chair: Paolo Emilio Adami. *Universita Degli Studi Di Roma "Foro Italico", Rome, Italy.*
(No relevant relationships reported)

1648 Discussant
Hallie Labrador. *NorthShore University HealthSystem, Gurnee, IL.*
(No relevant relationships reported)

1649 Discussant
Shelley Street Callender. *Navicent Health System, Macon, GA.*
(No relevant relationships reported)

1650 May 30 1:30 PM - 1:50 PM
Chest Pain in a Football Strength Coach
Michael Anacker, Keri Denay, FACSM. *University of Michigan, Ann Arbor, MI.* (Sponsor: Keri Denay, FACSM)
(No relevant relationships reported)

HISTORY: A 29-year-old adopted, African American male football coach traveled with the football team to Colorado to hike Pikes Peak. At 14,000 feet, he developed mid-sternal chest pain that radiated to his left upper abdomen and left shoulder. The pain worsened with deep breathing and exertion. He presented to a local ED, where a CT abdomen/pelvis revealed splenomegaly. Routine labs revealed a mild anemia and thrombocytopenia. Upon returning home, the pain continued for 2 days so he presented to clinic. There, he denied calf pain, extremity swelling, fever, nausea, palpitations, vomiting, hematuria, and syncope. He denied taking medications, supplements, and alcohol/drugs. He reported developing similar symptoms in 2015, also when hiking. At that time, he was diagnosed with pericarditis with symptom resolution in a few days.

PHYSICAL EXAMINATION:

Temp 36.9F, BP 132/61, HR 67, RR 16, O2 sat 97%

At rest, he was alert and comfortable. Breathing comfortably with symmetric aeration; no wheezing or crackles. Heart had regular rate and rhythm, without murmur.

Abdomen was soft and non-distended, though he was tender to palpation in the left upper quadrant. No lower extremity edema; calves were symmetric and non-tender to palpation.

DIFFERENTIAL DIAGNOSIS:

Pulmonary Embolus

Pericarditis

Mononucleosis

Sickle cell crisis in a patient with sickle cell trait

TEST AND RESULTS: A CT angiography chest, chest radiograph, and abdominal ultrasound were obtained and were notable for splenomegaly (14.3cm); otherwise unremarkable. An EKG revealed sinus bradycardia with sinus arrhythmia. Labs were obtained including CBCPD, CMP, CK, haptoglobin, LDH, and hemoglobin electrophoresis, and notable for a mild anemia (hemoglobin 12.2), thrombocytopenia (platelets 52), mild transaminitis (AST 42, ALT 37), and evidence of hemolysis (haptoglobin < 10, LDH 486, CK 348). Hemoglobin electrophoresis was consistent with sickle cell trait.

FINAL WORKING DIAGNOSIS: Sickle cell crisis in a patient with sickle cell trait

TREATMENT AND OUTCOMES:

1. Trended labs for 2 weeks.
2. Avoid strenuous activity until pain resolved.
3. Provide counseling regarding hydration, heat illness, and training especially at altitude.
4. Follow up with hematology.
5. Consider screening NCAA coaches/athletic trainers given NCAA athletes are screened for sickle cell.

1651 May 30 1:50 PM - 2:10 PM

Rib Pain - Football

Christopher Hicks. *University of Virginia, CHARLOTTESVILLE, VA.* (Sponsor: John M. MacKnight, M.D., FACSM)

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(No relevant relationships reported)

HISTORY: 21-year-old collegiate football defensive lineman complained of rib pain after a road game in Tennessee. Aside from a mild ankle sprain, he denied any specific injury to his torso/ribs. Pain began on the left side and then migrated to the right side with radiation to flank and sternum areas bilaterally. Had pain with deep breathing and sensation of tightness in the rib area. Took naproxen with some relief of his symptoms. Denied chest pressure, shortness of breath, palpitations, fevers or chills.

PMH: HTN, ADD

Meds: Amlodipine, Adderall

SH: No tobacco, social ETOH, no illicit drugs

FH: Non contributory

PHYSICAL EXAMINATION:

Well gentlemen in mild distress due to pain

Blood pressure 140/90, pulse 72, RR 14.

Neck- No JVD

CV: RRR, normal heart sounds. No gallop or rub. No murmur.

Pulmonary: No respiratory distress. Breath sounds normal. Good air movement. No wheezes or rales.

Chest: Tenderness to palpation along the flank areas greatest over ribs 5-7 bilaterally. No true focal pain noted.

Ext: DP and PT +2. No edema.

DIFFERENTIAL DIAGNOSIS:

1. Costochondritis
2. Rib fracture
3. Chest wall strain
4. Pneumothorax
5. Pulmonary Embolism

Interim History: Treated for chest wall injury with varying response over the next 4 days. Re-presented 2 hours before the next home game with shortness of breath, tachypnea, and worsening chest discomfort. Transferred to ER.

TEST AND RESULTS:

Chest x-ray- focal right lower lobe opacification

D-Dimer 774

CT PA- acute bilateral segmental and sub-segmental pulmonary emboli, without evidence of right heart strain

Factor V Leiden, Anti-Cardiolipin, and Prothrombin negative

Lupus anticoagulant, Protein S, Protein C and Antithrombin III pending

FINAL/WORKING DIAGNOSIS: Acute bilateral segmental and sub-segmental pulmonary emboli, unclear etiology.

TREATMENT AND OUTCOMES:

1. Anticoagulation therapy with Apixaban for minimum of 3 months with considerations for lifetime treatment.
2. No contact sports or activities while on anticoagulation.
3. Continued hematology follow-up of coagulation workup.
4. Ongoing discussion of importance of inclusion of PE on the differential for chest pain even in healthy athletes with no discernible risks.

1652 May 30 2:10 PM - 2:30 PM

10 Months of Dyspnea Following Long Runs in Marathon Athlete

Jay Shah, Jose Velasquez, James Pearson, Hamed Shalika.
Citrus Valley Health Partners, West Covina, CA. (Sponsor: Dr. Aaron Rubin, FACSM)
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(No relevant relationships reported)

HISTORY:

A 51-year-old male marathon runner presented with pleuritic chest pain and increasingly progressive shortness of breath at the end of his runs. At baseline, he was running a marathon in 3 hours, but his runs were reduced to less than 15 miles. He completed a 15k in 1 hour and 30 minutes but with severe dyspnea on exertion. Patient was referred to the Sports medicine clinic for further evaluation.

PHYSICAL EXAMINATION:

Vitals within normal limits
 NAD, speaking in full sentences, no chest wall tenderness. CV: regular rate and rhythm. no edema. Pulmonary: normal respiratory effort without distress, absent of wheezes or rales.

DIFFERENTIAL DIAGNOSIS:

- 1) Overtraining syndrome
- 2) Asthma/Exercise induced bronchospasm
- 3) Viral syndrome
- 4) Pulmonary embolism

TESTS AND RESULTS:

8/2017: EKG nonspecific/chest X-ray reported small bilateral pleural effusion
 8/2017: Non contrast chest CT - no pleural effusion
 8/2017: TTEcho: EF 60-65%, unremarkable valves & chambers
 8/2017: Treadmill test unspecific, high exercise tolerance
 9/2017: CXR - persistence of bilateral pleural effusion.
 1/2018: Myocardial perfusion scan - no evidence of stress induced ischemia
 3/2018: Spirometry - normal, no response to Bronchodilators.
 3/2018: Non Contrast chest CT - Diminished right lung pleural opacity, probably represented inflammatory change
 9/2018: D-dimer 564
 9/2018: CT-A - small embolus in a subsegmental branch of the pulmonary artery to the left lower lobe. Second pulmonary embolus in a segmental branch of the pulmonary artery to the right lower lobe.

FINAL/WORKING DIAGNOSIS

Bilateral unprovoked pulmonary embolism

TREATMENT AND OUTCOMES

- 1) Discussed indications, risks, benefits, and dietary & activity precautions of anticoagulation with Warfarin vs. Direct Oral Anticoagulant such as Pradaxa with patient in extensive detail. Patient opted for Pradaxa.
- 2) Hypercoagulable work-up sent and hematology referral

1653 May 30 2:30 PM - 2:50 PM

Chest Injury-football

Kendrick I. Watkins, Rehal A. Bhojani. *University of Texas Health Science Center, Houston, TX. (Sponsor: Charles Chassay, FACSM)*

(No relevant relationships reported)

HISTORY: 17 year old high school football wide receiver presented with left back and rib pain. He sustained a hit in that region during a football game the night before. He was taken out of the game due to pain and difficulty breathing which ultimately kept him from finishing the game. After the game he continued to have pain for which he took a muscle relaxant that he had from a previous injury and over the counter pain medication with minimal pain relief. The pain persisted through the night and into the following morning. His pain was worse with deep breathing and any pressure on his chest. He denied any shortness of breath, dyspnea with exertion, cough, wheezing or hemoptysis.

PHYSICAL EXAMINATION: Appeared in no acute distress, Ecchymosis over the posterior lateral aspect of left lower ribs with tenderness to palpation. No crepitus, No palpable deformity, Symmetric chest expansion, posterior rib/back pain reproduced with deep inspiration, Equal bilateral breath sounds, No hyper-resonance to percussion, Normal respiratory rate, Negative anterior posterior compression test, Positive lateral compression test, Full AROM of the back

DIFFERENTIAL DIAGNOSIS: Rib fracture, Pneumothorax, Pulmonary contusion, Pulmonary embolism

TEST AND RESULTS: X-ray Rib series: Small left apical pneumothorax involving approximately 20% of the hemi thorax. Suspected nondisplaced fractures involving the posterolateral left eighth and ninth ribs with small linear lucencies within these regions. Chest CT scan: Small left-sided pneumothorax approximately 20%. No acute osseous injury.

FINAL WORKING DIAGNOSIS: Pneumothorax

TREATMENT AND OUTCOMES:

The patient was sent to ER after being seen in clinic to expedite getting a CT scan done after the X-rays. After the CT scan was obtained it was decided by the ED to admit the patient for observation. He obtained a subsequent x-ray that evening 12 hours after is initial which showed a slightly smaller left apical pneumothorax. He was discharged the next day. Repeat chest x-ray done three days after discharge showed improving pneumothorax. Patient was seen in clinic 2 weeks after his discharge from the hospital and was started on a graded exercise program with repeat x-ray at 1 week after clinic visit showed resolution of pneumothorax. He returned to full game play at 4 weeks after his initial injury.

1654 May 30 2:50 PM - 3:10 PM

Focal Chest Pain- Rugby

Joshua Martin, Prakash Jayabalan, Joseph Ihm, FACSM. *Shirley Ryan AbilityLab/ Northwestern, Chicago, IL.*

(No relevant relationships reported)

HISTORY: A 21-year old rugby-playing male presented with a one year history of worsening anterior chest wall pain. Pain was associated with a popping sensation in the anterior chest. Additionally, symptoms were aggravated by overhead movements and chest exercises. Pain was focal, without discomfort in the ribs or thoracic back. He denied shortness of breath, pain while coughing, and all other systemic symptoms.

PHYSICAL EXAMINATION: Local examination revealed a tender swelling at the manubriosternal joint (MSJ). Chest expansion was full and deep breaths did not elicit pain. Full painless range of motion at the shoulder, with strength intact to manual muscle testing throughout

DIFFERENTIAL DIAGNOSIS:

1. Strain of pectoralis major
2. Costochondritis
3. Inflammatory arthritis
4. Osteoarthritis of the MSJ
5. Pulmonary embolism
6. Pneumothorax
7. Pericarditis

TEST AND RESULTS:

Prior cardiology work-up did not reveal an eliciting cause

Lateral x-ray of the chest (sternal view)

- Bone resorption on both sides of the MSJ, and soft tissue swelling anterior to the joint.

Chest MRI

- Irregularity at the sternal and manubrial articular surfaces, along with a small effusion, compatible with osteoarthritis.

Further rheumatological workup for inflammatory markers

- Unremarkable CBC, ESR and CRP

FINAL WORKING DIAGNOSIS: Manubriosternal osteoarthritis

TREATMENT AND OUTCOMES:

1. Refrained from rugby for several months
2. Started on regular daily meloxicam 7.5mg for 1 month
3. Significant improvement in symptoms

D-16 Clinical Case Slide - Foot and Ankle

Thursday, May 30, 2019, 1:30 PM - 3:10 PM
Room: CC-305

1655 Chair: Stephen M. Simons, FACSM. *Saint Joseph Regional Medical Center, South Bend, IN.*

(No relevant relationships reported)

1656 Discussant

John Fraser. *Naval Health Research Center, San Diego, CA.*

(No relevant relationships reported)

1657 Discussant

Kirk McCullough. *Ortho Sports Medicine Kansas City, Kansas City, KS.*

(No relevant relationships reported)

1658 May 30 1:30 PM - 1:50 PM

Recurrent Foot Pain - A Case Series of Two Division 1 College Football Athletes

Elizabeth L. Albright. *Penn State Health, State College, PA.*
(Sponsor: Peter Seidenberg, MD, FACSM)

(No relevant relationships reported)

HISTORY: Patient 1 (P1) is a 21 y/o white male who presented for pain over lateral aspect of his right foot after twisting on it during scrimmage. He had immediate pain with ambulation. He denied hearing/feeling a pop or paresthesias. Patient 2 (P2) is a 21 y/o African-American male who presented after feeling a pop in his lateral left foot during cutting maneuver at practice. He had significant pain with ambulation and denied paresthesias. Both were 5 months status post percutaneous screw fixation of Jones fracture of the ipsilateral foot. After initial injury, Vitamin D levels were 24 and 27 ng/ml respectively. They were started on Vitamin D supplementation and provided a bone stimulator. They remained non-weightbearing in CAM boot for 4 weeks followed by weightbearing in CAM boot for 2 weeks. At 6 weeks, they progressed back into regular shoes. They completed rehab with athletic trainer and had returned to full activity at time of reinjury. **PHYSICAL EXAMINATION:** Both: Skin intact. Full ankle ROM. TTP of Base of 5th metatarsal. Neurovascularly intact. No TTP of navicular, bilateral malleoli, ankle ligaments, Lisfranc joint, peroneal tendons, bifurcate ligament, calcaneus, or cuboid. Both had flexible, forefoot induced, inverted varus positioning of calcaneus with positive Coleman block test. P1 had equivocal fulcrum test and pes cavus. P2 had mild edema of lateral foot and pes planus. **DIFFERENTIAL DIAGNOSIS:** Repeat Jones Fracture, 5th Metatarsal shaft or Avulsion fracture, Peroneal Tendon Rupture, Bifurcate Ligament Sprain, Cuboid Subluxation, Avascular Necrosis **TESTS AND RESULTS:** P1: New lucency at previously healed fracture site on XR, No hardware issues P2: Initially improved compared to previous XR but bone reabsorption evident at 2 weeks. No hardware issues **FINAL WORKING DIAGNOSIS:** Recurrent Jones Fracture **TREATMENT AND OUTCOMES:** Non-weight bearing in CAM boot. Restart bone stimulator. Continue Vitamin D. At 1 week, transitioned to weightbearing in CAM boot. At 4 weeks, P1 transitioned into regular shoe with custom clamshell orthotic to correct hindfoot deformity and started return to play progression. At 6 weeks, he returned to full activity with orthotic in cleats. P2 required an additional 2 weeks in boot for slow fracture remodeling but then started RTP with full return by 8 weeks

1659 May 30 1:50 PM - 2:10 PM

Heel Injury-Figure Skate

Naoko Onizuka, Suzanne Hecht, FACSM. *University of Minnesota, Minneapolis, MN.* (Sponsor: Suzanne Hecht, FACSM)

(No relevant relationships reported)

HISTORY: A nine year old female figure skater presented with 6 weeks of atraumatic right foot pain. She recently started training double jumps prior to the onset of pain. Pain was located on the plantar side of the right midfoot and she initially noticed it following practices. Weight bearing increased her pain and eventually it hurt during practice as well as after practice. No changes in training time or frequency. She has been figure skating for two years. No history of previous foot injuries or bone stress injuries. No family history of osteoporosis. Her past medical history is significant for chronic Lyme's disease.

PHYSICAL EXAM: Ht 4' 6" (1.372 m) | Wt 69 lb (31.3 kg) | BMI 16.64 kg/m2 (56 percentile), Healthy and NAD. Accompanied by her mother.

Examination:

Inspection: Neutral foot type. Normal alignment of lower extremities. There was no redness, swelling, or skin changes.

Palpation: moderate tenderness on the right plantar mid foot.

Range of motion: there was full active range of motion of the ankle, without significant pain.

Strength: Muscle strength (ankle plantarflexion, dorsiflexion, inversion, eversion) full.

Special tests: Fracture test (tap, percussion, bump) negative, squeeze test negative, anterior drawer test negative, Talar tilt test negative, Stress test negative, Thompson test negative.

DIFFERENTIAL DIAGNOSIS:

1. Navicular bone stress injury
2. Tarsal coalition
3. Anterior tibialis tendinopathy
4. Posterior tibialis tendinopathy
5. Bone tumor
6. Nerve entrapment
7. Heel pad syndrome
8. Sever disease

TEST AND RESULTS:

1. Ankle X-ray- No obvious fracture or callus
2. MRI Ankle- bone marrow edema in the neck of the calcaneus
3. DXA- Normal bone density

FINAL DIAGNOSIS: Calcaneus bone stress injury

TREATMENT AND OUTCOMES:

1. Decreased activity level
2. Non-weight bearing on crutches for 2 weeks
3. Walking boot for 3 weeks with partial weight bearing on crutches
4. PT 1-2x/ week for 2-3 weeks
5. Vitamin D 2000 IU everyday
6. Partial weight bearing to full weight bearing as tolerated
7. Gradual return to sports after 12 weeks of injury, when she did not have pain with ambulation, and repeat MRI showed no evidence of residual bone marrow edema.

1660 May 30 2:10 PM - 2:30 PM

Ankle Pain - Basketball

Mary Lynch, David Soma. *Mayo Clinic, Rochester, MN.*
(Sponsor: Karen Newcomer, FACSM)

(No relevant relationships reported)

HISTORY: Our patient is a healthy 17 year old female basketball and softball player who had been treated for bilateral Achilles tendonitis. Two weeks prior to presentation, she jumped and created a moment of extreme plantar flexion of her left foot. She had immediate posterior ankle pain without edema or erythema. A physical therapist recommended heel cups. She did not consistently rest. Her basketball performance was poor over the next two weeks.

• **PHYSICAL EXAMINATION:** Normal gait and inspection. Tender deep to the Achilles tendon near the junction of the talus and calcaneus with mild tenderness along the Achilles tendon and musculotendinous junction. No tenderness of the calcaneus, medial or lateral malleolus, or midfoot. Active ROM preserved. Passive ROM limited a few degrees in both dorsiflexion and plantar flexion compared to the contralateral foot. 5/5 plantar flexion and dorsiflexion strength. Resisted plantar flexion and hopping on left foot caused significant discomfort. Normal Achilles squeeze test.

• DIFFERENTIAL DIAGNOSIS:

- 1. Achilles tendonitis
- 2. Retrocalcaneal bursitis
- 3. Fracture of os trigonum
- 4. Tendonitis of flexor hallucis or flexor digitorum tendon
- 5. Posterior facet arthritis of the subtalar joint

• TEST AND RESULTS:

- **X-ray:** Originally radiologist read as normal, but sports medicine interpretation was that there appeared to be a lucency extending through the lateral tubercle of the posterior process of the talus consistent with acute fracture.
- **MRI:** Nondisplaced fracture of the Stieda process of the talus with associated bone marrow edema. Additional findings include small effusions in the posterior facet of the subtalar and tibiotalar joints, minimal tendinopathy of distal Achilles tendon, and a tiny amount of fluid in the retrocalcaneal bursa.
- **FINAL WORKING DIAGNOSIS:** Fracture of Stieda process
- **TREATMENT AND OUTCOMES:**
 - 1. After two weeks of rest in a boot, she began isometric exercises without the boot and stationary cycling in the boot.
 - 2. After four weeks in the boot, she progressed to one week of light activity before returning to play at the end of her senior year of high school basketball and playoffs. She was counseled about the risk of non-union or re-injury given that she did not rest for a more prolonged period.
 - 3. One year later, she remains pain free playing college basketball.

1661 May 30 2:30 PM - 2:50 PM

Atypical Ankle Pain In A 10-year-old

Robyn C. Knutson Bueling. *TRIA Orthopedics, Woodbury, MN.*
Email: robyn.knutsonbueling@parknicollet.com

(No relevant relationships reported)

HISTORY: Active 10-year-old non-athlete with acute onset of severe ankle pain and swelling for two days. Occurred while at school but can't recall injury during PE or recess. Taken to Children's hospital ER and treated with ice. Presented to Acute Injury Clinic for further evaluation.

PHYSICAL EXAMINATION: Significant TTP diffusely about R ankle. Moderate-to-severe R ankle joint effusion. Unable to weight-bear. Limited ROM secondary to pain. No rash. No fever. L ankle exam normal.

DIFFERENTIAL DIAGNOSIS: Occult injury. Lyme disease. Joint infection. Post-infectious septic joint. Tumor.

TEST AND RESULTS: -Aspirate normal CBC, elevated uric acid, normal CRP, negative culture, negative crystals, substantial RBC and some WBC, Lyme negative. -MRI with large tibiotalar joint effusion with multiple large intra-articular masses consistent with polyvillous nodular sclerosis or other synovial metaplasia.

FINAL WORKING DIAGNOSIS: PVNS R ankle

TREATMENT AND OUTCOMES: -Very uncommon presentation of PVNS in atypical joint and atypical age-group. -Splinted for comfort. Narcotic pain medicines prn. -Evaluated by orthopedic oncology. Take for surgical intervention. -Patient has now had full return to full activity with ongoing surveillance.

1662 May 30 2:50 PM - 3:10 PM

A Poorly Timed Slapshot To The Foot in a Hockey Player

John Gunel, Christopher Lutrzykowski. *Maine Dartmouth Sports Medicine Fellowship, Augusta, ME.* (Sponsor: James Dunlap, MD, FACS)M

(No relevant relationships reported)

History: This is a 16 year old female ice hockey player who is a senior at a boarding school. She presents with right medial foot pain. This occurred after blocking a slap shot with her instep three weeks prior. Being recruiting season, she continued to play on her painful foot, lift weights daily, and run 3 miles two times per week. She has changed her gait to reduce pain with these activities. NSAIDs and working with her AT on strengthening and range of motion have not improved her symptoms. Due to worsening pain with weight bearing, she received right foot xrays at an urgent care center and she would like to follow up on the results. She anxiously states that in two weeks, she will be returning to her boarding school where she seeks to participate in a showcase tournament where multiple scouts will be present. **PE:** Gen: NAD.

MSK: BL foot and ankles: Inspection: Soft tissue swelling in anteriolateral right ankle. Palpation: TTP over navicular. No TTP over 5th metatarsal or medial/lateral malleolus. Squeeze test positive. ROM: normal in all planes but painful at right at end ranges of motion. Strength: 5/5 in all planes. Special tests: negative drawer and false tilt. Sensation: intact Vascular: DP 2+, cap refill Proprioception: Single leg stance, heel raise: normal **Differential Diagnosis:** Stress fracture Bipartite navicular Osteochondritis dissecans Avascular necrosis Avulsion fracture Morton's Neuroma Tarsal coalition **Imaging:** 1) X-RAY, RIGHT FOOT - possible navicular fracture. No other bony abnormalities, malalignment, soft tissue abnormality.

2) MRI FOOT, RIGHT: Edema throughout the navicular, proximal diaphysis of the third metatarsal, and the base of the fourth metatarsal. **Final Diagnosis:** Stress fracture of the Navicular, third metatarsal, and fourth metatarsal. **Treatment:** Non weight bearing with boot for 5 weeks, then gradual return to weight bearing.

Outcome: Ongoing pain with weight bearing but no TTP at follow up. Her treatment was complicated by her boarding school not having a team physician for our office to release her to.

After a risk/benefit discussion, the patient elected to participate in a showcase tournament with pain in her navicular while playing. She otherwise complied with the treatment plan. Her pain resolved at 6 weeks and she signed a letter of intent with a D1 school for ice hockey.

D-17 Clinical Case Slide - Running

Thursday, May 30, 2019, 1:30 PM - 3:10 PM

Room: CC-306

1663 **Chair:** Adam S. Tenforde. *Stanford University, Palo Alto, CA.*

(No relevant relationships reported)

1664 **Discussant**Emily Kraus. *Stanford University, Palo Alto, CA.*

(No relevant relationships reported)

1665 **Discussant**Irene S. Davis, FACS. *Harvard Medical School Spaulding-Cambridge, Cambridge, MA.*

(No relevant relationships reported)

1666 May 30 1:30 PM - 1:50 PM

A Rare Cause Of Pain In A Runner: The "Nail-Patella Syndrome"

Kenneth Vitale, Evelyne Fliszar. *University of California San Diego, School of Medicine, La Jolla, CA.*

(No relevant relationships reported)

HISTORY: 26-yo female presented with 1 year of anterior knee pain with running, worse on hills and squatting. Had seen multiple providers and diagnosed with patellofemoral pain but didn't improve with treatment. ROS was significant for elbow stiffness, unable to fully extend elbows since childhood. No known medical/family history but reports that multiple relatives have same problem. She also reported "unusual appearance" of thumbnails since childhood, covers with fake nails and polish. Had seen Orthopedics and Dermatology without clear answer. **PHYSICAL EXAMINATION:** 5' 5", 99lb, BMI 16.5. Bilateral knees no effusion, ROM 0-150° with patellar maltracking and palpably small patellae. Increased femoral anteversion and femoral adduction, but normal composite hip ROM. Hypoplastic thumbnails noted with ridging and splitting. Bilateral elbow flexion contractures ~45°. Normal neurovascular exam. **DIFFERENTIAL DIAGNOSIS:** Patellofemoral pain syndrome, Patellar subluxation/dislocation, Painful bipartite patella, Congenital deformity/dysplasia. **TEST AND RESULTS:** Knee x-rays showed severely hypoplastic patellae, trochlear dysplasia with prominent lateral femoral trochlea. Elbow x-rays revealed hypoplastic convex radial heads and capitellum with chronic posterior radial head dislocations. Due to these findings a pelvic x-ray was recommended which displayed iliac bone exostoses, confirming the diagnosis. **FINAL WORKING DIAGNOSIS:** Hereditary Osteo-Onychodysplasia, the "Nail-Patella Syndrome." **TREATMENT AND OUTCOMES:** Patient had been treated for individual manifestations of disease without recognition of the syndrome. Education was provided on diagnosis; as Nail-Patella is a syndrome of multiple abnormalities, including renal anomalies, a Nephrology referral was given to screen for renal dysplasia. Understanding of these congenital abnormalities is key to management of associated sequelae, and genetic counseling was further recommended as this is an autosomal dominant disorder. Elbow treatment option would be radial head resection, which may not improve elbow extension; patient declined. Focused leg strengthening and activity modification to accommodate knee abnormalities resulted in pain reduction, and in 2 months was able to return to light jogging (without hills) and modified yoga.

1667 May 30 1:50 PM - 2:10 PM

Barefoot Rehabilitation Of Arch Pain In A Veteran Foot Injury--RunningMatt Heindel¹, Kirsten Buchanan¹, Irene Davis, FACS².

¹University of New England, Portland, ME. ²Harvard Medical School, Cambridge, MA.

(No relevant relationships reported)

HISTORY: The patient was a 39-year-old male veteran who complained of dull pain along the plantar portion of the left, medial longitudinal arch. This pain persisted for 3 months and was most noticeable during weight bearing activities. Most notably, the patient was unable to participate in recreational running of any duration secondary to pain. The patient was evaluated by his primary care physician who referred him to outpatient physical therapy after ruling out a fracture through x-ray examination. **PHYSICAL EXAMINATION:** The patient presented with increased pain along the left medial longitudinal arch during heel elevation, mild swelling along the medial

malleolus, decreased left dorsiflexion range of motion, decreased left plantarflexion and inversion strength, a flexible flatfoot deformity, and pain with any attempt to run recreationally.

DIFFERENTIAL DIAGNOSIS:

1. Posterior Tibialis Tendon Dysfunction
2. Eversion Ankle Sprain
3. Foot/ankle fracture

TEST AND RESULTS:

Strength: Manual muscle testing 3+/5 with pain on left foot plantarflexion and inversion

Range of motion: Left talocrural dorsiflexion 2° with knee extended and 5° with knee flexed to 90°

Ligamentous testing: Negative external rotation test, anterior drawer, and talar tilt

Neural testing: Negative sciatic nerve tension test with tibial nerve sensitization

Foot fracture: Negative Ottawa ankle rules

Functional Outcomes:

- LEFS 49/80

- Single leg Heel Rise Test: 0 reps

FINAL/WORKING DIAGNOSIS: Stage II posterior tibialis tendon dysfunction

TREATMENT AND OUTCOMES:

1. Strengthening

a. Barefoot short-foot exercise - 3 sets of 10 reps 1x/day

b. Inversion strengthening with red resistance band - 150-600 reps for 3 sets per day

c. Double heel rise with unilateral descent - 3 sets of 10 reps 1x/day

d. Gluteal Strengthening

2. Stretching

a. Barefoot gastroc and soleus stretches. 3 sets of 30 seconds 1x/day

3. Joint Mobilization

a. Modified Mulligan technique into dorsiflexion for 3 sets of 30 seconds

4. Outcomes

a. LEFS score improved from 49/80 to 71/80

b. Single leg heel rise test increased from 0 to 16 reps

c. Range of motion with left dorsiflexion improved from 2° to 10° with full knee extension and from 5° to 15° with 90° of knee flexion

d. Strength improved from 3+/5 to 5/5 with PF and inversion

e. Patient reported 3 consecutive days of running 2 miles without pain

1668 May 30 2:10 PM - 2:30 PM

Ankle Injury -- Running

Jaire N. Saunders MPH, MD, Kevin Mullins MD, Brandee Waite MD. *UC Davis, Sacramento, CA.* (Sponsor: Brian Davis MD, FACSM)

(No relevant relationships reported)

HISTORY

57yr old female with pmhx HTN, T2DM, HLD, previously seen in clinic for right knee OA secondary to remote injury. Presenting with 3-week history of acute onset right ankle pain. Occurred while running on treadmill after prolonged decrease in activity level due to BUE injuries. Receiving viscosupplementation in right knee with good relief. With the positive relief, three months prior to injury, patient started to increase frequency and intensity of exercise to help lose gained weight. Reports no obvious injuries to RLE.

PHYSICAL EXAMINATION

Heavy body habitus (BMI 34 kg/m²). Unable to walk on right ankle without significant pain. Antalgic gait.

INSPECTION- Significant soft-tissue swelling RLE. Right foot edema. No major bruising. No erythema in

PALPATION- Severe tenderness in all areas of the ankle limiting physical exam.

Increased warmth around foot and ankle. Unable to palpate pulses in foot or ankle, but RLE warm.

RANGE OF MOTION- Limited active and passive ROM and in all planes due to swelling and pain

DIFFERENTIAL DIAGNOSIS

1. Ankle sprain or other ligamentous injury at ankle or foot
2. Ankle or foot fracture
3. Achilles injury

4. Gout

5. Other inflammatory arthropathy

6. Stress fracture

7. Avascular necrosis

TEST AND RESULTS

Ankle xray: negative

ESR: 6 (nl 0 - 30mm/Hr)

CRP: 0.7 (nl 0.1 - 0.8mg/dL)

Uric acid: 7.9 (2.2 - 7.7mg/dL)

CT Gout Study lower extremity: No evidence of monosodium urate deposition in ankle or foot.

MRI lower extremity joint: transverse fracture through distal tibial metaphysis

CT Scan Addendum (after MRI completed): Findings of a distal right tibial fracture

DEXA: pending

FINAL DIAGNOSIS

Tibia fracture (from stress fracture)

TREATMENT AND OUTCOMES

1. Non-weight bearing

2. Knee scooter

3. Activity modification/maintain cardiovascular exercise

4. Advance activities in 6-8 weeks

5. Awaiting DEXA for possible treatment

1669 May 30 2:30 PM - 2:50 PM

A Case For Running Without Toes!

Lindsay Wasserman, Irene S. Davis, FACSM. *Spaulding National Running Center, Cambridge, MA.* (Sponsor: Irene Davis, FACSM)

Email: lwasserman@partners.org

(No relevant relationships reported)

TEXT:

HISTORY: 43 yr. old F runner training for her 1st half marathon had an amputation of all 10 toes distal to MTP on October 2014 due to a systemic infection. By October 2016, she started a run/walk program and began to develop L lateral ankle pain, due to increased inversion during gait. After undergoing surgery to remove scar tissue from her lateral foot and re-align the EHL tendon to resist inversion, the lateral ankle pain decreased. However, when she attempted to run or walk long distances, she experienced medial lower leg pain, L>R, that progressed to a 7/10 on the L. Despite being told she wouldn't be able run anymore, her goal was to train for another half-marathon.

PHYSICAL EXAM:

1. Callus formation L 5th metatarsal, suggesting increased lateral loading

2. Pain/ tenderness noted on the medial lower leg BIL, L>R

3. Limited calcaneal eversion on the L and ankle DF on the R

4. Weakness of the inverters, everters, and plantarflexors BIL

5. Weakness of the Hip ABD, EXT and ER L>R. Lower abdominals were also very weak

6. Running Gait (w/custom orthotics and a cushioned running shoe)

Rearfoot striker BIL

Increased hip ADD, IR and pelvic drop BIL

L inverted and toed-in at foot strike

Increased L arch drop during mid support

Pain was 3/10 on the L. When cued to toe out on the L, symptoms reduced and shifted to the calf.

WORKING DIAGNOSIS

Posterior tibialis tendinosis L>R due to weakness and reduced mobility in foot/ankle, along with medialization of the leg due to Hip ADD and IR.

TREATMENT:

1. Weaned pt. slowly out of orthotics to reduce lateral loading

2. Transition to minimal shoes for walking to promote foot/ankle strength

2. Increase mobility of foot/ankle

3. Promote foot/ankle function and control with balance and plyometrics

4. Incr. hip/core strength to improve dynamic alignment

5. Gait retraining to reduce toe in, inv. at foot strike and improve alignment proximally

OUTCOME: Pt was discharged March 2018 running 30 min 3x/wk pain-free in a low profile partial minimal cushion shoe w/o orthotics. She exhibited improved foot alignment and reduced hip add, IR and CPD. Pt continued to wear full minimal shoes during her cross-training. She was able to wear high heels for the first time since her amputations without pain. In Sept 2018, she completed her half marathon pain-free.

1670 May 30 2:50 PM - 3:10 PM

Knee Pain - Running

Adam K. Willson, Joshua Berkowitz. *UNC Chapel Hill, Chapel Hill, NC.*

(No relevant relationships reported)

HISTORY: 19 year old female who developed right knee pain over two years ago during mile 23 of a marathon without specific, focal injury. She then consistently developed severe right posterior lateral knee pain after running around 2 miles, significant enough that she cannot continue running. Pain is improved with rest. She was a college athlete (running) but had to quit due to this pain. She had completed 3 courses of physical therapy without improvement. She did not report any other symptoms. She has no pain with activities other than running, or with running distances up to 1.5-2 miles. Prior MRI is normal with the exception of some slight signal in the distal biceps femoris tendon.

PHYSICAL EXAMINATION: Right knee – no erythema, swelling or ecchymosis. Mild to moderate tenderness to palpation at the posterior lateral fibular head and just proximally. No other abnormalities.

DIFFERENTIAL DIAGNOSIS:

1. Biceps femoris tendinopathy

2. Popliteus tendinitis
3. Popliteal artery entrapment syndrome
4. Common peroneal nerve entrapment

TEST AND RESULTS:

- PVL arterial duplex: No change in PT and AT artery waveforms with plantar and dorsiflexion. Not suspicious for popliteal artery entrapment
- MRI right knee: Suggestive of mild trochlear dysplasia. Visualized posterolateral corner right knee structures were normal. Intact right knee ligaments and menisci
- US-guided diagnostic (anesthetic) injection to the biceps femoris tendon sheath yielded no improvement in symptoms
- US-guided corticosteroid injection to the posterolateral corner (deep to the biceps femoris tendon) provided 3 weeks of complete symptomatic relief and she was able to run 5 miles without symptoms

FINAL/WORKING DIAGNOSIS:

- Low-grade posterolateral corner injury only symptomatic with prolonged exertion

TREATMENT AND OUTCOMES:

- Clinically has characteristics localizing to the posterolateral corner, deep to the biceps femoris tendon, possibly related to scar tissue formation or dynamic entrapment
- Ultrasound-guided corticosteroid injection deep to the distal biceps femoris tendon provided relief but only for 3 weeks
- Plan for PRP injection to the posterior lateral corner for further treatment and evaluation
- Possible consideration of exploratory arthroscopy if even transient response to posterior lateral corner treatment can be redemonstrated

D-18 Rapid Fire Platform - Acute Hypoxia and Aerobic Performance

Thursday, May 30, 2019, 1:30 PM - 2:40 PM
Room: CC-Hall WA2

1671 Chair: Nisha Charkoudian, FACSM. *USARIEM, Natick, MA.*
(No relevant relationships reported)

1672 May 30 1:30 PM - 1:40 PM
The Role of Ventilatory Responsiveness During Exercise in Performance Impairment in Acute Hypoxia
Keren Constantini, Anna C. Bouillet, Bruce J. Martin, Robert F. Chapman, FACSM. *Indiana University, Bloomington, IN.*
Email: keconsta@indiana.edu
(No relevant relationships reported)

The ability to increase exercise ventilation to defend arterial oxyhemoglobin saturation during hypoxic exercise is commonly viewed as an important factor contributing to large individual variations in the degree of performance impairment in hypoxia. While the hypoxic ventilatory response (HVR) could provide insight into the underpinnings of such impairments, it is almost exclusively measured at rest, under isocapnic conditions.

Purpose: 1) to determine in a cohort of highly trained athletes whether the integrated ventilatory response to progressive hypoxia at rest (HVR_{REST}) and during exercise (HVR_{EX}) are comparable, and 2) to determine whether HVR_{EX} is related to the degree of performance impairment in acute hypoxia.

Methods: Sixteen endurance-trained men (VO_{2peak} : 62.6 ± 6.2 ml·kg⁻¹·min⁻¹) performed two poikilocapnic HVR tests: 1) during seated rest (HVR_{REST}) where inspired O₂ fraction (FiO₂) was progressively reduced; and 2) while cycling at 40% of power at normoxic VO_{2peak} (HVR_{EX}) where FiO₂ was reduced in a square-wave fashion every 5 min (FiO₂ = 0.21, 0.18, 0.15 and 0.12). On two separate visits, subjects (n = 12) performed a 10km cycling time trial (TT) while breathing either room air or a hypoxic gas mixture (FiO₂ = 0.16), in a randomized order. Performance impairment was calculated as the percentage change in time to complete the TT between normoxia and hypoxia (ΔTT).

Results: HVR_{EX} was significantly ($p < 0.05$) greater than HVR_{REST} (1.51 ± 0.45 and 0.22 ± 0.14 l·min⁻¹·%⁻¹, respectively), and the two measures were not correlated ($r = -0.05$, $p = 0.84$). ΔTT was not correlated with HVR_{REST} ($r = -0.06$, $p = 0.86$) or HVR_{EX} ($r = 0.36$, $p = 0.28$). The percentage change in VCO₂ and ventilation between TTs was significantly ($p < 0.05$) correlated with ΔTT ($r = -0.72$ and $r = -0.58$, respectively), and these variables together explained 71% of the variance in performance impairment in acute hypoxia ($p < 0.01$).

Conclusions: 1) HVR_{REST} may not be an appropriate or applicable measure to utilize when studying ventilatory and other physiological responses to exercise and/or exercise performance; and 2) Although HVR_{EX} may explain little to the degree of performance impairment in acute hypoxia, (adequate) ventilation is likely essential for mitigating these expected hypoxia-induced impairments in performance, at least to some degree.

1673 May 30 1:40 PM - 1:50 PM

Sex Differences In Respiratory And Circulatory Cost And Arterial Oxygen Saturation During Hypoxic Walking

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(No relevant relationships reported)

PURPOSE: Since women have smaller lungs and a decreased capacity for lung diffusion compared to men, these differences may increase the work required for women to maintain a given rate of pulmonary ventilation (V_E), resulting in greater exercise-induced arterial hypoxemia (EIAH). Previous studies have ignored the energy expenditure (EE) on circulation (i.e., heart rate; HR) and ventilation during exercise. **METHODS:** We sought to investigate sex differences in EE, V_E and HR in response to changes in SpO₂. We hypothesized that women would experience greater EIAH, and that the contribution rate of EE, V_E and HR in response to changes in SpO₂ would be different between the sexes. We measured EE during walking on a level gradient under normoxia (room air, 21% O₂), and moderate hypoxia (13% O₂). Ten healthy young men and ten healthy young women walked on a treadmill at seven speeds (0.67-1.67 m s⁻¹). Each walking speed lasted for four minutes. EE was calculated using pulmonary oxygen uptake and carbon dioxide output. **RESULTS:** During walking, reductions in SpO₂ trended slightly greater in women under hypoxia (71.5 ± 4.5 % for men and 67.7 ± 6.1 % for women at the fastest gait speed, $P > 0.05$). Hypoxia-induced elevation in EE, HR, and V_E were calculated by the difference between values in hypoxia and normoxia. Using a multivariate model that combined EE, V_E and HR to predict ΔSpO_2 (hypoxia-induced reduction), we obtained a very strong fit model both for men ($r^2 = 0.900$, $P < 0.001$) and for women ($r^2 = 0.957$, $P < 0.001$). We also tried to estimate the relative contributions of ΔEE , ΔV_E and ΔHR to predict ΔSpO_2 by using standard partial regression coefficients. The contribution rate to predict ΔSpO_2 was markedly different between men and women. In women, the effect of ΔEE and ΔV_E were greater (EE: 28.1% in women vs. 15.8% in men; V_E : 4.1% in women vs. 1.7% in men). Conversely, in men the contribution of ΔHR was greater (82.5 % in men and 67.9 % in women). Moreover, significant sex differences in breathing frequency and tidal volume were observed ($P < 0.05$, respectively).

CONCLUSIONS: These findings suggested that high-altitude adaptation in response to hypoxemia has different underlying mechanisms between men and women. Our results can help to explain how men and women adapt high-altitude environments.

1674 May 30 1:50 PM - 2:00 PM

Hypoxia Reduces Steady State Cycling Workload

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Training in hypoxia is growing in popularity among athletes. Exercise in hypoxic conditions produces decrements in steady state and maximal workload capacity.

PURPOSE: The purpose of this pilot study was to characterize the differences in steady-state exercise power between hypoxic and normoxic conditions. **METHODS:** 10 healthy adults (5 males, 5 females) mean age of 23.8 ± 4.5 years volunteered to participate in the study. Pretesting included a graded exercise test to determine cycle resistance at 75% of age predicted heart rate max for each condition. The two conditions are defined as, normoxia (FiO₂ = 20.5%) and normobaric hypoxia (FiO₂ = 14.4%). A Hypoxico 5570 Everest Summit II Altitude training system was used to create conditions. Intervention days were at least 72 hours apart but no more than one week. A single blinded and counterbalanced model was used. Steady state exercise was performed on a cycle ergometer (Watt bike Pro, Waukesha, WI, USA) at a rate of 60 RPM for 30 min. Heart rate (HR), blood oxygen saturation (SPO₂), cycling watts and mean power was recorded every minute. **RESULTS:** SPO₂ were significantly lower during hypoxic exercise than during normoxic exercise (average SPO₂ = 80.58 ± 4.3 in hypoxia and 95.23 ± 0.97 in normoxia) $p < 0.001$. Average cycle wattage was also significantly decreased during hypoxic exercise (110.7 ± 34.5 , compared to 125.9 ± 49.6) $p = 0.044$. Mean HR was not significantly different between the two conditions. Mean power output in normoxia to wattage in hypoxia, $r^2 = 0.7556$. Pearson's correlation = 0.869 $p < 0.001$. **CONCLUSION:** Hypoxia reduced steady state power without changes in relative intensity. Mean cycling power in normoxic conditions and hypoxic positively correlate. These preliminary findings suggest that a predictive equation could be possible with further data collection.

1675 May 30 2:00 PM - 2:10 PM

Higher Muscle Tissue Oxygenation When Exposed To Hypobaric Hypoxia Than Normobaric Hypoxia

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(No relevant relationships reported)

PURPOSE: There has been recent debate on the potential difference in physiological response between exposure to simulated altitude (normobaric hypoxia) and terrestrial altitude (hypobaric hypoxia). Therefore, the purpose of this research was to determine the difference in the physiological response to normobaric and hypobaric hypoxia during exercise. **METHODS:** Eight recreationally active subjects (age: 27 ± 5 y, body weight: 73.1 ± 7.4 kg, height: 170.6 ± 6.7 cm, body fat: 19.3 ± 9.2 %) completed incremental cycling exercise to volitional fatigue in three separate environments, normobaric normoxia (NN; 350 m), normobaric hypoxia (NH; simulated 3094 m) and hypobaric hypoxia (HH; 3094 m). Heart rate, blood oxygen saturation, and muscle tissue oxygenation were measured at rest and continuously throughout the exercise trials. **RESULTS:** Blood oxygen saturation (SpO_2) was $\sim 10\%$ higher in NN compared to the two hypoxic conditions ($p < 0.001$) at rest and all exercise stages, with no difference between NH and HH ($p > 0.05$). Heart rate was higher at rest in HH (98 ± 13 bpm) compared to NN (83 ± 15 bpm, $p = 0.011$) and NH (84 ± 14 bpm, $p = 0.001$) which persisted until 165 watts at which point no difference was observed ($p > 0.05$). Muscle tissue oxygenation was 17% higher in HH compared to NN and 19% higher than NH throughout exposure ($p < 0.05$). **CONCLUSIONS:** This data indicates that the hypoxic stress resulting from normobaric and hypobaric hypoxia are not the same and that hypobaric hypoxia may not result in hypoxia at the level of the tissue.

1676 May 30 2:10 PM - 2:20 PM

Hypoxic Exercise Performance with an Antihistamine: Influence of Aerobic Fitness

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At altitude, impairments in pulmonary oxygen diffusion and oxygen delivery have a detrimental effect on endurance exercise tolerance. Analogues of over-the-counter antihistamines have been shown to improve oxyhemoglobin saturation (S_pO_2) and oxygen delivery during heavy exercise, but hypoxic performance outcomes have not been studied. **Purpose:** To determine the effect of the antihistamine, cetirizine (Zyrtec®) on hypoxic exercise performance in recreationally active subjects. **Methods:** Eight subjects [6 men, 2 women; age = 22 ± 1 y; $\dot{V}O_{2max}$ = 44.3 ± 8.3 ml·kg⁻¹·min⁻¹ (range: 32.0-55.2 ml·kg⁻¹·min⁻¹)] completed constant load exercise at 45% and 65% of normoxic $\dot{V}O_{2max}$ and an 8km time trial in conditions of normoxia (NORM), hypoxia with placebo (HYP+P), and hypoxia with cetirizine (HYP+C). Subjects inspired 15% oxygen to simulate an altitude of 2,500m for HYP+P and HYP+C and were given a 10mg fixed-dose of cetirizine one hour prior to exercise for HYP+C. Measures of S_pO_2 via pulse oximetry and muscle tissue oxyhemoglobin concentration ([OxyHb+Mb]) of the vastus lateralis via near infrared spectroscopy were continuously measured throughout exercise. **Results:** There was no significant difference ($P \geq 0.232$) in S_pO_2 between HYP+P and HYP+C during the 45% ($89 \pm 6\%$ vs. $89 \pm 4\%$) and 65% ($87 \pm 6\%$ vs. $85 \pm 5\%$) constant loads. The cetirizine intervention had a significant effect ($P = 0.005$) on Δ [OxyHb+Mb] (%) during the 65% constant load with a difference between HYP+P and HYP+C ($-28 \pm 45\%$ vs. $+14 \pm 16\%$). There was no difference in 8km performance times between HYP+P and HYP+C (18.08 ± 2.87 min vs. 17.03 ± 1.92 min, $P = 0.112$, $d_r = 0.63$). However, when co-varied by $\dot{V}O_{2max}$, cetirizine had a significant effect ($P = 0.047$) on 8km time trial performance with a difference of 1.06 min (95% CI [0.01, 2.11]) between HYP+P and HYP+C. $\dot{V}O_{2max}$ accounted for 53% of the variance in time trial performance changes between interventions. **Conclusion:** Cetirizine improves endurance exercise performance in hypoxia with a larger effect on individuals with lower $\dot{V}O_{2max}$. The cetirizine intervention resulted in greater skeletal muscle oxygenation at 65% $\dot{V}O_{2max}$ with hypoxia. These results would suggest that cetirizine does not improve S_pO_2 , but improves hypoxic exercise performance perhaps through enhanced oxygen delivery to the skeletal muscles.

1677 May 30 2:20 PM - 2:30 PM

The Influence of Acetazolamide on Endurance Exercise Performance at 3500 m

Karleigh E. Bradbury, Beau R. Yurkevicius, Katherine M. Mitchell, Kirsten E. Coffman, Charles S. Fulco, Roy R. Salgado, Robert W. Kenefick, FACSM, Nisha Charkoudian. *USARIEM, Natick, MA.* (Sponsor: Nisha Charkoudian, FACSM)
(No relevant relationships reported)

Members of the military and recreational athletes often rapidly ascend to altitude with the intention of completing physically demanding tasks. Rapid ascent can result in acute mountain sickness (AMS) which is commonly treated with acetazolamide (AZ). However, the side effects of AZ may impair exercise capability and previous literature regarding the impact of AZ on exercise performance is unclear. **PURPOSE:** To determine the impact of AZ on endurance exercise performance during a 30-hour exposure to hypobaric hypoxia equivalent to 3500 m altitude. **METHODS:** After completing three familiarization time trials (TT) at sea level (SL), six men (Age: 22.2 ± 3.2 yrs; Weight: 77.5 ± 11.5 kg; Height: 176.2 ± 7.1 cm; SL $\dot{V}O_{2peak}$: 50.8 ± 6.5 ml·kg⁻¹·min⁻¹) completed two, 30 hr altitude exposures at ~ 3500 m. In a single blind, randomly assigned study design, subjects were given 250 mg of AZ twice a day during one exposure and a placebo during the other. Administration of the doses started 48 hr prior to entering the hypobaric chamber, and continued through the 30 hr exposure. Exercise testing was completed ~ 24 hr after ascent to altitude and consisted of 15 min steady state walking on a treadmill at 40-45% SL $\dot{V}O_{2peak}$, followed by a 2 mile self-paced, treadmill TT. During the TT, subjects were blinded to treadmill speed and were only notified of distance completed at half mile increments. Heart rate (HR) and oxygen saturation (SaO_2) were recorded at baseline and every half mile. Rate of perceived exertion (RPE) was recorded at baseline and at the end of the TT. **RESULTS:** There was no difference in time to complete 2 miles between the AZ and placebo TT after ~ 24 hr of hypobaric hypoxia (22.3 ± 3.7 vs 22.0 ± 2.6 min, respectively; $P > 0.05$). Furthermore there were no differences in final TT HR (186 ± 13 vs 182 ± 16 , $P > 0.05$) or RPE (17 ± 3 vs 17 ± 2 , $P > 0.05$) between trials. SaO_2 was significantly higher at the end of the AZ TT vs the placebo TT (83 ± 4 vs 80 ± 4 , $P < 0.05$). **CONCLUSION:** Our results suggest that AZ (500 mg/day) does not negatively impact endurance exercise performance at 3500 m and that its stimulatory effect on ventilation helped maintain higher levels of oxygen saturation. *Funded by USAMRMC; author views not official US Army or DOD policy.*

1678 May 30 2:30 PM - 2:40 PM

Influence Of Acetazolamide On The Physiological And Perceptual Responses To Steady-state Exercise At Altitude

Katherine Mitchell, Karleigh Bradbury, Beau Yurkevicius, Kirsten Coffman, Charles Fulco, Roy Salgado, Robert Kenefick, FACSM, Nisha Charkoudian, FACSM. *US Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Nisha Charkoudian, FACSM)
(No relevant relationships reported)

Acetazolamide (AZ) is a common prophylactic for acute mountain sickness (AMS), particularly during rapid ascent to moderate or high altitudes. However, its diuretic effect could have a negative impact on physiological responses during steady-state exercise; these potential influences are poorly understood. **PURPOSE:** To evaluate the impact of AZ on heart rate (HR), rate of perceived exertion (RPE), and oxygen saturation (SaO_2) during steady-state treadmill walking after ~ 24 hours exposure to hypobaric hypoxia equivalent to 3500 m altitude.

METHODS: After completing three sea level familiarization trials, six men (Age: 22.2 ± 3.2 yr; Weight: 77.5 ± 11.5 kg; Height: 176.2 ± 7.1 cm; SL $\dot{V}O_{2peak}$: 50.8 ± 6.5 ml·kg⁻¹·min⁻¹) completed two 30 hr altitude exposures (AZ and placebo, single-blind randomized crossover design) in a hypobaric chamber equivalent to ~ 3500 m. After ~ 24 hr of exposure, volunteers completed exercise testing consisting of 15 min of steady-state treadmill exercise at 40-45% sea level $\dot{V}O_{2peak}$. HR & SaO_2 were recorded at baseline and at minutes 5, 10, and 15 of exercise. RPE was recorded at baseline and at minute 15 of exercise.

RESULTS: There were no significant differences between AZ and placebo for post-exercise HR (AZ: 141 ± 11 bpm [mean \pm SD] vs. Placebo: 145 ± 12 bpm; $p > 0.05$) or RPE (AZ: 9.5 (6-13) [median (range)] vs. Placebo: 9.0 (7-14); $p > 0.05$). SaO_2 was significantly higher in the AZ trial (AZ: $86 \pm 3\%$ vs. Placebo: $81 \pm 4\%$, $p < 0.01$). Furthermore, the extent (delta) of desaturation from pre- to post-steady-state exercise was less in the AZ trial compared to the placebo trial (AZ: $-5 \pm 3\%$ vs. Placebo: $-7 \pm 1\%$; $p < 0.05$). **CONCLUSIONS:** Our results suggest that AZ does not negatively impact physiological and perceptual responses during steady-state exercise. Indeed, AZ may be beneficial by helping to maintain oxygen saturation during steady-state exercise in hypobaric hypoxia. *Funded by USAMRMC; author views not official US Army or DOD policy.*

D-38 Thematic Poster - Biomechanics after ACL Reconstruction

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-102A

1741 Chair: Robin Queen, FACSM. *Virginia Tech, Blacksburg, VA.*

(No relevant relationships reported)

1742 Board #1 May 30 3:45 PM - 5:45 PM
Effect of Lower Extremity Static Alignment on Dynamic Valgus in Adolescents Following ACL Reconstruction

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(No relevant relationships reported)

PURPOSE: Knee abduction moments may lead to valgus collapse, potentially causing ACL rupture. The contribution of static lower extremity alignment to knee abduction moments is unknown. This study assessed relationships among lower extremity static alignment and dynamic kinematics and kinetics during side-step cutting in uninjured adolescent athletes.

METHODS: This retrospective study included 8 adolescents with recent unilateral ACL reconstruction (mean age 14.8 yr, SD 1.2; 3/8 female). Frontal plane hip to ankle imaging (EOS) was used to measure mechanical axis deviation (perpendicular distance from the center of the femoral condyles to the mechanical axis line connecting the center of the femoral head to the center of the talar dome) and tibial-femoral angle. 3D motion capture provided lower extremity kinematics and kinetics during quiet standing and loading (initial contact to peak knee flexion) of an anticipated 45° side-step cut; 2-3 trials per limb were averaged for analysis. Relationships among imaging, static motion capture and dynamic motion capture measures were investigated using correlation, and backward stepwise linear regression was used to evaluate potential predictors of average dynamic knee abduction moment.

RESULTS: Regardless of surgical status, standing knee abduction angle was correlated with standing hip adduction ($r=0.60$, $p=0.02$) and ankle eversion ($r=0.85$, $p<0.0001$) along with larger mechanical axis deviations ($r=0.83$, $p=0.0001$) and higher knee abduction on EOS ($r=0.44$, $p=0.09$). Dynamic knee abduction moment was best predicted by a combination of EOS knee abduction angle, standing ankle eversion, standing knee abduction, standing knee rotation, ankle eversion during cutting, along with ground reaction force and age ($R^2=0.94$; $p<0.004$). There was no significant relationship between knee abduction moment and side (surgical vs. contralateral) ($p=0.63$).

CONCLUSIONS: In this small group of adolescent athletes with recent ACLR, knee abduction moment during side-step cutting was related to age and anatomic lower limb alignment in addition to dynamic factors such as ankle positioning and ground reaction force. ACL alignment or standing posture with greater hip adduction, knee abduction, and ankle eversion may indicate a higher risk for injury during dynamic activities.

1743 Board #2 May 30 3:45 PM - 5:45 PM
Wearable Sensor-based Classification Of ACL Reconstructed Limbs During Exercise In Male And Female Patients

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(No relevant relationships reported)

Purpose: Early identification of subtle, sub-clinical, aberrant motion characteristics in patients with ACL reconstructed knees can inform rehabilitation and return to sports decision making. Wearable sensors enable characterization of movement in native sport and activity environment. The purpose of the study was the ability of a machine learning algorithm to accurately classify male and female participants' reconstructed limb from the contralateral healthy limb using inter-limb movement variability from sensor data during walking and jogging. **Methods:** We evaluated 109 patients (23.5 ± 10.2 Yr, 172.6 ± 9.6 cm, 73.4 ± 16.7 kg) with primary, unilateral and uncomplicated ACLR at approximately 6 months from index surgery. All participants walked for 5 minutes at 3 mph and jogged for 3 minutes at 6mph on a treadmill. Subjects were fitted with 5 wireless sensors (Shimmer3 IMU Unit, Dublin, Ireland)

secured bilaterally on the wrists and ankles and around the waist at the sacrum. Accelerations from the sensors were continuously monitored during the walking and jogging trials. The multi-dimensional time-varying biomechanical data captured by the sensors were processed to generate a graphical model and matrixes to represent the cause-and-effect relationship in inter-limb movement. The matrixes extracted from the sensor data were used to train machine learning algorithms and then these trained algorithms were evaluated to classify participants' ACLR limb from their contralateral healthy limb. The performance of these trained algorithms was calculated to generate the individual classification accuracy. **Results:** While walking, the trained algorithms were able to classify the ACLR limb in males with 81.5% accuracy and females with 73.7% accuracy. While jogging, ACLR limbs were classified with 76.7% accuracy in males and 83.0% accuracy in females. **Conclusion:** Cause-and-effect analysis of inter-limb movement variability demonstrated a high level of accuracy in classifying an injured ACLR limb from a healthy contralateral limb during exercise. The accuracy of classification may be influenced by gait speed and sex.

1744 Board #3 May 30 3:45 PM - 5:45 PM
The Impact of a Functional Knee Brace on Sports Performance Following ACL Reconstruction.

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Reported Relationships: W.E. Garrett: Industry contracted research; Don Joy Orthopaedics.

Up to 250,000 anterior cruciate ligament (ACL) injuries occur in the United States annually with most athletes undergo an ACL reconstruction. No literature has examined physical performance during return to sport (RTS) and the impact of a functional knee brace. Braces have been shown to improve mechanics, but compliance remains an issue due to performance concerns.

PURPOSE: To determine differences in performance between braced (B) and non-braced (NB) tasks across time (RTS and six weeks following RTS (RTS+6)). We hypothesize that performance will improve across time with no differences between brace conditions.

METHODS: ACL patients ($n=40$; 20 male, 20 female) were enrolled after being RTS. Participants were provided a custom fit knee brace and instructed to wear the brace for all activities more dynamic than walking. A series of tasks (40 yard dash, 5-10-5 shuttle run, vertical jump, broad jump, and a triple hop) were completed at RTS and RTS+6. Each participant completed three practice trials and two recorded trials. Task and brace condition order was randomized. The ACL-RSI, IKDC and a VAS pain scale were completed. A 2X2 (time: RTS, RTS+6 by brace: B, NB) repeated measure ANOVA for performance measures and a paired t-test for patient reported outcomes were performed ($p<0.05$).

RESULTS: Participants (height: 1.7 ± 0.1 m, weight: 75 ± 15 kg, age: 18.6 ± 3 yr) demonstrated improvements in ACL-RSI ($p=.003$) and IKDC ($p<.001$) with no difference in VAS pain ($p=.297$). Performance declined during the 40yd Dash, vertical jump, and broad jump in the B condition. Performance improved across time for the broad jump and triple hop (Table 1).

CONCLUSIONS: Brace condition differences were small (40yd Dash: 0.1 sec, Vertical Jump: 0.5 in, Broad Jump: 0.9 in) or nonexistent and would not likely lead to noticeable sport deficits. Performance concerns should be minimal in ACL patients looking to RTS when wearing a knee brace.

ACKNOWLEDGEMENTS: This work was supported by a DonJoy Orthopaedics grant.

Table 1: Physical performance results for the Braced and Non-Braced conditions and between the two time points. (NS = Non-Surgical, S=Surgical)

Variable	Brace		Non-Braced		Interaction	ME Time	ME Brace
	RTS	RTS+6	RTS	RTS+6			
40yd Dash (sec)	6.3 ± 0.7	6.2 ± 0.6	6.1 ± 0.7	6.1 ± 0.7	0.068	0.680	0.011
5-10-5 shuttle (sec)	5.9 ± 0.5	5.9 ± 0.5	5.9 ± 0.5	5.9 ± 0.5	0.421	0.943	0.941
Vertical Jump (inches)	17.7 ± 3.4	17.9 ± 3.6	18.2 ± 3.7	18.4 ± 3.9	0.797	0.383	<0.001
Broad Jump (inches)	69.0 ± 10.4	71.2 ± 11.4	70.5 ± 11.5	71.5 ± 11.7	0.213	0.034	0.019
Triple Hop (NS) (inches)	162.8 ± 30.0	172.7 ± 35.7	162.9 ± 30.5	174.4 ± 32.7	0.653	<0.001	0.544
Triple Hop (S) (inches)	147.9 ± 32.0	157.7 ± 38.4	143.3 ± 32.4	158.3 ± 38.9	0.073	0.002	0.141

1745 Board #4 May 30 3:45 PM - 5:45 PM
Lower Extremity Kinetic and Kinematic Asymmetries 4, 6, and 9 Months Post-ACL Reconstruction In Elite Collegiate Athletes

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(No relevant relationships reported)

Abnormal lower extremity (LE) biomechanics post-anterior cruciate ligament reconstruction (ACLR) may increase re-injury risk and reduce sports performance. Although most athletes return to sport (RTS) within 1 year from ACLR, the timeline for recovery of LE kinetics and kinematics during athletic tasks is not well defined. Identifying specific movement deficiencies will guide rehabilitation efforts to promote successful RTS and reduce re-injury risk. **PURPOSE:** To evaluate vertical ground reaction forces (vGRF) and hip, knee, and ankle kinematics during running and jumping in elite collegiate athletes 4, 6, and 9 months post-ACLR.

METHODS: Twelve Division I athletes (age 20.5 ± 1.2 , BMI 25.9 ± 3.6 , 6 female) performed maximal countermovement jumps (CMJ) and treadmill running at a maximally comfortable speed 4.0 ± 0.3 , 6.1 ± 0.5 and 8.9 ± 1.5 months post-surgery while whole body kinematics were recorded. VGRF impulses, knee flexion excursion, and peak sagittal plane hip, knee, and ankle joint angles were obtained during the stance phase of running (RUN) and the eccentric, concentric (CON), and landing (LAND) phases of the CMJ. Limb symmetry indices (LSI) were computed for all variables and effect sizes (ES) were calculated. LSIs at each interval were evaluated using the Wilcoxon Signed-Ranks test.

RESULTS: At 4 months post-surgery, all CMJ and RUN asymmetries were significant (LSI: 69.5-95.9%, $p < .023$, ES: .46-.62). Involved limb CMJ CON phase and RUN vGRF impulses were significantly less than uninvolved limb values at all intervals (LSI: 85.7-94.2%, $p < .005$, ES: .58-.63). RUN peak joint angle and knee flexion excursion asymmetries were significant at all intervals (LSI: 69.5-94.7%, $p < .013$, ES: .51-.62). Involved limb CMJ CON phase knee (LSI: 90.6-98.6%, $p < .041$, ES: .42-.62) and ankle (LSI: 80.2-86.1%, $p < .010$, ES: .53-.62) angles were reduced throughout, while no CMJ LAND phase asymmetries were detected 9 months post-op.

CONCLUSIONS: Despite excellent surgical care and high volumes of rehabilitation, elite collegiate athletes present with LE kinetic and kinematic asymmetries 9 months post-surgery, after or close to typical RTS. In particular, knee joint kinematics during the stance phase of running and the CON phase of the CMJ are categorically asymmetric and should be addressed with targeted interventions.

1746 Board #5 May 30 3:45 PM - 5:45 PM
Physical Factors Differentiate Pain-free Return To Play And Return With Knee Symptoms 9 Months After ACL Reconstruction

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(No relevant relationships reported)

Purpose

The aim of this study was to identify strength, power and biomechanical differences between male athletes who made a pain free return to play (RTP) and those that did not at 9 month post ACL reconstruction.

Methods

Nine months after ACLR 158 males athletes who had returned to pre-injury sport participation (64 reporting knee symptoms/94 reporting none) carried out strength testing using isokinetic dynamometry on quadriceps and hamstrings and 3D biomechanical analysis of single countermovement jump, single leg drop jump and planned and unplanned 90° change of direction (CoD) as well as an IKDC questionnaire. Differences in IKDC, strength and jump height measures on the ACLR side and in limb symmetry index (LSI) between groups were analysed with statistical parametric mapping (SPM, 0D unpaired t-test). The odds ratio for making a pain free RTP if LSI >90% was also calculated for the strength and jump variables independently and collectively. Biomechanical differences in the jump and CoD tests on the ACLR side and in symmetry between groups was analysed with SPM (1d, unpaired t-test). Effect size was calculated using Cohen's D for all analyses.

Results

There was a large effect size (ES) difference in IKDC score between groups (89 ± 6 with no pain; 80 ± 8 with pain; ES 1.1). There were medium effect size differences in quadriceps strength on ACLR side (ES 0.42) and LSI (0.45) with an odds ratio of 2.7. There were similar differences in SLDJ height on ACLR side (ES 0.3) and LSI (0.37) with an odds ratio of 3.5. The odds of making a pain free RTP when LSI >90% on all tests was 6.8. There were no biomechanical differences between groups on the jump tests. There were biomechanical differences on the more demanding CoD tests with differences on the ACLR side and symmetry in foot rotation angle, knee

extension moment and hip rotation angle (ES 0.51 to 0.61) in the unplanned CoD and in symmetry of posterior and vertical ground reaction force and COM velocity at initial contact (ES 0.5 to 0.58) in the unplanned CoD with greater asymmetry in the painful group.

Conclusion

This study demonstrates strength, power and biomechanical differences in those that RTP with knee symptoms after ACLR with those achieving >90% LSI in all 4 strength and jump tests almost 7 times more likely to make a pain free RTP.

1747 Board #6 May 30 3:45 PM - 5:45 PM
A Long-term Follow-up Of Patients With Physseal-Sparing Iliotibial Band ACL Reconstruction: Kinetic Analyses

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(No relevant relationships reported)

Longer-term biomechanical implications of anterior cruciate ligament reconstruction with Iliotibial band autograph (ACLR-ITB) remain under-investigated. **PURPOSE:** To determine biomechanical parameters of knee function at various time intervals following the ACLR-ITB: 1-2 years, 2-5 years, 5-10 years, and >10 years post-surgically. **METHODS:** Patients who had undergone ACLR-ITB as skeletally immature children were recruited for testing, which included drop vertical jumps and vertical single-limb hops. A three dimensional (3D) motion analysis system with force plates was used to assess various parameters. The landing phase was defined as the moment of initial contact with the force plates, where the vertical ground reaction force (VGRF) exceeded 10 N, to 500 ms after initial contact. Major outcome variables included external knee moments (sagittal, frontal, and horizontal planes), VGRF, and vertical jump height. The knee moments and VGRF were normalized by mass (kg), and vertical jump height was calculated through following equation: $\frac{1}{2} g(t/2)^2$, where $g=9.81 \text{ m/s}^2$ and t =time in seconds in the air. Peak values of each outcome variable were analyzed. Paired t-tests were employed to compare VGRF and vertical jump height between the two limbs by four groups (1-2 years, 2-5 years, 5-10 years, and >10 years) separately. **RESULTS:** Based on available data (N=38, 30 males, 8 females; 1-2 years: N=8; 2-5 years: N=10; 5-10 years: N=10; >10 years: N=8), paired t-tests showed no statistically significant differences in peak knee moment (sagittal plane: $p=.613$, frontal plane: $p=.340$ horizontal plane: $p=.248$) and peak VGRF ($p=.106$) in drop vertical jump test. Also, no statistical significant difference was detected in peak knee moment (sagittal plane: $p=.101$, frontal plane: $p=.955$ horizontal plane: $p=.341$), peak VGRF ($p=.384$) and peak vertical jump height ($p=.876$) in single-limb hops. The findings were consistent when the data was analyzed based on the 4 follow-up time groups. **CONCLUSIONS:** The biomechanical function of knees undergoing this procedure appears to be no different compared to the uninjured side at 1-2 years, 2-5 years, 5-10 years, and >10 years following ACLR-ITB procedure. The current data support a long-term safety of the ACLR-ITB procedure for skeletally immature athletes with complete ACL tears.

1748 Board #7 May 30 3:45 PM - 5:45 PM
Competing After ACL Injury: Profiles of Division 1 Athletes who Successfully Return to Sport

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(No relevant relationships reported)

Female athletes face significant risk of musculoskeletal injury when playing collegiate level sports. Sustaining injury, particularly to the ACL, can end an athlete's career. Prior research has evaluated individuals' movement profiles and patient reported outcomes (PROs) following ACL injury; however, there is a dearth of evidence evaluating the movement profile and PROs of those who successfully return to sport at an elite level following ACL injury. **PURPOSE:** To compare the movement profile and PROs of Division 1 women's college athletes who successfully return to sport following ACL injury to healthy athletes. **METHODS:** We conducted a cross-sectional analysis of baseline data on 66 participants collected as part of standard injury screening for Division 1 women's soccer, lacrosse, and field hockey teams (mean \pm SD; Age = 19.9 ± 1.3 yrs, Ht = 166.6 ± 5.8 cm, Wt = 64.1 ± 8.1 lbs). We used health history and survey data to identify those who had previously sustained an ACL injury as well as single assessment numeric evaluation (SANE) scores for the knee. The Landing Error Scoring System (LESS) was used to evaluate each athlete's movement pattern while completing a jump landing task. The LESS and SANE scores for the injured and non-injured groups were compared using T-Tests with pooled variance

($\alpha=0.05$). **RESULTS:** T-Test results showed that those athletes who went on to play Division 1 sports following ACL injury ($n=18$) had significantly better ($p<0.02$) LESS scores than did their previously uninjured counterparts (Successful Return: 3.9 ± 1.4 faults, Previously Uninjured: 5.2 ± 2.0). SANE scores were significantly different ($p<0.03$) in the opposing direction (Successful Return: $89.8 \text{ points} \pm 7.6$, Previously Uninjured: 95.3 ± 9.1). **CONCLUSION:** Female athletes who successfully returned to compete in Division 1 sports following an ACL injury demonstrated a better movement profile than those without history of ACL injury; notably scoring below previously established cut points (5.0 faults) for increased risk of injury. This was in the setting of the lower PRO scores than their uninjured counterparts. This may indicate that athletes who sustain injury and wish to play at elite levels may need to improve their movement profile to a point better than their peers and care must be taken to balance PROs with an objective measure of movement.

1749 Board #8 May 30 3:45 PM - 5:45 PM
Altered Center of Pressure Dispersion and Regularity during Dual-Task Balance following Anterior Cruciate Ligament Reconstruction

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Athletes demonstrate neuroplastic changes and altered neuromuscular control after anterior cruciate ligament reconstruction (ACLR). Conflicting reports of impaired balance and cognitive performance exist for dual-task balance following ACLR. Thus, significant gaps remain in understanding altered postural control strategies in this population. **PURPOSE:** To understand altered postural control strategies in ACLR individuals in the presence of sensory, motor, and cognitive challenges. **METHODS:** Fourteen ACLR (20.7 ± 2.0 yr, 76.9 ± 19.1 kg, 1.7 ± 1.4 m, 6.7 ± 1.9 Tegner) and 14 matched healthy control participants (CON) (21.2 ± 1.4 yr, 75.4 ± 15.3 kg, 1.7 ± 1.5 m, 7.4 ± 1.4 Tegner) were analyzed. Three 20-second trials of single-leg balance (ACLR limb, matched side for CON) were performed under the following conditions: eyes open (EO), eyes closed (EC), dual cognitive (DC), and dual motor (DM). DC involved mental addition every two seconds and DM required participants to catch a ball from a ball machine every 2 seconds. Traditional center of pressure (CoP) measures of 95% confidence ellipse area (EA) and medial-lateral root-mean-squared excursion (RMS_{ml}) were calculated after a 5 Hz 4th-order Butterworth low-pass filter. These measures were log transformed to satisfy model assumptions. Sample entropy (SEn, unitless) was also calculated for increment resultant CoP data after downsampling to 50Hz, without filtering. Linear mixed models included subject pair as a random effect and ACLR status, trial type, and ACLR * trial type as fixed effects. **RESULTS:** The ACLR group had increased CoP dispersion (e.g., **ln(EA):** ACLR: $7.74 \pm 0.78 \text{ mm}^2$, CON: $7.47 \pm 0.91 \text{ mm}^2$, $P = 0.003$) and increased CoP signal regularity (**SEn:** ACLR: 0.78 ± 0.20 , CON: 0.86 ± 0.23 , $P = 0.001$). Significant interactions were also observed for SEn, EA, and RMS_{ml} that suggest the ACLR group impairments are most pronounced during the DC condition (e.g., 95% confidence interval for CON – ACLR for DC SEn: (0.03, 0.35), $P = 0.01$). **CONCLUSION:** Altered postural control is present following ACLR compared to healthy controls. A cognitively-challenging task resulted in greater ACLR-specific balance alterations compared to closing eyes or a motor dual-task. These findings are consistent with ACLR individuals adopting a more attentionally-focused approach to postural control.

D-39 Thematic Poster - Blood Flow

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
 Room: CC-101A

1750 Chair: Jamie Burr, FACSM. University of Guelph, Guelph, ON, Canada.

(No relevant relationships reported)

1751 Board #1 May 30 3:45 PM - 5:45 PM
Resistance Training with and Without Blood Flow Restriction to Repetition Failure: More Pain, Same Gain

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 (No relevant relationships reported)

Evidence suggests blood flow restricted (BFR) resistance training performed with low-loads (20-40% 1-repetition maximum; 1-RM) is superior to low-load training

when volume (load x repetitions) is matched. Since it has been shown using traditional resistance training that similar gains in muscle strength and hypertrophy occur between high- and low-load training when performed to repetition failure, it is of interest if this also occurs with low-load training with/without BFR. Moreover, the perception of pain at repetition failure between protocols and over time has not been examined in a training setting.

PURPOSE: To determine if low-load resistance training to repetition failure with/without BFR elicits similar muscular strength, hypertrophy and perceived pain. **METHODS:** Seven young (25 ± 1 yr) males were recruited to perform single-leg Smith-machine squats 3 d/wk for 6 wk. Each leg was randomly assigned to perform 30% 1-RM with (BFR) or without BFR (RT) for 3 sets to repetition failure with 100s of rest after each set. Tourniquet pressure was set at 60-70% of the lowest occlusive pressure and remained inflated throughout the 3 sets. Leg strength (1-RM), muscle hypertrophy (leg lean mass; LLM) by dual-energy X-ray absorptiometry, and ultrasound derived vastus lateralis (VL) muscle thickness (MT), were measured before and after the 6-weeks. A visual analog scale (1000 point) was used to assess pain after each set and rest period for the 1st, 4th, 8th, 11th and 15th training session. **RESULTS:** 1-RM increased similarly in both groups after training (BFR 79 ± 13 to 95 ± 13 kg vs. RT 82 ± 13 to 100 ± 13 kg, $p<0.002$) and VL MT (BFR: 2.69 ± 0.08 to 2.98 ± 0.1 vs. RT: 2.75 ± 0.16 to 2.96 ± 0.1 cm, $p<0.016$) with non-significant changes in LLM (BFR 7.29 ± 0.38 to 7.40 ± 0.39 vs. RT 7.28 ± 0.37 to 7.34 ± 0.36 kg, $p<0.243$). There was an increase in perceived pain with BFR training compared to the RT group across all sessions following the first rest period (BFR: 288 ± 25 vs. RT: 155 ± 9 a.u., $p<0.05$) and second rest period (BFR: 433 ± 31 vs. RT: 160 ± 9 a.u., $p<0.05$). While there was a trend for a decrease in pain over time with repeated training, this effect was non-significant. **CONCLUSIONS:** When performed to failure, low-load training with and without BFR have similar muscle strength and hypertrophy despite differences in perceived pain. Supported by NSERC, CFI and ERA

1752 Board #2 May 30 3:45 PM - 5:45 PM
Investigating The Use Of Vibration Platform And Blood Flow Restriction As A Warm-up Procedure

Ricardo Parra, Jovanna Bonilla, Elda Padilla, Laura Rodriguez, Murat Karabulut, FACSM. University of Texas - Rio Grande Valley, Brownsville, TX.

(No relevant relationships reported)

PURPOSE: The purpose of this study was to observe the combined effect of a whole body vibration (WBV) warm up and Blood Flow Restriction (BFR) on muscle temperature, flexibility, vertical jump height, and estimated $\dot{V}O_{2\max}$. **METHODS:** Nineteen subjects (8 males and 11 females; Mean \pm STDEV age = 24.21 ± 3.47 years; height = 166.94 ± 8.82 cm) completed the study, which involved performing a warm-up protocol under 5 conditions. The conditions were: 5-min treadmill walking (C1), 5-min WBV at a low amplitude (C2), 5-min WBV at a low amplitude with BFR (C3), 5-min WBV at a high amplitude (C4), 5-min WBV at a high amplitude with BFR (C5). For the BFR sessions, cuffs were placed on the uppermost portion of the thighs. Cuffs were then inflated to 120 mmHg, and then increased in increments of 20 mmHg until the final pressure was achieved. Final pressure was found via thigh circumference and capillary refill time. The vibration plate was set at a frequency of 30 Hz. During the four interventions, the subjects performed 3 lower-body exercises (squat, sumo squat, calf raises) for 60 seconds each, with 30 seconds of rest between exercises. Thigh temperature was measured between exercises. Total training time with rest was 12 minutes. Following the warm-ups, vertical jumping height, flexibility, and aerobic fitness (via Queen's College Step Test) were assessed. **RESULTS:** Significant time and gender main effects for thigh temperature were seen ($p < .01$). Males had a higher mean thigh temperature than females. A significant condition main effect for average flexibility values was detected ($p < .01$). The C4 (compared to C1, C2, and C3) and C5 (compared to C1 and C2) protocols resulted in higher values in flexibility ($p < 0.03$). There was also a significant condition*gender interaction for estimated $\dot{V}O_{2\max}$ ($p < 0.04$). Females had the highest values for estimated $\dot{V}O_{2\max}$ following the C1 protocol and the lowest for the C5 protocol, but males had the highest values for estimated $\dot{V}O_{2\max}$ following the C5 protocol. **CONCLUSION:** Based on our findings, the high amplitude WBV condition with or without BFR improved flexibility, but the effects of conditions on estimated $\dot{V}O_{2\max}$ values were different for each gender. The findings indicate that gender of individuals performing tests may be important and should be considered for testing different health/fitness variables.

1753 Board #3 May 30 3:45 PM - 5:45 PM
Effects Of Hyperoxic-Supplemented High Intensity Interval Training On Endurance Performance, Maximal Oxygen Consumption And Mitochondrial Function In Trained Cyclists

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(No relevant relationships reported)

PURPOSE: Hyperoxia (HYPER) increases O₂ delivery to the working muscles together with an improved lactate metabolism, power output and endurance compared to normoxia (NORM) (Cardinale & Ekblom, 2017). Considering the O₂ delivery limitation and the exercise induced hypoxemia at exercise intensities near to maximum it was hypothesized that muscle mitochondrial oxidative phosphorylation (OXPHOS) capacity would be upregulated along with a higher endurance performance following endurance interval training with HYPER compared to NORM. **METHODS:** 23 trained cyclists, age 35.3±6.4 years (mean ± standard deviation (SD)) body mass 75.2±9.6 kg, height 179.8±7.9 m, and VO₂max 4.5±0.7 L·min⁻¹ performed 6 weeks endurance training on a cycle ergometer consisting of supervised HIIT sessions 3 days/week (3-8 min) and additional long slow distance training 2 days/week. Cyclists were randomly assigned to either HYPER (FiO₂ 0.30; n=12) or NORM (FiO₂ 0.21; n=11) breathing condition during training in a single blinded study design. VO₂max, OXPHOS capacity in permeabilized fibers and in isolated mitochondria, and 20 min cycle performance were tested pre and post intervention. **RESULTS:** Over the intervention change in VO₂max (HYPER 1.1±3.8%, NORM 0.0±3.7%; p = 0.55, ES = 0.08), mass-specific mitochondrial respiration (HYPER 27.3±46.0%, NORM 16.5±49.1%; p = 0.21, ES = -0.06); intrinsic mitochondrial respiration (HYPER 26.1±80.1%, NORM 15.9±73.3%; p = 0.66, ES = 0.69) and mean power output during 20 min trial (HYPER 6.0±3.7%, NORM 2.4±5.0%; p = 0.073, ES = 0.32) did not statistically significantly differ between the groups. **CONCLUSIONS:** These data showed that 6 weeks hyperoxic-supplemented high-intensity interval-training on a cycle ergometer was not superior to conventional training at sea level in improving VO₂max, intrinsic and mass-specific mitochondrial respiration and cycle performance in already trained cyclists. Therefore, despite the small meaningful positive effect in cycling performance that might be relevant in sport, considering the cost/benefit of performing hyperoxic-supplemented HIIT, it is questionable whether this strategy is worthwhile in maximizing endurance performance in already trained cyclists.

1754 Board #4 May 30 3:45 PM - 5:45 PM
Acute Effects of Blood Flow-restricted Exercise on Microcirculation, Neuromuscular Activation and Metabolite in Underweight Women.

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(No relevant relationships reported)

PURPOSE: This investigation measured local microcirculation, neuromuscular activation and systematic metabolite in underweight women during bilateral knee extension exercise in five conditions: high load [80% of one-repetition maximum (1RM)] without blood flow restriction [BFR, (HL)], low load (30%1RM) without BFR (LL) and low load (30%1RM) with 40% (BFR₄₀), 60% (BFR₆₀), 80% (BFR₈₀) of arterial occlusion pressure. **METHODS:** 18 moderately active underweight women (17.63±0.68kg/m²) performed four sets of knee extension to failure with 60 s rest in five conditions. Variables of microcirculatory function [Oxygen saturation (SO₂), relative hemoglobin (rHb), blood flow (flow) and blood velocity (velo)] and neuromuscular activation of the vastus lateralis (VL) and the whole blood lactate (WBL) were measured across different time points. Finally, calculating the repetitions of five conditions. **RESULTS:** SO₂ in HL and LL were similar during whole process (HL: 79.2±19.1%, LL: 72.4±18.20%) which were significantly higher than the other three conditions (P<0.05). Flow was highest in BFR₆₀ with the other conditions were similar (e.g., set3: 213.1 AU for BFR₆₀ vs-196.3 AU for other conditions). After exercise, velo in BFR₆₀ (56.8±1.2AU) was higher than the other conditions [-51.8±1.5AU, (P<0.05)]. rHb did not change in all conditions. LL resulted in greatest activation during the first two sets when exercise is taken to failure (e.g., set1: 69.3% MVIC in LL vs-47.9% MVIC in other conditions). After exercise, WBL was highest in BFR₆₀ and lowest in HL (BFR₆₀>LL>BFR₄₀>BFR₈₀>HL). Changes in SO₂ and muscular activation were similar between pressures, while higher pressure led to fewer repetitions during exercise. **CONCLUSIONS:** Low-load exercise to failure results in a greater neuromuscular response to that of high-load exercise in

underweight women. When different pressures are applied to low-load exercise, there are considerable changes in microcirculation and metabolite, among which BFR₆₀ has the characteristics of greater perfusion and higher metabolic stress. **Funding:** This study was supported by Major Natural Science Research Projects in Colleges and Universities of Jiangsu Province, China (18KJA320002) and Postgraduate Research and Practice Innovation Plan of Jiangsu Province, China (KYCX17_1367).

1755 Board #5 May 30 3:45 PM - 5:45 PM
The Effect Of Blood Flow Restriction And Whole-body Vibration As A Warm-up Strategy

Jonathan Salinas, Natalie Castillo, Aaron Garcia, Jessica Martinez, Ricardo Parra, Murat Karabulut, FACSM. University of Texas Rio Grande Valley, Brownsville, TX.

(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the effects of blood flow restriction (BFR) and whole-body vibration (WBV) on hemodynamics, muscle temperature, flexibility, and explosive power.

METHODS: Twenty-five subjects (14 females (age = 24±2.7 years) and 11 males (age = 24.5±3.5 years) completed the study, which involved following 6 sessions: a 5-min (5-WBV) and a 10-min (10-WBV) lower-body warm up on a vibration platform, a 5-min (5-BFR) and a 10-min (10-BFR) lower-body warm up using blood flow restriction cuffs, and a 5-min (5-CYC) and a 10-min (10-CYC) warm up on a cycle ergometer. For the BFR session, cuffs were placed on the uppermost portion of the thigh. Inflation began at 120 mmHg and progressively increased to a target pressure, which was based on the subject's thigh circumference and capillary perfusion. Squat exercises were performed between the knee angle of 90-180 degrees for 5 or 10 sets (each set lasted 60 s with a 60 s rest in between sets) on a vibration platform at 30 Hz with low amplitude or a flat surface while wearing BFR cuffs. Pre and post-exercise data for hemodynamics, quad and hamstring temperature, flexibility, and explosive power index were recorded. Explosive power was measured using a jump mat, where 60 maximal exertion jumps were performed, with mean ground contact time (GCT), mean vertical jump height (MVJ), and explosive power index (EPI) for the first 15 and last 15 jumps. Hemodynamics, muscle temperature, and flexibility were again recorded following the explosive power index test.

RESULTS: There was no condition*time interaction or condition main effect for GCT, MVJ, and EPI, but there was a time main effects for all three variables (p<0.01). There were significant condition and time main effects and condition*time interaction for heart rate (p<0.01), time main effect for systolic blood pressure (p<0.01) and flexibility (p<0.01). Significant time main effect and condition*time interaction were detected for quadricep (p<0.01) and hamstring muscle temperatures (p<0.01).

CONCLUSIONS: Our findings indicate that all the conditions and durations investigated resulted in similar responses in flexibility and jump performance. Future studies should examine different pressure settings of BFR and/or frequency/amplitude setting of WBV on the variables tested in the study.

1756 Board #6 May 30 3:45 PM - 5:45 PM
Physiological Responses to Intermittent Endurance Exercise with Blood Flow Restriction in the Moderate Intensity Domain

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(No relevant relationships reported)

Blood flow restriction (BFR) endurance training may induce both endurance and strength improvements. However, there is no consensus on the ideal BFR endurance exercise prescription in order to balance the physiological and perceptual responses.

Purpose: The purpose of this investigation was to examine the physiological responses, as well as the perceived exertion in responses to a range of BFR endurance protocols. **Methods:** Participants randomly performed 7 exercise protocols: 50% of the difference between peak oxygen uptake (VO₂) and ventilatory threshold (VT) (Δ50%), 90%, 80%, and 70% of VT with and without BFR. Each protocol consisted of two sets of five work intervals (2 minutes work, 1 minute rest) separated by 5 minutes of recovery. Pulmonary VO₂ was recorded breath-by-breath, muscle activation (vastus medialis (VM), vastus lateralis (VL)) was assessed by surface electromyography (sEMG), microvascular oxygenation (tissue oxygenation index (TOI)) was assessed by near-infrared spectroscopy (NIRS), and level of perceived exertion (RPE) was assessed using the Borg scale. The last 30 seconds of intervals 5 and 10 were used for analysis. sEMG data were normalized to baseline cycling (20 watts). TOI during each condition was analyzed compared to baseline cycling and then expressed as change from baseline (arbitrary units) to compare between conditions. **Results:** The Δ50% protocol resulted in a higher end exercise (interval 10) VO₂ compared to all other conditions, no other differences in VO₂ were observed. No sEMG differences were observed between conditions (VL- p = 0.24, VM- p = 0.33) or between interval 5 and 10. All BFR conditions resulted in a decrease in TOI from baseline. TOI was greater for all BFR conditions (70%BFR = -36.4 ± 21.9, 80%BFR = -40.4 ± 6.5, 90%BFR = -44.7±7.25)

compared to the non-BFR conditions ($70\% = +4.3 \pm 20.2$, $80\% = +11.8 \pm 5.5$, $90\% = +7.25$). No differences in TOI between $\Delta 50$ (-36.93 ± 10.8) and any BFR conditions were observed. RPE was greater during 90%BFR (18.0 ± 0) and 80%BFR (17.1 ± 1.1) compared to 70% (11.3 ± 0.6) and 90% (13.0 ± 0). No differences were observed between 70%BFR (14.6 ± 0.6) and non-BFR conditions. **Conclusion:** This study demonstrated that cycling with the addition of BFR at an intensity equivalent to 70% of VT may provide a balance between physiological strain and perceived exertion.

1757 Board #7 May 30 3:45 PM - 5:45 PM
Muscle Oxygenation Patterns during a 20-km Time Trial with Intermediate Sprints and Recoveries.

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 (No relevant relationships reported)

PURPOSE: Pacing strategies are necessary during endurance events in which the goal is to finish in as little time as possible. Both anaerobic and aerobic attributable sources of ATP are used during such efforts. Rating of Perceived Exertion (RPE) increases linearly as heart rate (HR) and power output (PO) increases, however these markers of intensity are not instantaneous. Near infrared spectroscopy (NIRS) allows for the measurement of local muscle oxygen saturation (SmO_2) which may respond to short-term fluctuations in PO. Previously, SmO_2 has shown a moderate correlation with oxygen consumption (VO_2) and HR during an incremental exercise. The purpose of this study was to determine how SmO_2 changes with increases in PO during a non-incremental cycling time trial (20-km) with various interspersed sprints and if decrements in PO due to shorter rest times were associated with lower SmO_2 .

METHODS: Well-trained cyclists ($n=9$) ($\text{VO}_{2\text{max}} = 55.4 \pm 10.4 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; $\text{PO}_{\text{max}} = 305 \pm 45 \text{ W}$), habituated to 20-km trial, performed a self-paced 20-km time trial and two time trials with 1-km sprints imposed, separated by 2- or 4-km of self-paced cycling. SmO_2 saturation, PO, and HR were measured. RPE was recorded each kilometer. Pearson's partial correlations were used to analyze relationship between SmO_2 and PO. A one-way analysis of variance was used to determine if there were differences in finishing times between trials.

RESULTS: There was a significant inverse relationship between SmO_2 and PO during all time trials ($r = -0.263$, $P < 0.0001$). There was no significant difference ($p = .572$) between the finishing times amongst 20-km protocols.

CONCLUSIONS: This study revealed that the imposed sprints caused reciprocal changes in the extent of SmO_2 and PO that are larger than the changes in a self-paced time trial. In other words, as the subjects were instructed to significantly increase their PO to simulate a break-away, the SmO_2 decreased in a reciprocal manner.

1758 Board #8 May 30 3:45 PM - 5:45 PM
Living In Confinement Conditions: Physical Training Can Improve Muscular Oxygen Uptake and Heart Rate Kinetics

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 (No relevant relationships reported)

PURPOSE: Inside the NASA Human Exploration Research Analog (HERA) facility the effects of 45 d of confinement in combination with restrictions for sleep and a defined physical training on muscular oxygen uptake ($\text{V}'\text{O}_{2\text{muscle}}$) kinetics and cardiovascular regulation during exercise was investigated.

METHODS: To date, fourteen healthy individuals (5 females, 9 males, 37 ± 7 y, $23 \pm 3 \text{ kg} \cdot \text{m}^{-2}$) were analyzed 8 d before (MD-8), during and 4 d after (MD+4) a simulated Space mission. A cycle exercise test with pseudo-random binary work rate changes (WR) of 30 W and 80 W and an incrementally increasing step protocol ($25 \text{ W} \cdot \text{min}^{-1}$) to assess peak oxygen uptake ($\text{V}'\text{O}_{2\text{peak}}$) was applied. Heart rate (HR) and mean arterial blood pressure (MAP) were measured beat-to-beat and pulmonary oxygen uptake ($\text{V}'\text{O}_{2\text{pulm}}$) breath-by-breath. $\text{V}'\text{O}_{2\text{muscle}}$ was estimated from HR and $\text{V}'\text{O}_{2\text{pulm}}$. Kinetics responses were assessed by maxima of the cross correlation function (CCFmax) between WR and the respective parameter indicate faster kinetics (Hoffmann et al., Eur J Appl Physiol 113:1745-1754, 2013). During the mission, exercise training sessions were scheduled every second day with a maximal HR restricted to below 85% of the age-related maximum. Sleep was restricted to 5 h per weekday and 8 h at the weekends. Differences in $\text{V}'\text{O}_{2\text{peak}}$ and kinetics from MD-8 to MD+4 were calculated and correlated with the values measured at MD-8 using the Pearson test. Level of significance was set to $\alpha = 5\%$.

RESULTS: $\text{V}'\text{O}_{2\text{peak}}$ differed not significantly ($P=0.221$) between MD-8 ($37.8 \pm 5.8 \text{ ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$) and MD+4 ($38.9 \pm 4.6 \text{ ml} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$). Changes in CCFmax(HR) correlated significantly with CCFmax(HR) at MD-8 ($r = -0.839$, $P < 0.001$), changes in

CCFmax($\text{V}'\text{O}_{2\text{muscle}}$) correlated significantly with CCFmax($\text{V}'\text{O}_{2\text{muscle}}$) at MD-8 ($r = -0.641$; $P = 0.014$) and the difference in $\text{V}'\text{O}_{2\text{peak}}$ correlated with $\text{V}'\text{O}_{2\text{peak}}$ at MD-8 ($r = -0.614$; $P = 0.019$).

CONCLUSIONS: Exercise training during forty-five days of confinement in combination with sleep restrictions, may prevent from losses in cardio-muscular kinetics. Those individuals who started with slow kinetics or a low $\text{V}'\text{O}_{2\text{peak}}$ benefited from the exercise training during the mission. The volume and/or intensity of the exercise training intervention might have been higher during the HERA C4 missions compared to most of the crew members' everyday life activities.

D-40 Thematic Poster - Combined Environmental Stressors

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
 Room: CC-102B

1759 Chair: James A. Pawelczyk, FACSM. Penn State University, University Park, PA.

(No relevant relationships reported)

1760 Board #1 May 30 3:45 PM - 5:45 PM
Erythropoietin Response to Endurance Exercise under Heat and Hypoxic Conditions

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Hypoxic training has been shown to improve aerobic capacity because hypoxia stimulates erythropoiesis due to increased erythropoietin (EPO) production. However, it takes several weeks to increase hemoglobin mass during endurance training in hypoxia. In the present study, we have focused on the combined effects of "hypoxia" and "heat stress" for EPO production. Considering that endurance exercise under heat condition augments plasma volume, hypoxic and heat conditions may promote additively erythropoiesis.

PURPOSE: The purpose of the present study was to determine EPO response to endurance exercise under heat and hypoxic conditions.

METHODS: Twelve healthy males (21.5 ± 0.3 yrs, 168.1 ± 1.2 cm, 63.6 ± 2.0 kg) participated. They conducted a 60 min pedaling exercise at 60% of $\text{VO}_{2\text{max}}$ under either "heat and hypoxic condition (H+H)" [fraction of inspiratory oxygen (FiO_2): 14.5%, 32°C], "hypoxic condition (HYPO)" (FiO_2 : 14.5%, 23°C) or "normoxic condition (NOR)" (FiO_2 : 20.9%, 23°C). After completing the exercise, subjects remained in the chamber for 3 h to evaluate metabolic and endocrine responses during post-exercise. We evaluated changes in muscle oxygenation (using NIRS) during exercise, blood variables, percutaneous oxygen saturation (SpO_2), muscle temperature during exercise and 3 h of post-exercise.

RESULTS: The SpO_2 was significantly decreased both under H+H and HYPO ($P < 0.01$). Blood lactate level increased during exercise ($P < 0.05$), but with no difference between the three conditions. Serum growth hormone level significantly increased ($P < 0.01$), and H+H showed significantly higher level compared with HYPO ($P < 0.05$). Serum EPO level was significantly increased in both H+H and HYPO 3 h after exercise, but no difference was observed between the two conditions.

CONCLUSIONS: Serum EPO level was significantly increased with endurance exercise under hypoxic condition. However, heat stress during endurance exercise in hypoxia (heat and hypoxic condition) did not augment the EPO response.

1761 Board #2 May 30 3:45 PM - 5:45 PM
Neuromuscular Responses to Combined Heat Stress and Hypoxia During 20-km Cycling Time Trials

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The effect of combined heat stress and hypoxia on exercise performance may be dependent on the modality of exercise. In response to constant-work exercise, combined environmental stressors demonstrate an interaction effect on time to exhaustion; however, similar combined stressors have an independent influence on cycling time-trial (TT) performance. Investigation of the neuromuscular responses to combined environmental stressors may clarify the underlying mechanism(s) that

contribute to apparent task-specific responses. **PURPOSE:** To examine the isolated and combined effects of ambient temperature [cool (18°C, 20% rh) vs hot (35°C, 20% rh)] and inspired oxygen content [normoxia (F_{iO_2} 0.21) vs hypoxia (F_{iO_2} 0.16)] on neuromuscular function in response to a cycling TT. **METHODS:** Five physically active male participants (23 ± 6 y) performed four 20-km cycling TTs in different environmental conditions [cool/normoxia (COOL); hot/normoxia (HOT); cool/hypoxia (HYPO); hot/hypoxia (H-H)]. Neuromuscular responses of the soleus, as indicated by changes in isometric MVC (iMVC), M-wave, twitch force (Q_{tw}), and voluntary activation (VA), were assessed prior to and following each time-trial. Linear mixed model analyses were used to examine the neuromuscular responses, with fixed effects for each condition and a random intercept for participants. **RESULTS:** Time-trial performance was impaired during HOT (2211 ± 85 s; 192 ± 18 W), HYPO (2213 ± 122 s; 192 ± 27 W), and H-H (2214 ± 117 s; 192 ± 27 W) compared to COOL (2090 ± 54 s; 221 ± 14 W, $p < 0.02$). Similar reductions in iMVC ($-9.0 \pm 12.0\%$) and VA ($-14.0 \pm 9.6\%$) were observed across all conditions ($p < 0.05$); however, no significant differences were observed in M-wave ($p = 0.09$) or Q_{tw} ($p = 0.43$). **CONCLUSION:** Neuromuscular impairments following 20-km cycling TT are attributed to central mechanism(s) (i.e., VA); however, neuromuscular adaptations were similar in conditions where heat stress and hypoxia were combined, to conditions where each environmental stressor was examined in isolation.

1762 Board #3 May 30 3:45 PM - 5:45 PM
Physiological Responses to Repeated Sprint Exercise under Combined Heat and Hypoxic Conditions

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During sprint exercise in hypoxia, anaerobic energy supply is increased with augmented blood volume in muscle. Exposure to heat stress also increases anaerobic energy supply and blood volume in the muscle. Therefore, the combined treatments of "hypoxic exposure" and "heat stress" may cause further increases in above responses. **PURPOSE:** To determine the effect of combined heat and hypoxic conditions on physiological responses to repeated sprint exercise. **METHODS:** Ten male athletes (19.6 ± 0.3 yrs, 173.3 ± 2.2 cm, 71.6 ± 1.8 kg) completed repeated sprint exercise (three sets of 3×10 s maximal pedaling exercise) under four different conditions: [1] control condition (CON, 20°C, F_{iO_2} : 20.9%), [2] hypoxic condition (HYP, 20°C, F_{iO_2} : 14.5%), [3] hot condition (HOT, 35°C, F_{iO_2} : 20.9%), [4] combined hot and hypoxic conditions (HH, 35°C, F_{iO_2} : 14.5%). Power output, muscle oxygenation in vastus lateralis [evaluated by near infrared spectroscopy (NIRS)], respiratory variables and arterial oxygen saturation (S_{pO_2}) were continuously monitored throughout the exercise. We also measured skin and muscle temperature, heart rate, and blood variables (blood lactate, glucose, pH, PO_2 , PCO_2 levels). **RESULTS:** HYP and HH showed significantly lower average oxygen uptake (CON: 2.3 ± 0.1 L/min, HYP: 1.9 ± 0.1 L/min, HOT: 2.4 ± 0.1 L/min, HH: 2.0 ± 0.1 L/min) and average S_{pO_2} (CON: $94.8 \pm 0.6\%$, HYP: $89.5 \pm 0.5\%$, HOT: $94.8 \pm 0.5\%$, HH: $89.5 \pm 0.4\%$) compared with CON and HOT ($p < 0.05$). Muscle temperature was significantly higher in HOT and HH compared with CON and HYP throughout the exercise ($p < 0.05$). Furthermore, HOT and HH presented significantly greater peak power output in the first set of the exercise compared with CON and HYP ($p < 0.05$). No significant difference among trials was observed for changes in blood variables, and muscle oxygenation in vastus lateralis. **CONCLUSIONS:** Peak power output was higher in HOT and HH, although HH showed lower oxygen uptake and S_{pO_2} . These results suggest that combined heat and hypoxic conditions (HH) would cause greater power output than control condition in spite of decreased aerobic energy supply.

1763 Board #4 May 30 3:45 PM - 5:45 PM
Downhill Running: An Effective Countermeasure To Limitations Of Exercise In Acute Hypoxia?

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Exercise stress that results in increased expression of heat shock protein 72 (Hsp72) is linked to physiologic adaptations. Adaptations to one environmental stressor, such as heat, increase Hsp72 and induce cross adaptations to other stressors (i.e. hypoxia). Previously, two bouts of downhill running (DHR) conferred classic markers of heat acclimation (lower T_{re} , earlier onset of sweating). We sought to increase Hsp72 through repeated DHR to potentially expedite the acclimation process. **PURPOSE:** To analyze the effect of DHR on exercise performance in normobaric hypoxia. **METHODS:** 8 males (23.8 ± 5.8 years, VO_{2max} 54.1 ± 5.1 ml kg^{-1} min^{-1} , $13.6 \pm 5.2\%$ body fat) performed two 45-minute DHR bouts (-12.5% grade) separated by 5-7 days in the speed that elicited V_{Tmax} while running downhill. Pre and post blood samples were collected to quantify monocyte Hsp72. Muscle soreness (DOMS) was assessed 24

and 48 hours after each downhill bout using a Likert scale. Two normobaric hypoxic (16% FiO_2) 5 km time trials (TT) were performed: one before any DHR and one 5-7 days after the last bout. Hydration was assessed before the TT while blood lactate was measured pre and post TT. During the TT, heart rate, RPE and O_2 saturation (SA_{O_2}) were recorded every 1 km. **RESULTS:** Monocyte Hsp72 showed no change across time ($p = 0.53$). Specifically, basal concentration from DHR I to DHR II were not different (3.5 ± 2.3 to 2.9 ± 1.5 AU). TT performance was similar between conditions (1377 ± 192 ; 1364 ± 174 sec). Hydration (1.018 ± 0.007 ; 1.013 ± 0.009 urine specific gravity), RPE (14.9 ± 1.1 ; 14.6 ± 1.3), HR (178 ± 8 ; 178 ± 8), and blood lactate (post TT1 11.6 ± 1.8 ; post TT2 12.0 ± 3.1 mM) were similar in both TTs. However, SA_{O_2} significantly increased from TT1 to TT2 (84.5 ± 4.0 ; $87.2 \pm 2.3\%$, $p < 0.05$). DOMS was significantly lowered 24 (5.1 ± 0.8 to 3.5 ± 1.4 , $p = 0.00$) and 48 (4.6 ± 1.0 to 2.6 ± 1.5 , $p = 0.00$) hours following the second DHR trial when compared to the first trial. **CONCLUSIONS:** While no change in Hsp72 or TT time were observed, this could be due to large variations found in the data with these variables. The increase in SA_{O_2} after DHR may improve exercise capacity at elevation during moderate exercise intensities.

1764 Board #5 May 30 3:45 PM - 5:45 PM
Heat Acclimation Mediated Crosstolerance In C2C12 Myotubes

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 (No relevant relationships reported)

Background. Heat acclimation enhances animal and human tolerance during subsequent novel hypoxic stress exposure. This heat-acclimation-mediated crosstolerance (HACT) is attributed to shared cellular stress response pathways. Although skeletal muscle is the largest organ (by mass) in the mammalian body, to our knowledge no research has been conducted examining HACT in skeletal muscle cells. **Purpose.** The timecourse of HACT and the mechanisms behind this response were examined in differentiated C2C12 myotubes. **Methods.** Heat acclimation (HA) was established by heating (40°C) C2C12 myotubes for 6 consecutive days (2h/d). Control myotubes were maintained for the same duration under control conditions (37°C). Control and HA myotubes were subsequently challenged with Hypoxia (1% F_{iO_2}) or Hypoxia + LPS (1% F_{iO_2} + 500 ng/ml LPS) for 2h. Cell lysates were collected immediately post (+0h) and 12h post (+12h) challenge. Western blot was used to assess protein markers of the heat shock response (HSR), inflammation, and apoptosis. Data were analyzed with two-way ANOVA with Newman-Keuls post-hocs. **Results.** HA myotubes exhibited increased phosphorylation of HSF-1 [+59%, $p = 0.03$] and reduced phosphorylation of IKB α [-56%, $p = 0.01$] at +0h. Control myotubes exhibited reduced SIRT1 at +0h following challenge with Hypoxia [-36%, $p = 0.04$] and Hypoxia + LPS [-47%, $p = 0.02$]. By +12h Control myotubes that had been challenged with Hypoxia or Hypoxia + LPS exhibited increased phosphorylation of HSF-1 [+86% ($p < 0.01$) and +77% ($p < 0.01$); respectively] and HSP70 content [+158% ($p < 0.01$) and +153% ($p = 0.04$); respectively]. However, these changes occurred too late to afford cytoprotection, as Control myotubes that were challenged with Hypoxia + LPS also exhibited increased TLR4 (+77%, $p = 0.01$) and NF κ B (+117%, $p = 0.03$), in conjunction with elevated phosphorylation of JNK [+55%, $p = 0.03$] and Caspase 3 content (+25%, $p = 0.02$). **Conclusion.** We present evidence of HACT in C2C12 myotubes. We speculate that through elevations in SIRT1 and activation of the HSR, HA confers lower inflammatory and apoptotic drive in skeletal muscle cells. We note that HACT is not evident until +12h following challenge, suggesting studies that do not follow an extended timecourse for cell lysate collection could potentially miss benefits associated with this response.

D-41 Thematic Poster - Energy Metabolism and Health

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-104B

1765 Chair: Tanya M. Halliday. University of Utah, Salt Lake City, UT.

(No relevant relationships reported)

**1766 Board #1 May 30 3:45 PM - 5:45 PM
Pre-intervention Endothelial Function and Hyperglycemia Modifies Flow-mediated Dilation Following Short-term Exercise Training in Adults with Prediabetes**

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Purpose: Impaired glucose tolerance (IGT) elevates type 2 diabetes and cardiovascular disease (CVD) risk above and beyond impaired fasting glucose (IFG) alone. Hyperglycemia can impair endothelial function through increased inflammatory responses. However, it is unknown whether exercise training vascular function differently among prediabetes phenotypes. We examined whether improvements in endothelial function following 2-wks of aerobic training is affected different in adults with IFG+IGT compared to those with IFG alone. **Methods:** Middle-aged, obese adults with IFG (n=11, 58.3±9yrs; 34.2±7.9 kg/m²; FPG: 106.5±6.1mg/dl, 2-hr glc: 127.0±31.7mg/dl) and IFG+IGT (n=13, 61.6±8.1yrs; 32.8±3.1 kg/m²; FPG: 104.2±10mg/dl, 2-hr glc: 162.2±29.6mg/dl) were randomized to 12-work matched cycling aerobic exercise bouts (~70% HR_{peak}, 60 min/d) over 2-wks. A 2-hr 75g OGTT was performed pre and post-intervention to determine glucose tolerance. Endothelial function was determined by brachial artery flow mediated dilation (FMD) prior to the OGTT. Aerobic fitness (VO_{2peak}), body composition (BIA), and vascular inflammation (VCAM, ICAM) were also assessed before and after training. **Results:** Training significantly increased VO_{2peak} (P=0.03), fat-free mass (P=0.001) and VCAM (P=0.01) in both phenotypes. There was no effect of training on FMD in either IFG+IGT or IFG (0.33±3.9 vs. 1.13±4.7%, P=0.66 respectively). However, pre-intervention FMD (r=-0.45, P=0.04) and glucose total area under the curve (r=-0.56, P=0.007) were associated with increased FMD in response to training. Moreover, increased FMD adaptation was linked to decreased circulating VCAM after training (r=-0.52, P=0.02). **Conclusion:** These data highlight that impaired endothelial function and hyperglycemia prior to exercise treatment may affect improvements in endothelial function following short-term training in people with different prediabetes phenotypes. The mechanism by which people with prediabetes respond to exercise-induced vascular adaptation may relate to reduced vascular inflammation and warrants further investigation.

**1767 Board #2 May 30 3:45 PM - 5:45 PM
Low-Calorie Diet With or Without Interval Exercise Reduces Post-Prandial Aortic Waveform in Obese Women**

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(No relevant relationships reported)

Purpose: Arterial stiffness is considered a strong predictor of cardiovascular disease (CVD). Women have higher values of arterial stiffness than men, suggesting that females are at a greater risk of heart-related complications. While a low calorie diet (LCD) reduces arterial stiffness, in part through lowering metabolic syndrome (MetS) risk factors and/or increasing insulin sensitivity, no study has tested if interval exercise (INT) adds to the benefit of LCD on arterial stiffness in obese women. **Methods:** Twenty-four obese women (49.2 ± 2.4yrs; 37.9 ± 1.3kg/m²) were randomized to LCD (n=12; mixed meals of ~1200 kcal/d) or LCD+INT (n=12; 60 min/d of supervised INT at 90% HR_{peak} for 3 min and 50% HR_{peak} for 3 min). An additional 350kcal was provided to LCD+INT post-exercise to equate energy availability between groups. Augmentation index (AIx, systemic aortic waveform adjusted for heart rate of 75 bpm) and carotid-femoral pulse-wave velocity (cfPWV, central index) were measured during a 75g OGTT before and after the intervention to assess arterial stiffness. MetS risk

severity (z-scores) and insulin sensitivity (Si; simple index of insulin sensitivity) were also measured. **Results:** LCD+INT increased VO_{2peak} (L/min) and HDL compared to LCD (P=0.03 and P=0.04, respectively). However, both interventions decreased body fat, fasting SBP, TG, total cholesterol, MetS severity and LDL (all P<0.01) as well as improved Si (P=0.03). Despite no effect on fasting AIx (LCD: -3.2 ± 3.2 vs. LCD+INT: -2.7 ± 3.8%, P=0.32) or cfPWV (LCD: -0.22 ± 0.54 vs. LCD+INT: 0.73 ± 0.83 m/s, P=0.76), LCD and LCD+INT decreased AIx tAUC_{120min} (-662.5 ± 263.3 vs. -801.0 ± 286.5, P=0.04, respectively). Pre AIx_{0min} correlated with pre fasting DBP (r=0.40, P=0.04) and decreased AIx_{0min} (r=-0.45, P=0.03). Further, this decreased AIx_{0min} correlated with increased Si after treatment (r=-0.44, P=0.03). **Conclusion:** Independent of exercise, LCD reduces post-prandial aortic waveform and MetS severity in obese women. Decreased systemic arterial stiffness appears to be related to insulin sensitivity following reduced energy availability, given no effect on cfPWV. Further work is warranted to determine how dietary manipulation, with and without exercise, impacts fasted vs. post-prandial arterial stiffness to optimize CVD risk reduction.

**1768 Board #3 May 30 3:45 PM - 5:45 PM
Effects of Exercise Modality on Glycemic Control After 6 Weeks of Training in Middle Aged Men**

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BACKGROUND: Glycemic control is impaired with age and is accompanied by an age-related decline in muscle mass. Regular exercise maintains muscle mass and improves glycemic control. Whether the mode of exercise training differentially affects glycemic control during middle-age is unknown.

PURPOSE: To investigate changes to glycemic control after a 6 week exercise training program in inactive, middle-aged men with overweight/obesity.

METHODS: Thirty-five men (39.6 ± 2.4 y, BMI: 28.8 ± 3.7 kg/m²; mean ± SD) enrolled in a 6-week training study and were randomly stratified (by lean body mass) to one of three training groups (endurance cycling (END, n=12); high intensity interval cycling training (HIIT, n=12); resistance training (REX, n=11)) in a parallel groups design. Two-hour OGTTs were conducted as secondary analyses on two occasions (pre and post intervention) and total AUC (trapezoid method) was calculated. Statistical analyses were performed using linear mixed models (group × time), with significance set at P<0.05.

RESULTS: For glucose variables, there were no differences between groups at baseline (fasting glucose: 5.2 ± 0.6 mmol/L; AUC: 13.7 ± 3.2 mmol/L/h). A main effect of time for lower post-intervention total AUC glucose was observed (-0.7 ± 2.0 mmol/L/h, P=0.043). Fasting glucose concentrations showed a group × time interaction (P=0.008) where REX training increased fasting glucose levels post-training (+0.4 ± 0.5 mmol/L, P=0.005). Training modality had a similar effect on fasting insulin or total insulin AUC. However, a main effect of time was observed for the reduction in total AUC insulin from pre to post intervention (-15 ± 42 mIU/mL/h, P=0.046).

CONCLUSIONS: Regardless of modality, exercise training for 6 weeks induced improvements in total glucose and insulin AUC measures in response to an OGTT in middle-aged men with overweight/obesity. The small improvements in glycemic control are likely related to the normal glycemic tolerance at baseline. Future investigations of exercise modality should be performed in individuals with abnormal glucose tolerance to determine if exercise modality is an important factor in improving glycemic control.

ACKNOWLEDGEMENTS: This study was funded by ACURF grants to Dr Camera and Dr Parr.

**1769 Board #4 May 30 3:45 PM - 5:45 PM
Effect of Exercise Training Intensity on Glycemic Control in Older Adults with Prediabetes**

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INTRODUCTION: Older adults have the highest rates of prediabetes and diabetes in the US. Exercise is a well-established method to improve glycemic control, however, the optimal dose (duration and intensity) of exercise required to improve glycemic control among older adults is unclear. **PURPOSE:** To compare the effect of 12 weeks of moderate vs. high intensity exercise training on daily glycemic control in older adults with prediabetes. **METHODS:** 15 older adults (66.4 ± 5.1 yrs) with prediabetes (HbA1c 5.7-6.4% or fasting glucose 100-125 mg/dl) participated in a 12-week supervised aerobic exercise training intervention. Participants were screened prior

to being randomized to the moderate (MOD: 60-65% HR_{max}) or vigorous (VIG: 80-85% HR_{max}) intensity training group. During the intervention, participants exercised 4 days per week (45 minutes/session) in their target heart rate range. Continuous glucose monitors (CGM) were worn for 1 week at baseline and during the 12th week of supervised exercise training. Daily glycemic control was quantified over 24 hour periods (00:00 to 23:29) for each day the CGMs were worn during the week at baseline and after exercise training. We calculated mean, total area under the curve (trapezoidal method), and duration of hyperglycemia (percent time glucose ≥ 140 mg/dL). Using linear mixed models with repeated measures, we determined the effect of exercise training and whether the effect of training varied by exercise intensity group. Significance was set at $p < 0.05$. Data are reported as mean \pm SD. **SUMMARY OF RESULTS:** There were no significant differences in any baseline participant characteristics (e.g. sex, age, BMI) between exercise training groups. At baseline, VIG had significantly lower mean (MOD: 136.0 \pm 18.4; VIG: 122.6 \pm 7.4 mg/dL), total area under the curve (AUC) (MOD: 3243.0 \pm 505.1; VIG: 2873.4 \pm 226.2 mg*hr/dL), and duration of hyperglycemia (MOD: 38.5 \pm 28.6%; VIG: 19.9 \pm 9.6%). After the intervention, there were no significant changes in mean glucose, AUC, or duration of hyperglycemia in either group. **CONCLUSION:** Regardless of exercise intensity, 12 weeks of aerobic exercise training did not significantly change daily glycemic control in older adults with prediabetes, suggesting that changing other lifestyle factors may be needed to improve glycemic control in this population.

1770 Board #5 May 30 3:45 PM - 5:45 PM
Nutritional Intervention Increases the Likelihood of Menses in Exercising Women with Menstrual Disturbances

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Exercising women in whom energy intake is inadequate for energy expenditure develop low energy availability (EA) and are at risk for menstrual disturbances and poor bone health. The first line of treatment is an increase in energy intake to reverse low EA. REFUEL is the first randomized controlled trial (RCT) to assess the effectiveness of 12 months of increased energy intake on menstrual function and bone health in women with exercise-associated menstrual disturbances (EAMD).

Purpose: To determine if an intervention of increased energy intake improves menstrual regularity among women with EAMD.

Methods: Young, exercising women with EAMD were randomized into two groups. The treatment group (EAMD+Cal, n=32) increased energy intake 20-40% above baseline energy needs; whereas, the EAMD Control group (n=30) maintained exercise and eating habits. Menstrual function was tracked throughout the intervention with menstrual calendars and daily urine samples for reproductive hormones. A conditional recurrent events Cox Proportional Hazards model tested the effects of the intervention.

Results: The EAMD+Cal women (21.6 yrs, BMI: 20.2 kg/m²) increased energy intake by 353 kcal/day ($p < 0.001$ vs. Control) and gained 1.9 kg of body weight ($p = 0.035$ vs. Control), which corresponded with a 1.2 kg increase in fat mass ($p = 0.080$ vs. Control) and 64% increase in leptin ($p = 0.074$ vs. Control); whereas, the EAMD Controls (20.9 yrs, BMI: 21.3 kg/m²) had no change in energy intake (-32 kcal/day) and minimal change in body weight (0.8 kg), fat mass (0.4 kg), and leptin (21% increase). After controlling for BMI and menstrual status at baseline, the intervention had a positive effect on the likelihood of experiencing menses vs. the Control group ($p < 0.001$).

Women in the EAMD+Cal group were twice as likely (104% increase) to experience menses during the intervention than those in the EAMD Control group.

Conclusions: Exercising women with EAMD who moderately increased energy intake were twice as likely to experience menses vs. EAMD women who maintained their usual exercise and eating habits. The intervention was associated with a modest increase in body weight. This study is the first RCT to demonstrate the effectiveness of a nutritional intervention for the improvement of menstrual function in women with EAMD.

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1771 Board #6 May 30 3:45 PM - 5:45 PM
Sensitivity And Specificity Of Resting Metabolic Rate Measures To Predict Exercise Associated Menstrual Disturbances

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Energy deficiency in exercising women can lead to menstrual disturbances (MD). There is no gold standard to accurately estimate energy deficiency. Ratios of measured

to predicted resting metabolic rate (RMR) have been used as a proxy to categorize women as energy deficient. **PURPOSE:** To evaluate whether measured to predicted RMR ratios are predictive of amenorrhea or other MD. **METHODS:** We performed a cross-sectional comparison of 223 exercising women (≥ 2 hrs/wk, age 18-35 years, BMI 16-30 kg/m²) who were ovulatory (OV), amenorrheic (AMEN), or subclinical MD (sMD) (including oligomenorrhea, anovulation, and luteal phase defects). Menstrual status was determined using urinary measures of reproductive hormones and menstrual calendars. Body composition was measured with DXA and RMR with the SensorMedics Vmax. Harris-Benedict, Cunningham, and DXA equations were used to calculate predicted _{HB}RMR, _CRMR, and _{DXA}RMR and to calculate the measured to predicted RMR ratio. ANOVA and Kruskal-Wallis tests determined group differences and logistic regression determined predictors of AMEN or any MD. Calculations of sensitivity, specificity and positive predictive value (PPV) assessed accuracy of predictions. **RESULTS:** Groups did not differ in lean or fat free mass. AMEN had lower body mass ($p < 0.01$) than sMD, and lower BMI, percent body fat, fat mass ($p < 0.001$) and measured RMR (1172 \pm 21 kcal/d) ($p < 0.05$) than OV (1227 \pm 20 kcal/d) and sMD (1233.68 \pm 17 kcal/d). _{HB}RMR was lower in AMEN (1402 \pm 8 kcal/d) vs sMD (1434 \pm 9 kcal/d) ($p < 0.05$). _CRMR ratio (0.84 \pm 0.01) was lower in AMEN vs OV (0.88 \pm 0.01) ($p < 0.05$), but _{DXA}RMR ratio (0.90 \pm 0.01) was lower in AMEN vs both OV (0.96 \pm 0.01) and sMD (0.95 \pm 0.01) ($p < 0.01$). Each ratio predicted AMEN (_{HB}RMR: $\chi^2 = 4.822$, $p < 0.05$; _CRMR: $\chi^2 = 8.708$, $p < 0.01$; _{DXA}RMR: $\chi^2 = 14.068$, $p < 0.001$), but only _{DXA}RMR ratio predicted any MD ($\chi^2 = 6.795$, $p < 0.01$). _{DXA}RMR ratio correctly identified the most women with AMEN (ppv=0.5; sensitivity= 0.49, specificity= 0.74) and with any MD (AMEN+sMD: ppv=0.75; sensitivity= 0.39, specificity= 0.75). **CONCLUSIONS:** Each ratio may be used to predict AMEN, but only _{DXA}RMR significantly predicts MD, regardless of severity. Similarly, _{DXA}RMR ratio correctly identified the most subjects. _{DXA}RMR ratio can be utilized to correctly identify women with AMEN or MD secondary to energy deficiency.

1772 Board #7 May 30 3:45 PM - 5:45 PM
Effect of Interval Exercise Plus a Low-Calorie Diet on Endothelial Function in Obese Women

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PURPOSE: Low calori ediet (LCD) and interval exercise (INT) both improve endothelial dysfunction, in part, by reducing hyperglycemia. Whether adding INT to LCD raises endothelial function compared with LCD under energy available matched conditions though is unknown. **METHODS:** Obese women (47.2 \pm 2.6y, 37.5 \pm 1.3kg/m²) were randomized to 2-wks of a LCD (n=12; mixed meals of 1000-1200kcal/d) or LCD+INT (n=13; 60min/d of supervised INT at 90% and 50% HR_{peak} for 3 min each). LCD+INT subjects received 350kcal post-exercise to equate energy availability with LCD. A 75g OGTT was performed pre- and post-test to examine fasting, 1 and 2h large conduit artery endothelial function (FMD; flow mediated dilation) and substrate use (respiratory exchange ratio (RER) via indirect calorimetry) as well as glucose and insulin incremental area under the curve (iAUC) and insulin sensitivity (IS; Matsuda Index). Fitness (VO_{2peak}), body composition (BodPod), and vascular inflammation (VCAM, ICAM) were also determined. **RESULTS:** LCD+INT increased VO_{2peak} ($P = 0.02$) compared to LCD, and both treatments improved fat mass ($P < 0.001$), IS ($P = 0.02$), and ICAM ($P = 0.002$). LCD+INT and LCD had no effect on fasting or iAUC FMD, but there was notable variation. In fact, low baseline fasting and iAUC FMD was linked to enhanced fasting and iAUC FMD post-treatment ($r = -0.71$, $P < 0.001$; $r = -0.89$, $P < 0.001$, respectively). When comparing subjects who increased fasting endothelial function after each treatment ($> 50\%$; LCD n=5, LCD+INT n=7), LCD+INT increased fasted FMD more than LCD (6.3 vs. 2.8%, $P = 0.04$), and LCD+INT attenuated FMD iAUC compared to LCD (-499.3 vs. 64.6%, $P = 0.02$). Enhanced fitness related to increased fasting FMD ($r = 0.43$, $P = 0.03$) and attenuated FMD iAUC ($r = -0.44$, $P = 0.03$). Attenuated FMD iAUC correlated with reduced glucose iAUC ($r = 0.55$, $P = 0.004$), as well as increased fasting and 1h RER ($r = -0.55$, $P = 0.004$ and $r = -0.42$, $P = 0.04$, respectively). **CONCLUSIONS:** There was large FMD variation post-treatment. However, INT enhanced the effect of LCD on fasting FMD in those with low endothelial function, and this was mirrored by low post-prandial FMD stimulation. Low post-prandial FMD was linked to improved glucose tolerance and carbohydrate metabolism, suggesting INT enhanced nutrient delivery and utilization to lower type 2 diabetes and CVD risk.

1773 Board #8 May 30 3:45 PM - 5:45 PM
Effect Of Diurnal Exercise Timing On Postprandial Glucose Responses: A Randomized Controlled Trial

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 (No relevant relationships reported)

PURPOSE: Postprandial exercise has been shown to reduce postprandial glucose (PPG) response to a greater degree than preprandial exercise, suggesting an important yet under-acknowledged role for exercise timing on glycemic control. Whether diurnal timing of exercise imparts additional benefits on PPG responses remains unclear. This study aimed to determine the diurnal effect of exercise timing on PPG response in individuals enrolled into a 12-week supervised multi-modal exercise training program. **METHODS:** Forty sedentary overweight individuals (17 males, 23 female; age: 51 ± 13 years; BMI: 30.9 ± 4.2 kg/m²) with (n = 20) or without T2DM diagnosis were randomly allocated to either a morning (amEX) or evening (pmEX) exercise training group. All participants completed the 12-week supervised multi-modal exercise training program (3 days per week), which consisted of 30 minutes of aerobic exercise (walking protocol) and 4 resistance-based exercises (3 sets of 12-18 repetitions). The amEX and pmEX training sessions occurred in the postprandial state between 0700-0900h and 1700-1900h, respectively. Changes in postprandial glucose (PPG) and insulin (PPI) responses, during a mixed meal tolerance test (MMTT) were the primary outcome measures of the study assessed at baseline and post-intervention at 12 weeks. All data is displayed as mean differences ± SD.

RESULTS: Exercise training reduced (main effect of time, $p < 0.01$) PPG and PPI concentrations during the MMTT, with no group differences observed ($p = 0.69$). A significantly greater reduction in PPG-iAUC was observed for the pmEX group (-78.56 mmol/L) when compared to the amEX group (-33.22 mmol/L) at post-intervention ($p = 0.03$). Reductions in PPI iAUC (main effect of time, $p < 0.01$) were observed at post-intervention, with no group differences reported ($p = 0.18$).

CONCLUSIONS: Irrespective of the diurnal timing of exercise performance, 12-weeks of multi-modal exercise training significantly improved PPG and PPI responses in both overweight non-T2DM and T2DM individuals.

D-42 Thematic Poster - Head Impacts and Concussion

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
 Room: CC-101B

1774 Chair: James Onate. Ohio State University, Columbus, OH.
 (No relevant relationships reported)

1775 Board #1 May 30 3:45 PM - 5:45 PM
A Comparison of Head Impacts in Boys and Girls High School Lacrosse

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 (No relevant relationships reported)

Purpose: The purpose of this study was to compare the number and severity of head impacts between high school varsity girls and boys lacrosse players. **Methods:** Twenty-four subjects (13 girls, 9 boys) were individually assigned a wearable sensor (gForceTracker) for one season to measure the number of head impacts and the corresponding linear and angular acceleration. The sensor was fixed via headband (girls) or attached via dual lock strip onto the inside of a helmet (boys). A total of 21 (10 practices, 11 games) events for girls and 16 (11 practices, 5 games) events for boys were monitored. A 10g threshold was used and false impacts were removed by observing the events. Previously established correction equations were applied to raw data. Data were analyzed by t-test ($p < 0.05$). Institutional review board approval was received. **Results:** Boys experienced 33% more impacts per AE compared with girls, while girls had a higher average PLA than the boys ($p = 0.007$). There were a wide range of impacts per AE when examining individual athletes. The female athletes ranged from 0-12 impacts per AE, while the range for males was 3-20 impacts per AE. The majority of the impacts recorded were below 20 g for both boys and girls across either event. Surprisingly, a higher percentage of impacts were below 20 g for games when compared with practices for both girls (75% vs 56%) and boys (73% vs 69%). Girls experienced more impacts above 90 g than boys across either event. **Conclusion:**

Female athletes in similar or same sports sustain more concussions than males. The reason for this is unclear. Few studies have directly compared the number of impacts and head acceleration in boys and girls sports at the high school level. One previous study compared boys and girls hockey and also found that boys had a higher number of impacts but girls had a slightly higher average PLA, which is similar to our findings.

	Boys	Girls	P-val
Number Of Impacts Per Athletic Event			
Total	9.7	3.5	
For Games	9.1	4.4	
For Practices	9.9	2.5	
Peak Linear Acceleration (g)			
Total	19.6	21.1	0.007
For Game	19.4	20.1	0.327
For Practice	19.7	23.6	<0.001
Peak Angular Acceleration (rad/s ²)			
Total	1208.3	1166.2	0.217
For Game	1089.2	1059.5	0.636
For Practice	1327.3	1442.5	0.435

1776 Board #2 May 30 3:45 PM - 5:45 PM
Evaluation of Concussion Prediction with Head Impact Density by Receiver Operating Characteristic

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 (No relevant relationships reported)

PURPOSE: Head impact density has previously been introduced as a novel metric to evaluate the concussive risk of a series of head impacts. The originally proposed head impact density was calculated by summing the magnitude of a given impact divided by the time from the previous impacts for each of the 20 previous impacts. However, because the 20 previous impacts may occur over multiple days, this study computes density as the sum of head impact magnitudes divided by time since the previous impact for all impacts on a single day. The purpose of this study is to evaluate the predictiveness of a daily impact density and other head impact metrics using a receiver operating characteristic curve.

METHODS: 185 high school football players (n=185, age 16.3 ± 0.8 years, 180.8 ± 8.1 cm, 85.0 ± 18.3 kg) were outfitted with a head impact telemetry system that measured the magnitude, number, and location of head impacts sustained during all games and practices over a course of a football season. From the telemetry system, peak linear acceleration (PLA), peak rotational acceleration (PRA), kinematic impulse, daily PLA impact density, and daily PRA impact density were computed. A support-vector binary classifier (SVC) was fit to the data to predict whether or not a player had sustained a concussion on the given day. Receiver operating characteristic (ROC) and corresponding area under ROC (auROC) was computed using k-fold cross-validation with 5 folds.

RESULTS: Best auROC of 0.75 ± 0.11 was obtained using sum peak linear accelerations (PLA) for the day of impact, sum of peak rotational accelerations (PRA) for the day of impact, PLA impact density for the day, PRA impact density for the day, and the kinematic impulse density for the day as predictors. Despite a moderate auROC, the model's positive predictive value (PPV) was only 0.01 (f1-score = 0.02). **CONCLUSIONS:** Prior work has shown that density based head impact metrics are correlated with the concussion risk. Nevertheless, a binary classifier based only on head impact metrics was not able to provide a high level of PPV (i.e., precision). While head impact metrics are likely important to predicting concussion risk, this work adds to a growing body of evidence that neither individual hit characteristics nor the characteristics of a series of hits are reliable predictors of concussion.

1777 Board #3 May 30 3:45 PM - 5:45 PM
Head Impact Biomechanics in Youth Flag Football: An Exploratory Analysis

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(No relevant relationships reported)

Youth flag football has been proposed as a safe alternative to tackle football due to rising concerns of neurodegeneration from repetitive blows, but the true head impact (HI) burden in youth flag football is unknown.

PURPOSE: To examine overall and age-specific HI exposure and magnitude in youth flag football.

METHODS: Five youth flag football teams ($n = 35$, age = 8.5 ± 1.1 yrs, height = 138.5 ± 10.5 cm, mass = 35.3 ± 8.8 kg) comprised of two age groups (7-8Us and 9-10Us) wore HI sensors (Triax Sim-G) during practice and game sessions over one season. Sensors recorded HI frequency, linear (g), and rotational acceleration (rad/s^2). Athlete exposure was calculated as one player participating in one practice or game session. Impact rates (IR) were calculated as impacts per 10 athlete exposures. Impact rate ratios (IRR) compared session type and age groups. Acceleration values were placed into low- and high-magnitude categories via median splits. Magnitude category frequencies were compared between age groups using χ^2 tests ($p < 0.05$).

RESULTS: We observed 203 overall flag football HIs (127 game, 76 practice; 5.8 impacts/player; 0.56 impacts/exposure). Overall median linear acceleration was 32.7g ($16.0\text{g} - 100.9\text{g}$) and angular acceleration was $4,300 \text{ rad/s}^2$ ($1,000 \text{ rad/s}^2 - 12,500 \text{ rad/s}^2$). 90th percentile accelerations were 63.0g and $8,400 \text{ rad/s}^2$ during games and 49.5g and $8,200 \text{ rad/s}^2$ during practices. Players experienced significantly higher IRs during practices than games (IRR = 1.54, 95% CI: 1.16-2.05). There were no age group HI differences overall (IRR = 1.12, 95% CI: 0.83-1.51) or for games (IRR = 1.15, 95% CI: 0.80-1.64). Practices resulted in 1.80 times the IR (95% CI: 1.02 - 3.17) in the 9-10Us compared to the 7-8Us. No significant associations between age groups were observed for low- and high-magnitude HIs for linear ($p = 0.73$) or angular acceleration ($p = 0.32$).

CONCLUSIONS: Flag football players experienced a low-frequency of HIs and relatively high-impact magnitudes, but whether high-frequency or magnitude HIs contribute to neurodegeneration is unknown. Practices had greater odds for HI frequencies than games, suggesting practice modifications can further decrease total HI. The 9-10Us experienced greater HI frequencies, potentially indicating more aggressive or risky game play with age.

1778 Board #4 May 30 3:45 PM - 5:45 PM
Effect Of A Dynamic Dual-Task Paradigm And Concussion History On Motor And Cognitive Performance

Maria Talarico, Christopher Ballance, Laura Boucher, James Onate. *The Ohio State University, Columbus, OH.*

(No relevant relationships reported)

Prior to and following a concussion, athletes exhibit deficits in gait and cognitive performance between single-task (ST) and dual-task (DT) paradigms. Current motor tasks used in these divided attention paradigms may not be challenging enough to detect long-term changes following injury. **PURPOSE:** To determine if differences exist between ST and DT paradigms while performing a multi-directional gait task and Stroop test. **METHODS:** Fifteen male Big Ten Universities Rugby Conference athletes (20.53 ± 1.60 yrs; 1.76 ± 0.10 m; 86.11 ± 9.47 kg) and 17 male American Collegiate Hockey Association athletes (20.06 ± 1.75 yrs; 1.79 ± 0.07 m; 85.96 ± 10.25 kg) volunteered to participate. Two tasks were performed: 1) recite the color of the Stroop stimulus and 2) walk around a 3.05×3.05 m (10×10 ft.) box while maintaining forward gaze. Tasks were completed independently (ST) and concurrently (DT). Attempted responses were calculated as a percentage of attempted out of total possible responses (56 stimuli). The number of incorrect responses were calculated as $[(\text{incorrect responses} / \text{attempted responses}) * 100]$. Dual-task effect (DTE) was calculated as $[(\text{DT performance} - \text{ST performance}) / \text{DT performance} * 100]$ for box distance and attempted responses. A paired samples t-test was performed to determine if differences in DTE existed between motor and cognitive performance. For all remaining outcome variables, 2 (paradigm) \times 2 (concussion history) mixed-model ANOVAs were performed. Alpha level was set *a priori* at $p < 0.05$. **RESULTS:** Participants walked a shorter distance under DT (10.49 m) compared to ST (11.66 m) ($p < 0.01$). Athletes with a concussion history had a higher percentage of incorrect responses (2.73%) compared to those without a history of concussion (0.58%) ($p = 0.01$). There were no differences in attempted responses between paradigms ($p = 0.38$) or concussion history ($p = 0.66$). DTE for box distance (-12.45%) and attempted responses (-3.80%) DTE were different ($p = 0.02$). **CONCLUSIONS:** Motor and cognitive differences existed under a DT paradigm whereby DT elicited a

greater degree of change from ST for motor performance than cognitive performance. Establishing a normative healthy DT baseline performance is warranted to better inform clinicians on appropriate return-to-play decisions following injury.

1779 Board #5 May 30 3:45 PM - 5:45 PM
The Relationship of Nonlinear Metrics of Postural Control Following Sport Related Concussion

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(No relevant relationships reported)

Postural control is a cardinal sign of sport-related concussion (SRC) and can be quantified via center of pressure (CoP) data using linear and nonlinear metrics. Recently, nonlinear metrics such as approximate (ApEn), sample (SampEn) and complexity index (CI) have been proposed as methods of analyzing the neurological organization or health of the postural control system. This is partially due to the properties of the signals being analyzed. Currently, research is divided about which of these nonlinear metrics are appropriate to use to quantify postural control deficits in neurological disorders, such as (SRC). However, these metrics have not been compared within the same sample of SRC. **PURPOSE:** The purpose of this study was to examine the relationship between ApEn, SampEn, and CI in a group of healthy match controls (CON) and sport-related concussion (SRC). **METHODS:** Sixteen Division 1 athletes with SRC and 16 CON performed 3 trials of feet together quiet upright stance in the eyes open (EO) and eyes closed (EC) conditions for 30 seconds on a force platform (100Hz) at 24-48 hours post-injury. SRC was diagnosed by the head team physician and verified by the presence of 2 or more vestibular/ocular symptom scores on Vestibular Ocular Motor Screening (VOMS) test. CON data were collected at pre-participation physicals. Raw CoP data were analyzed using ApEn and SampEn ($m=2$, $r=0.2$, $N=300$), and MSE ($m=2$, $r=0.15$, $S=1-10$, $N=300-3,000$). The data were analyzed using independent samples t-tests and Pearson's Product Correlations. **RESULTS:** A significant decrease in ApEn ($p=0.024$; $\text{SRC}=0.59 \pm 0.11$, $\text{CON}=0.68 \pm 0.10$ Cohen's $d=0.86$) SampEn ($p=0.022$; $\text{SRC}=0.65 \pm 0.14$, $\text{CON}=0.76 \pm 0.13$, Cohen's $d=0.81$), and MSE ($p=0.025$; $\text{SRC}=41.86 \pm 8.79$, $\text{CON}=48.69 \pm 7.55$, Cohen's $d=0.83$) was noted in the EC AP direction for SRC. No other significant differences were noted. A significant relationship was noted between ApEn and SampEn ($p < 0.001$, $r=0.99$), ApEn and MSE ($p < 0.001$, $r=0.99$), and SampEn and MSE ($p < 0.001$, $r=0.99$) in the EC AP direction for both SRC and CON. **CONCLUSION:** These results may indicate that ApEn, SampEn, and MSE are highly related to one another and may be viable in determining deficits postural control following SRC.

1780 Board #6 May 30 3:45 PM - 5:45 PM
Baseline Postural Control Measures: An Indicator For Increased Injury Frequency Following Sport-related Concussion

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(No relevant relationships reported)

Recent research indicates that within 1 year following sport-related concussion (SRC), those who have experienced a SRC are 1.97 to 3.5 times more likely to sustain an acute lower extremity (LE) injury with a risk rate that ranges from 2.88 to 6.22 per 1000 athlete exposures. These studies suggest that an association between SRC and LE injury exists, however, no known research has examined the potential cause. It has been suggested that lingering postural control deficits as a result of SRC, may play a role in the increased prevalence of injury. **PURPOSE:** The purpose of this study was to investigate the potential relationship between baseline postural control metrics and acute LE injury frequency in NCAA Division I athletes with a prior history of SRC. **METHODS:** Eighty-four NCAA Division I athletes (42 with a history of SRC [CONC]; 42 without a history of SRC [CTRL]) performed three trials of 30 seconds eyes open (EO) and eyes closed (EC) quiet upright stance during pre-participation baseline screening on a force platform (1000Hz). Acute LE injuries were prospectively tracked for a single athletic season following baseline. Raw center of pressure (CoP) data were further analyzed using a custom MATLAB code to obtain Root Mean Square (RMS), Mean Velocity (MEV), and Multiscale Entropy's Complexity Index (CI) for both anteroposterior (AP) and mediolateral (ML) directions. **RESULTS:** The results indicated that over the course of the season, 27.4% of the athletes reported an injury ($\text{CONC} = 15$, $\text{CTRL} = 8$ injuries) with a significant association between prior SRC history and incidence of injuries ($p=0.043$, relative risk=1.88 [$\text{CI}_{95} = 1.09, 3.95$]). In EO condition, RMS ($p=0.049$; $\text{CONC}=5 \pm 0.28\text{mm}$, $\text{CTRL}=4.1 \pm 0.22\text{mm}$; Cohen's $d=3.6$) and CI ($p=0.021$; $\text{CONC}=10.25 \pm 0.52$, $\text{CTRL}=11.80 \pm 0.57$; Cohen's $d=2.9$) in

the ML direction were significantly different between groups. Furthermore, in the EC condition, CI ($p=0.026$; $CONC=14.08\pm0.63$, $NORM=15.93\pm0.52$; Cohen's $d=3.2$) in the ML directions was significantly different between groups. No other significant differences were observed. **CONCLUSION:** These results indicate that a prior history of SRC is associated with a greater incidence of LE injury and postural control differences can be detected prior to injury occurrence using postural control variability.

- 1781** Board #7 May 30 3:45 PM - 5:45 PM
Laboratory Validation Of A Head Impact Sensor For Use In Water Polo And Non-helmeted Land Sports
 Nicholas J. Cecchi, Derek C. Monroe, Theophil J. Oros, Steven L. Small, James W. Hicks. *University of California, Irvine, Irvine, CA.*
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 (No relevant relationships reported)

Repetitive head impact exposure can result in brain injury, and impact sensors are increasingly being used to quantify head impact kinematics and patterns of risk in sports. Water polo is a contact sport that carries a risk of head impact from the ball and contact between players. However, monitoring head impacts presents a challenge since the sensors must be waterproof and small enough to be worn in a water polo cap. The SIM-G (Triax Technologies) sensor meets these criteria, but a validation of the SIM-G in a water polo cap has not yet been published.

PURPOSE

To evaluate the accuracy and reliability of a head impact sensor, previously validated for use in non-helmeted land sports, mounted in a standard water polo cap.

METHODS

A SIM-G sensor was placed in i) a water polo cap and ii) a headband. Each headgear was fitted to a 50th Percentile Male Hybrid III head and neck (headform; HF). A linear impactor impacted the HF at seven sites and four velocities (1.7, 2.7, 4.7, and 6.4 m/s). 1.7 m/s did not consistently produce impacts large enough for the SIM-G to detect, thus 155 impacts (77 headband, 78 water polo cap) were analyzed. Peak linear acceleration (PLA), rotational velocity (PRV), rotational acceleration (PRA) were recorded for all impacts. SIM-G reliability was tested using a series of regression analyses to compare PLA, PRA, and PRV to HF values. Differences in the regression coefficients were tested by the interaction term (i.e., magnitude x headgear). Accuracy was tested using a mixed model ANOVA with sensor (HF, SIM-G) as a repeated measure and headgear (cap, headband) as a between-trial factor. Interactions were decomposed with *post hoc* Bonferroni-corrected t tests.

RESULTS

The SIM-G sensor reliably quantified PLA, PRA, and PRV relative to the HF [$\beta>.559$, $t(151)>6.682$, $p<.001$] independent of headgear ($p>.191$). Regarding accuracy, there were sensor x headgear interactions [$F(1,153)>29.383$, $p<.001$, $\eta^2>.161$]. Relative to the HF, the SIM-G overestimated PLA, PRA, and PRV when mounted in the water polo cap and underestimated PRV when mounted in the headband ($p<.001$).

CONCLUSION

The SIM-G sensor demonstrated sufficient reliability for quantifying in the water polo cap and headband. However, due to sensor inaccuracy, relative metrics, rather than absolute impact magnitudes, are advised when calculating head impact exposure.

- 1782** Board #8 May 30 3:45 PM - 5:45 PM
Biomechanical Analysis of Head Impacts during Real Time Soccer Play: a Preliminary Study
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 (No relevant relationships reported)

Linear and angular head accelerations are recognized as the foremost mechanisms of head injuries in sports. However, in non-contact sports such as soccer, little is known about onfield head accelerations during soccer play, which limits the understanding of the risk and mechanism of head injury. **PURPOSE:** To assess the biomechanics underlying the risk of head injury during soccer play. **METHODS:** An instrumented headband was worn by 8 elite male (M) players (18 ± 0 yrs, 73.7 ± 9.5 kg, 1.73 ± 0.1 m) and 16 amateur female (F) players (24.1 ± 1.4 yrs, 63.5 ± 7.8 kg, 1.63 ± 0.1 m) during 7 (M) and 9 (F) games of a summer season. Head kinematics of each impact (peak linear and angular accelerations of the head) were grouped as heading techniques or involuntary impacts. Heading techniques were sub-categorized as jump, stable, head rotation or unstable. Involuntary impacts were sub-categorized as player-to-player contact, ball control (feet or chest), running (acceleration or deceleration), change-of-direction, ground impact, unstable or involuntary head-to-ball impact. Head kinematics were subjected to standard descriptive statistics. Wilcoxon signed-rank test was used to compare heading techniques and involuntary impacts kinematic. **RESULTS:** In total 239 head impacts were registered for M and 139 for F. Heading techniques accounted for 92 impacts for M ($36g\pm15g$; 4175 ± 2517 rad/s²) and 97 for F ($33g\pm13g$; 3334

±1747 rad/s²). Involuntary impacts accounted for 147 impacts for M ($20g\pm9g$; 1934 ± 1511 rad/s²) and 42 for F ($21g\pm11g$; 2095 ± 1603 rad/s²). For M and F, the average peak linear and angular accelerations of the head caused by heading techniques were associated with higher values than involuntary impacts ($p<0.05$). For both M and F, the most frequent heading technique was the jump and player-to-player contact was the most frequent for involuntary impact. **CONCLUSION:** Preliminary results show that heading techniques can cause higher values of head accelerations than involuntary impacts and therefore, could cause a higher risk of head injury in two different populations of players.
 Grant funding: this study was funded using NSERC and FRQNT research grants.

D-43 Free Communication/Slide - Cognition and Emotion

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
 Room: CC-105A

- 1783** Chair: Walter Bixby, FACSM. Anne Arundel Community College, Arnold, MD.
 (No relevant relationships reported)

- 1784** May 30 3:45 PM - 4:00 PM
Executive Function Performance And Cortical Activation When Cycling On An Active Workstation In Young Adults
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 (No relevant relationships reported)

BACKGROUND: Previous studies suggested that exercise on an active workstation while working may be a promising intervention strategy for reducing sedentary time at workplace. The influence of active workstation on cognitive function are not well studied and the existing studies yielded mixed findings.

OBJECTIVE: To investigate the effects of cycling on an active workstation on executive function and cortical activation in young adults.

METHODS: In a cross-over study design, 35 young adults (mean age = 21.4 ± 2.6 years, 45.7% females) were randomly assigned the following two task conditions separated by 48 hours: performing cognitive tests while sitting (SIT) and performing cognitive tests while self-paced cycling on an active workstation (ACTIVE). Executive function was assessed by a task-switching paradigm and Stroop Color and Word Test (SCWT) programed using E-Prime 2 professional (Psychology Software Tools, Inc., Sharpsburg, PA, USA), respectively. Global switch costs, local switch costs and Stroop effects were derived and used as the behavioral outcomes of the two tasks. Cortical activation during the two conditions was monitored using a 38-channel fNIRS (NIRx Medical Technologies LLC, USA).

RESULTS: There were no significant differences on Stroop effects (136.25 ± 125.67 vs. 101.61 ± 137.10 , $p=0.19$) between SIT and ACTIVE conditions. The global switch costs (463.19 ± 206.86 vs. 452.77 ± 167.05 , $p=0.73$) and local switch costs (-6.14 ± 147.22 vs. 9.97 ± 156.08 , $p=0.70$) also did not differ. For the fNIRS results, ACTIVE condition led to greater cortical activity in left-dorsolateral prefrontal cortex (left-DLPFC) related to Stroop effects (0.88 ± 17.75 vs. 13.85 ± 19.44 a.u., $p=0.02$). For the task switch test, there were no significant differences in cortical activation between SIT and ACTIVE conditions.

CONCLUSION: The results suggests that the performances on Stroop task and task-switching were not impaired by self-paced cycling on a workstation. Importantly, cycling led to greater recruitment of sub-region of prefrontal cortex indicated by a greater cortical activation related to Stroop effects in the left-DLPFC.

1785 May 30 4:00 PM - 4:15 PM

Physical Exercise, APOE E4 Genotype And Cognitive Trajectories: The Mayo Clinic Study Of Aging

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(No relevant relationships reported)

PURPOSE: To investigate whether physical exercise (PE) is differentially associated with global and domain-specific cognitive trajectories (memory, language, visuospatial skills, attention) among Apolipoprotein E (APOE) ε4 carriers and non-carriers.

METHODS: We included 2,060 community-dwelling individuals aged 70 years and older (50.5% males, 26.6% APOE ε4 carriers). Participants were cognitively unimpaired at baseline, and underwent serial cognitive testing and self-reported assessment of PE engagement in midlife (between 50-65 years of age) and late-life (within one year prior to assessment). We calculated linear mixed-effect models comparing three PE groups (light intensity such as leisurely walking or slowly dancing; at least moderate intensity such as hiking or swimming; at least vigorous intensity such as jogging or tennis singles) versus a none PE reference group (defined as each level of PE carried out less than once per week). Models were adjusted for age, sex, education and medical comorbidities, and run separately for mid- and late-life PE.

RESULTS: Among APOE ε4 non-carriers, midlife light PE was associated with less decline in memory (time x PE interaction coefficient 0.044, $p = 0.01$); midlife vigorous PE was associated with less decline in memory (0.033, $p = 0.05$); and late-life vigorous PE was associated with less decline in visuospatial skills (0.025, $p = 0.03$) and global cognition (0.034, $p = 0.03$). Among APOE ε4 carriers, late-life vigorous PE was associated with less decline in memory (0.067, $p = 0.03$), attention (0.083, $p = 0.01$) and global cognition (0.073, $p = 0.02$); and late-life moderate PE was associated with less decline in global cognition (0.048, $p = 0.05$).

CONCLUSIONS: Engaging in PE (light, moderate and vigorous) is associated with less decline in memory, attention, visuospatial skills and global cognition among community-dwelling older individuals, including those that are APOE ε4 genotype carriers who are at an increased risk of Alzheimer's disease.

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Effects of Acute High Intensity Interval Training on Information Processing Speed: An Electromyography Study

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(No relevant relationships reported)

Steady-state aerobic exercise has been shown to improve information processing speed. However, the effects of high intensity interval training (HIIT) on information processing speed using surface electromyography (sEMG) is limited. **PURPOSE:** The purpose of this study was to compare the effects of a single session of either aerobic HIIT (HIIT-A) or aerobic/resistance HIIT (HIIT-AR) to a resting control group on information processing speed. **METHODS:** Participants (N=57, mAge = 23.1) provided consent and were randomly assigned into the HIIT-A (n=20), HIIT-AR (n=18), or the control group (n=19). Information processing was assessed via a reaction time (RT) task using a serial response box, integrated with a Biopac MP100 system allowing for measurement of sEMG. The sEMG signals of the agonist synced with RT were temporally partitioned to assess central (premotor time (PMT)) and peripheral processing (motor time (MT)). A 3 (HIIT-A, HIIT-AR, & controlled) x 2 (pre-test & post-test) ANCOVA was performed for RT, PMT, and MT. **RESULTS:** For regular foreperiods (consistent time), the interaction between group and time for RT and MT was not significant ($p > .05$). There was a significant interaction between group and time for PMT, $F(2, 51) = 4.194$, $p = .021$, partial $\eta^2 = .141$. This interaction was likely due to a simple main effect of time (pre to post) and not group allocation. For irregular foreperiods (variable time), the interaction between group and time for RT ($F(2, 51) = 4.543$, $p = .015$, partial $\eta^2 = .151$) and PMT ($F(2, 51) = 3.219$, $p = .048$, partial $\eta^2 = .112$) was significant while the interaction for MT was not ($p > .05$). For RT, there was a significant simple main effect of group, $F(2, 53) = 7.271$, $p = .002$, partial $\eta^2 = .215$. Post hoc analyses revealed that both exercise groups had significantly faster RTs than the control group ($p < .01$). Additionally, for PMT, there was a significant simple main effect of group ($F(2, 53) = 4.275$, $p = .019$, partial $\eta^2 = .139$).

Post hoc analyses revealed that both exercise groups had significantly faster PMTs than the control group ($p < .01$). **CONCLUSION:** Improved RT appeared to be a result of reduced central processing rather than a significant change in peripheral processing. This study demonstrated that acute HIIT-A and HIIT-AR can significantly improve information processing speed in young adults.

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The Effects of Acute Bout of Aerobic Exercise on Cognitive Function in Older Adults

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Abstract: Age-related cognitive decline affects several aspects of cognitive performance, including processing speed, inhibition, executive function, and visual scanning. Aerobic exercise is a potential solution to mitigate age-related cognitive decline. Furthermore, older adults are more susceptible to benefits from the effects of both chronic and acute aerobic exercise compared to younger adults. **PURPOSE:** To determine the associations of life-long aerobic exercise as well as the effects of acute aerobic exercise on cognitive function among healthy older adults (65 - 84 years old). **METHODS:** Model-based cluster analyses were conducted based on parameters of the participant's cardiovascular health: (1) age; (2) VO₂max; (3) Carotid Augmentation Index; (4) Carotid-femoral pulse wave velocity (cfPWV); (5) Aortic systolic blood pressure (SBP); (6) Carotid intima-media thickness (IMT). A cross-sectional design was utilized to compare 27 active (A) with 31 inactive (I) older adults (70±5yrs). Cognitive function was measured at rest and after 15 minutes of moderate intensity exercise (55-65% HRR) via the trail-making test (TMT Form A and Form B). A series of one-way ANOVAs were performed on dependent variables. A repeated measures MANOVA was used to test differences on the TMT-A and TMT-B at rest compared to after an acute bout of exercise. Pearson's correlation analysis tested the associations among VO₂max, age, carotid IMT, cfPWV, and cognitive performance. **RESULTS:** VO₂max was not related to carotid IMT ($r = .15$, $p = .27$) or cfPWV ($r = -.12$, $p = .38$). Time to complete TMT-A (26 ± 1 vs 23 ± 1 seconds, $F(1,57) = 15.12$, $p < .001$) and TMT-B (57 ± 2 vs 53 ± 2 , $F(1,57) = 7.20$, $p < .01$) increased after an acute bout of exercise compared to at rest. VO₂max ($r = -.16$, $p = .23$), carotid IMT ($r = .17$, $p = .21$), and cfPWV ($r = .15$, $p = .26$) were not significantly correlated with cognitive performance on the TMT-A and TMT-B. Age was correlated with cognitive performance on the TMT-A and TMT-B ($r = .60$, $p < .01$). **CONCLUSION:** An acute bout of aerobic exercise may diminish cognitive performance among healthy older adults.

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Effects of Duration and Intensity of Aerobic Exercise on Cognitive Performance in Trained Individuals

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PURPOSE: This study explored the effect of acute aerobic exercise on cognitive performance in trained cyclists/triathletes. Specifically, it investigated the impact of different exercise durations (completed at a fixed moderate-intensity) and high/maximal intensity exercise (H/MIE) to volitional exhaustion (following a sustained bout of dehydrating activity) on simple and complex cognitive skills.

METHODS: On two separate occasions, 21 trained cyclists/triathletes; 11 male (M) (age: 31±8 y; VO₂max: 57±9 mL·kg⁻¹·min⁻¹) and 10 female (F) (34±7 y; VO₂max: 51±9 mL·kg⁻¹·min⁻¹), completed 45 min of fixed-intensity cycling (M: 80±8%; F: 74±5% HR_{max}) followed immediately by an incremental test to volitional exhaustion. Cognitive function was assessed at Baseline, after 15 and 45 min of exercise (15EX; 45EX), and at Exhaustion using a 4-choice reaction time (CRT) and Stroop Word-Color Association test (Incongruent/Congruent Reaction Time [RT]). A placebo treatment ("to improve cognition") was administered after 15EX on one trial to determine if positive expectancy influenced cognitive responses.

RESULTS: *Exercise Duration:* CRT, Congruent RT and Incongruent RT decreased (improved) at 15EX and 45EX compared to Baseline ($p < 0.005$). While CRT and Congruent RT were faster at 45EX than 15EX ($p < 0.020$), Incongruent RT was not ($p = 1.000$). *Exercise Intensity:* The incremental test lasted 11.4±2.8 min, with participants achieving a maximum heart rate (HR) equal to 93±7% HR_{max}. CRT, Congruent RT and Incongruent RT decreased at Exhaustion compared to Baseline, ($p < 0.005$), despite large fluid losses (M: -2.3±0.3% BM; F: -1.7±0.3% BM). The placebo treatment did not affect cognitive responses to H/MIE ($p > 0.05$).

CONCLUSIONS: Acute aerobic exercise improves cognitive performance in trained athletes. These effects are more pronounced when exercising for longer durations (~1hr), employing higher exercise intensities and/or more complex cognitive tasks.

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Accelerometer-Measured Sustained MVPA Is Related To Higher Decision-Making Competence Among Young Adults

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More competent decision makers report greater success in avoiding negative decision outcomes irrespective of general cognitive ability. While physically active young adults show more optimal executive functions, the relationship between daily moderate-to-vigorous physical activity (MVPA) patterns and decision-making competence (DMC) remains under-examined. **PURPOSE:** In this study, we assessed the relationship between accelerometer-measured sporadic and sustained MVPA to DMC in young adults. **METHODS:** We analyzed pre-intervention data from 220 participants (115 (52%) females, $M_{age}=24.3 \pm 5.4$ yrs, $BMI=24.4 \pm 4.0$ kg/m²) from the INSIGHT randomized controlled trial. MVPA was measured over 7 days with a hip-worn wGT3X-BT accelerometer. Valid wear time was defined as ≥ 4 days, ≥ 10 hrs/d. Daily (min/d), bouts of sporadic (<10 consecutive min) and sustained MVPA (≥ 10 consecutive min; frequency and min/d) were estimated using NHANES cut points. DMC was measured with the Adult-Decision Making Competence (A-DMC) battery and expressed as individual subtest scores and an A-DMC index (z-score). The relationships between MVPA and A-DMC variables were assessed with Spearman's rho controlling for wear time, age, sex, education, intelligence, fat free VO_{2max} , BMI and sedentary time (ST; <100 counts/min). **RESULTS:** After controlling for daily MVPA, frequency and time spent in sustained MVPA bouts were positively related to the ability to recognize social norms ($\rho_s=[0.15; 0.16]$, $P_s \leq 0.04$) and ignore unrecoverable costs when considering future decision outcomes ($\rho_s=[0.14; 0.15]$, $P_s \leq 0.04$). In contrast, neither sporadic nor daily MVPA were related to A-DMC subtests ($P_s \leq 0.08$). **CONCLUSION:** The quality of decision making varied primarily as a function of sustained MVPA. Young adults who engaged in more sustained MVPA were able to use their experience more effectively and make more rational choices to optimize decision outcomes. Our data reveal a novel relationship between MVPA patterns and a distinct set of higher order cognitive skills which are relevant to real-world decisions. Funding: Office of the Director of National Intelligence (ODNI), Intelligence Advanced Research Projects Activity (IARPA); Contract 2014-13121700004

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Alterations in Exercise-Affect between Those With Higher and Lower Intensity Preference and Tolerance

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(No relevant relationships reported)

High-intensity exercise results in a more negative affective response when compared to moderate- or low-intensity exercise. However, a large number of individuals continue participating in high-intensity exercise, in spite of these declines in affective state. **PURPOSE:** Determine whether differences exist in exercise-affect for those with higher versus lower exercise intensity preference and/or tolerance. **METHODS:** Undergraduates ($n=245$, 20.3 ± 1.7 yrs, 23.7 ± 3.8 BMI, 60.8% female, 82% regular exercisers) completed the Preference for and Tolerance of Exercise Intensity Questionnaire [Higher-intensity exercise preference, tolerance (HIP, HIT) ≥ 24 ; $n=155$, $n=154$; lower-intensity preference, tolerance (LIP, LIT) <24 ; $n=45$, $n=51$] along with completing 15-minutes of a high-intensity circuit (HIC), a walk, and a reading condition. Affective valence (via Feeling Scale) was taken prior to, every 3-minutes during, and 20-minutes post (P20) condition, while activity enjoyment was assessed immediately post. **RESULTS:** Multivariate ANOVAs revealed significant differences ($P < 0.05$) for preference-intensity groups in valence during HIC at minutes 3 (HIP=2.4, LIP=1.4; $d=0.615$), 6 (HIP=2.5, LIP=1.1; $d=0.772$), 9 (HIP=2.5, LIP=1.2; $d=0.659$), 12 (HIP=2.3, LIP=0.9; $d=0.625$), 15 (HIP=2.4, LIP=0.9; $d=0.632$), and at P20 (HIP=3.1, LIP=2.0; $d=0.554$), and for enjoyment following HIC (HIP=95.6, LIP=85.3; $d=0.545$), but not for walking or reading conditions. For those with differing intensity-tolerance levels, differences ($P_s < 0.05$) in exercise-affect were only observed during minutes 3 (HIT=2.4, LIT=1.5; $d=0.535$) and 6 (HIT=2.3, LIT=1.7; $d=0.366$), and enjoyment differed following HIC (HIT=95.8, LIT=86.5; $d=0.492$). **CONCLUSIONS:** These findings suggest the intensity-preference trait influences how an individual feels

during exercise at high-intensity intensity, but is less important during moderate/lower intensities. These differences may be predictive of whether an individual will continue high-intensity exercise programming.

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Training Modulation using Heart Rate Variability Improves Daily Training Cognitions for High Intensity Functional Training

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Participants in group-based high intensity functional training (HIFT) maintain exercise enjoyment and intentions; those training ≥ 5 days/week report highest intrinsic and extrinsic motives. Yet, overtraining and overreaching concerns exist. A promising monitoring method is heart rate variability (HRV), which tracks cardiac autonomic nervous system activity. **PURPOSE:** To examine differences in daily training cognitions for HIFT participants. Participants with workouts modulated based on HRV status were expected to report significantly better daily training cognitions. **METHODS:** Participants included 55 healthy adults randomized to HIFT-HRV (intervention) or HIFT (comparison). HIFT-HRV participants ($n=26$) were 23.7 ± 4.5 years, 46% female, body fat percentage (BF%) = $27.3 \pm 9.8\%$, and $VO_{2max} = 44.4 \pm 6.4$ mL/kg/min. HIFT participants ($n=29$) were 34.1 ± 4.1 years, 58.6% female, BF% = $32.4 \pm 10.7\%$, and $VO_{2max} = 42.1 \pm 6.8$ mL/kg/min. The 11-week study included 2 weeks baseline waking HRV, baseline testing week, 3 HIFT weeks (5 sessions/week), mid-point testing week, 3 HIFT weeks (5 sessions/week), and post-intervention testing week. HRV was recorded daily via photoplethysmography using a smartphone app. Self-reported motivation to train and fatigue, during HIFT weeks, were collected prior to training with performance satisfaction (PS) and perceived effort (RPE) collected immediately following. The training-related cognitions were assessed using the Visual Analog Scale and RPE using Borg's (6-20) scale. **RESULTS:** No significant differences were found between groups at baseline. HIFT-HRV participants reported cognitions for 674 daily training sessions and HIFT participants reported cognitions for 763. Average motivation was significantly higher for the HIFT-HRV than the HIFT group, $t(1435) = 2.41$, $p = .016$. Average fatigue [$t(1361) = 3.22$, $p = .001$] and RPE [$t(1271) = 5.68$, $p < .001$] were significantly lower for the HIFT-HRV than the HIFT group. No significant differences were found for PS. **CONCLUSIONS:** HRV modulation during HIFT training resulted in greater daily motivation and lower daily fatigue and perceived exertion. HRV status is a promising method to monitor and modulate HIFT training and may facilitate adherence; future work could focus on applied interventions for existing HIFT populations.

D-44 Free Communication/Slide - Understanding the Health Effects of Sitting, Fitness, and Physical Activity

Thursday, May 30, 2019, 3:45 PM - 5:45 PM
Room: CC-202C

1792 **Chair:** Sarah Keadle. *California Polytechnic State University, San Luis Obispo, CA.*

(No relevant relationships reported)

1793 May 30 3:45 PM - 4:00 PM

Sedentary Behavior Across Pregnancy, Gestational Age at Delivery, and Birthweight

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(No relevant relationships reported)

PURPOSE: Lower gestational age at delivery (GAD) and large for gestational age birthweight (LGA) are indicators of poorer maternal-fetal health. While physical activity during pregnancy has been associated with greater GAD and lower risk of LGA, the effects of sedentary behavior (SB) on these outcomes are unknown. We aimed to describe patterns of SB across pregnancy and associations with GAD and risk for LGAMETHODS: In this cohort study, SB (activPAL micro3) and physical

activity (waist-worn ActiGraph GT3X-BT) were assessed in women for ≥ 4 days with ≥ 10 hours, in each trimester of pregnancy. This preliminary analysis (59% recruited) includes women with available birth records and valid activity data for ≥ 1 trimester ($n=56$). Birthweight (BW) and GAD were abstracted from medical records. BW was categorized as LGA if $\geq 90^{\text{th}}$ percentile ($n=18$, 31%). Mean (SD) percent time spent sedentary was calculated in each trimester and differences across trimesters were tested using linear mixed models. The association of SB with continuous GAD and odds of LGA were estimated in separate regression models for each trimester. All beta coefficients were standardized (std β) per SD and adjusted for pre-pregnancy body mass index. If SB was associated with outcomes, further models estimated the effect of replacing SB with light physical activity (LPA) or moderate to vigorous physical activity (MVPA). **RESULTS:** Women spent a high percentage of time sedentary across trimesters: 1st ($n=53$) 64.0% (10.9); 2nd ($n=50$) 63.5% (9.5); and 3rd ($n=47$) 63.8% (10.4). SB did not differ across trimesters ($p=0.792$). Higher percent time spent sedentary in the first trimester was associated with lower GAD (std $\beta=-0.45$, $p=0.038$). Replacing first trimester SB with LPA (std $\beta=0.48$, $p=0.037$), but not MVPA (std $\beta=-0.12$, $p=0.581$), was associated with greater GAD. SB was not significantly associated with GAD in the 2nd (std $\beta=-0.24$, $p=0.241$) or 3rd (std $\beta=-0.22$, $p=0.264$) trimester. Odds of LGA was not significantly associated with SB in the 1st (OR=0.75, $p=0.389$), 2nd (OR=0.80, $p=0.503$), or 3rd (OR=1.03, $p=0.932$) trimester. **CONCLUSIONS:** Women in this study were highly and consistently sedentary across pregnancy. Higher LPA and lower SB during the first trimester may be advantageous for greater GAD, though risk for LGA offspring did not appear to be associated with SB.

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Structured Exercise as a Potential Treatment Option for Prenatal Depression

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PURPOSE: Up to 20% of pregnant women experience prenatal depression and up to 19% will continue to have depressive symptoms in the postpartum. Previous research supports exercise during pregnancy as an effective way to prevent prenatal depression, however evidence is lacking regarding exercise as a potential treatment for women who enter pregnancy already at risk for depression. Therefore the purpose was to determine if exercise during pregnancy is an effective option to treat depression during pregnancy. **METHODS:** This is a secondary analysis of two randomized controlled trials that followed the same exercise protocol and study methodology in Madrid, Spain. Women <16 weeks pregnant were randomized to an exercise group (EG) or standard care control group (CG). The EG participated in group fitness classes three times per week. The classes included moderate intensity aerobics and resistance training in accordance to the American College of Obstetrics and Gynecology guidelines. All participants completed the Centre for Epidemiologic Studies Depression scale (CES-D) at baseline and at the end of the intervention (36-38 weeks gestation). Women who scored ≥ 16 on the CES-D at baseline (at risk for depression) were included in the current study. A One-Way ANOVA was performed to determine if there was a difference in post CES-D scores between the EG and CG. A Chi-Square Analysis was performed to determine if there was a difference between the two groups for the number of women who had a decrease in their score at the end of the intervention and also scored below 16 post-intervention. **Results:** Thirty-six women in the EG and 25 women in the CG scored ≥ 16 on the CES-D at baseline. Post-intervention, the EG had a significantly lower mean CES-D score (14.4 ± 8.6) than the CG (19.4 ± 11.1 ; $p<0.05$). Additionally, more women decreased their score in the EG ($n=30$, 83.3%) than the CG ($n=14$, 56%; $p<0.05$) however there was no difference in the number of women who went below the 16 point cut-off between the two groups. **CONCLUSION:** A structured exercise program offered during pregnancy may reduce depressive symptoms among women who begin pregnancy already at risk for prenatal depression. Therefore exercise may be a viable treatment option for prenatal depression.

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Effects Of Breaking-up Prolonged Sitting With Stair-climbing On Vascular-metabolic Function After A High-fat Meal

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Frequent high-fat meal intake and prolonged sedentary time are prevalent in our modern society and associated with increased risk of cardiovascular disease. Alternatively, breaking up prolonged sitting is introduces health benefits, although not always practical.

PURPOSE: To test whether stair-climbing could be an effective way of breaking up prolonged sitting. **METHODS:** Twelve healthy adults (male=7) participated in two trials after a high-fat meal: 1) 4-h uninterrupted sitting, 2) 4-h sitting interrupted with 5-min of stair-climbing every hour (interrupted sitting). We measured triglycerides, glucose, brachial artery flow-mediated dilation, popliteal artery blood flow and shear rate. All variables were measured five times (before and every hours after high-fat meal), except for brachial artery flow-mediated dilation, which was measured before and after 4-h sitting. **RESULTS:** The intensity of 5-min stair-climbing was 66% of heart rate reserve. High fat meal increased glucose and triglycerides concentrations, without any significant differences between trials. Brachial artery flow-mediated dilation decreased in sitting trial, but increased in the interrupted sitting trial (uninterrupted sitting: 9.2 ± 2.16 to 9.0 ± 3.23 , interrupted sitting with stair-climbing: 7.9 ± 2.55 to 10.3 ± 2.89 , $p=0.009$). Popliteal blood flow and shear rate were increased in the interrupted sitting trial with a significant interaction effect (blood flow: $p<0.001$, shear rate: $p=0.006$). Also, interrupted sitting attenuated the prolonged sitting-induced increase of systolic blood pressure and pulse pressure. **CONCLUSION:** Stair-climbing appears to be an effective way of breaking up prolonged sitting to improve vascular function with easy accessibility in various settings.

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Associations of Fast Walking with Sleep Quality and Duration in Older Adults

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(No relevant relationships reported)

Purpose: Poor sleep has been associated with negative health outcomes in older adults. Since walking is the most popular form of physical activity in older adults, we examined the effects of daily steps and fast walking on sleep quality and duration. **Methods:** This cross sectional study included 402 older adults (56% women; 72 years old). Participants wore an accelerometer-based pedometer (Omron) during waking hours for 7 days. We used total average daily steps and average daily fast walking steps defined as ≥ 100 steps/min. Sleep duration and quality were measured using the Pittsburgh Sleep Quality Index (PSQI). Poor sleep quality (PSQ) was defined as a PSQI global score of >5 , and inadequate sleep duration (ISD) was defined as <7 hours/night. Odds ratios (ORs) and 95% confidence intervals (CIs) for PSQ and ISD were calculated among 4 groups: no daily fast steps and tertiles (thirds) of fast steps. Covariates were sex, age, body mass index, smoking, heavy alcohol intake, depression, anxiety, diabetes, hypertension, hyperlipidemia, and sleep apnea. **Results:** On average, participants took 5,764 steps, 1,598 fast steps (70% had at least 1 daily fast step), had a PSQI score of 4.6, and a sleep duration of 7.1 hours. Total steps were not associated with quality or quantity (both $p>0.05$). However, fast walking was associated with sleep quality with ORs (95% CIs) of 0.47 (0.24-0.90), 0.53 (0.27-1.04), and 0.82 (0.35-1.92) for <940 (lower third), 941-2600 (middle third), and >2600 (upper third) of fast steps, respectively, compared with no fast steps, adjusting for the confounders including total daily steps. Obtaining any fast steps was associated with 0.52 (0.30-0.90) reduced odds of PSQ compared with no fast steps. However, no associations were observed between fast steps and ISD. In a joint analysis, compared with those who took $<5,000$ daily steps and 0 fast steps, there were reduced odds of PSQ among those with $<5,000$ steps and >1 fast steps (0.43 [0.23-0.83]) as well as those with $\geq 5,000$ steps and >1 fast steps (0.42 [0.24-0.74]), suggesting the benefits of fast walking on sleep quality regardless of total daily steps. **Conclusion:** These results indicate that even small amounts of fast walking, rather than total daily steps, are associated with better sleep quality in older adults. Supported by unrestricted research grant by Biospace.

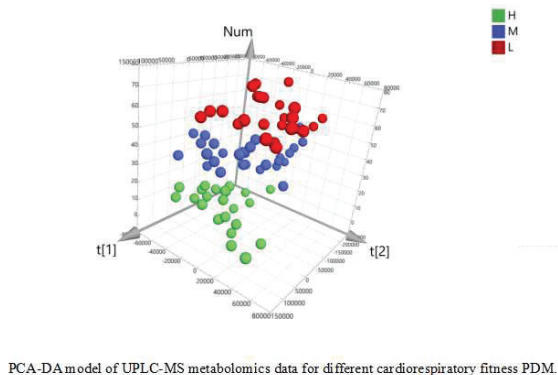
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Differences of Plasma Metabolites in Prediabetes with Different Cardiorespiratory Fitness and the Effects of Exercise

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(No relevant relationships reported)

PURPOSE: To identify the most significant plasma metabolites for higher and lower cardiorespiratory fitness (CRF) in pre-diabetes mellitus (PDM), and the effect of aerobic exercise training on these metabolites. **METHODS:** All 80 PDM subjects were selected [age: (51.62±10.03) yrs; body mass index: (26.17±3.60) kg/cm²; 24 males]. CRF was measured directly with a graded exercise test. Exercise intervention program: 3 times/week, 50 min per session at 46%-64% VO_{2max}, 3 month. Body composition was measured by dual-energy x-ray absorptiometry. Plasma metabolites were detected by ultra high performance liquid mass spectrometry (UPLC-MS), and analyzed by PCA and OPLS-DA. **RESULTS:** 1) Compared with lower CRF group, HOMA-IR, HOMA-β, LDL-C, BMI and Fat% of higher CRF group were lower, and the amount of low intensity activity was more. 2) There were different expressions of 7 metabolites in different CRF groups, including PC (20:1/14:1), PC(18:3/16:0), LysoPC(16:0), Valine, isocitric acid, Octyl carnitine and Linoleyl carnitine. 3) After 3-month exercise training, the fasting and OGTT-2h blood glucose of 61.11% of PDM subjects turned to normal; PDM subjects' VO_{2max} increased significantly (6.84%); but there was no significant correlation between the increase of VO_{2max} and 7 metabolites. **CONCLUSION:** PC, LysoPC, valine, isocitrate and acylcarnitine were different in different CRF groups, they may be potential biological markers of CRF. Exercise intervention improved the glucose metabolism and CRF of prediabetes mellitus, but we hadn't found the correlation between VO_{2max} increase and 7 metabolites expression change after exercise, which needs more study. Supported by Key Projects of State General Sports Administration of China (2014B007), the National Key Technology Research and Development Program of Prevention and Control of Major Chronic Non-communicable Diseases (2016YFC1300202)



1798 May 30 5:00 PM - 5:15 PM

Longitudinal Associations of Physical Activity and Blood Lipid Levels in Midlife Women in SWAN

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(No relevant relationships reported)

Decreasing levels of estrogen production, combined with the detrimental effects of aging, lead to large increases in cardiovascular disease (CVD) risk among midlife women. Physical activity has the potential to attenuate this increase in CVD risk; however, longitudinal associations of physical activity and blood lipid levels, important contributors to CVD, have not been studied in midlife women.

PURPOSE: To estimate the longitudinal associations of physical activity with blood lipid levels in midlife women.

METHODS: We used data from 3,230 participants in the Study of Women's Health Across the Nation (SWAN), a longitudinal cohort study spanning 14-17 years of nearly annual follow up. Women reported physical activity using the Kaiser Physical Activity

Survey at 7 study visits. We used the sports and exercise physical activity index score to estimate leisure-time moderate to vigorous intensity physical activity. SWAN measured total cholesterol, triglycerides, HDL, and LDL in blood collected at 8 study visits. We used generalized estimating equations to estimate longitudinal associations of moderate to vigorous intensity physical activity with each blood lipid biomarker, adjusted for age, race/ethnicity, education, and body mass index category.

RESULTS: Women were 46 years old, on average, at study entry. Forty-seven percent were non-Hispanic white; 28% were black; 9% were Japanese; 8% were Chinese, and 8% were Hispanic. Each additional one-unit increase in the sports and exercise physical activity index score was associated with an average 1.9 mg/dl lower triglyceride level (95% CI: -3.5, -0.2) and 0.6 mg/dl greater HDL level (95% CI: 0.4, 0.9). The sports and exercise physical activity index score was not associated with total cholesterol (mean difference=0.3; 95% CI: -0.4, 1.0) or LDL (mean difference=-0.2; 95% CI: -0.8, 0.4).

CONCLUSIONS: Moderate to vigorous physical activity is longitudinally associated with lower triglyceride levels and higher HDL levels in midlife women.

Supported by NIH grants T32DK11668401, U01NR004061, U01AG012505, U01AG012535, U01AG012531, U01AG012539, U01AG012546, U01AG012553, U01AG012554, U01AG012495. The content of this abstract is solely the responsibility of the authors and does not necessarily represent the official views of the NIA, NINR, ORWH or the NIH.

1799 May 30 5:15 PM - 5:30 PM

Who Is The Reference Group? An Examination Of The Involuntarily Inactive And Mortality

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(No relevant relationships reported)

PURPOSE: Physical activity studies often use inactive participants as a reference comparison group implying that all inactive participants can become more active. However, it remains unclear how much of this group is involuntarily inactive due to physical function limitations. This study aims to examine the involuntarily inactive and the association with mortality among older adults. **METHODS:** Study participants were from the National Health and Nutrition Examination Survey (NHANES), a population-based study with mortality follow-up through 2011. Participants were 60+ years old and wore the accelerometer for 4+ days (N = 2415). Moderate-to-vigorous physical activity (MVPA) was derived using standard accelerometer cutpoints and categorized based on the US Federal Physical Activity Guidelines: 1) <15 minutes (inactive); 2) 15—37.5 minutes; 3) 37.5-150 minutes; 4) ≥150 minutes per week (recommended). Participants self-reported limitations in walking, activities of daily living, and carrying objects and were classified as 1) no impairment, 2) some impairment, or 3) most impaired. To compare mortality rates, we calculated hazard ratios (95% confidence intervals), adjusting for relevant covariates. **RESULTS:** Over an average of 74.1 (SD = 23.8) months of follow-up, there were 572 deaths. Of the inactive participants (n = 719), 24.8% reported no impairment, 34.6% some impairment, and 40.6% were most impaired. There was no significant mortality rate difference between the inactive group and those participating in 15 to 37.5 minutes per week of MVPA in any of the function groups. Among those with no or some impairment, there was a significant decrease (39 to 62%) in premature mortality among those with at least 37.5 minutes per week of MVPA. Among those with the most impairment, a mortality rate reduction of 85% (HR = 0.15 (95% CI: 0.06, 0.35)) was observed among those with 37.5 – 150 minutes of MVPA, but no significant difference among those meeting the guidelines (HR = 0.72 (95% CI: 0.31, 1.67)), compared to the inactive group. **CONCLUSIONS:** Inactive referent groups may contain a disproportionate number of participants with physical limitations, however even among those with some or most impairment, greater levels of physical activity are associated with similar or greater mortality benefits.

1800 May 30 5:30 PM - 5:45 PM

The Use Of Resistance Exercises To Interrupt Sitting: Acceptability And Impact On Sleepiness, Discomfort, And Fatigue

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(No relevant relationships reported)

Emerging research suggests cardiometabolic benefit from using simple resistance exercises to interrupt prolonged sitting, yet it is unclear if such programming is acceptable and can affect discomfort, fatigue, and sleepiness. **Purpose:** To examine the acceptability of hourly, brief resistance exercise bouts and the effects on subjective

ratings of discomfort, sleepiness, and fatigue. **Methods:** Fourteen adults (age 53.4 ± 9.5 years, BMI 30.9 ± 4.8 kg/m²) completed two 4-hour randomized simulated laboratory-based work conditions on separate days: prolonged sitting (SIT) and sitting with hourly resistance exercise breaks (REX). Acceptability was assessed after REX in 5 domains: 1) willingness to use REX, 2) confidence to use REX unsupervised, 3) co-worker acceptance of REX, 4) employer acceptance of REX, and 5) Feasibility of frequency and Amount of REX. During each 4-hr protocol, ratings of sleepiness (Karolinska Sleepiness Scale), discomfort, and fatigue (Physical Discomfort and Fatigue Questionnaire) were assessed at baseline and then hourly. Linear mixed models evaluated overall condition effects and differences at each hour following Bonferroni adjustment. Cohen's d estimated magnitude of effects. **Results:** A majority of participants reported high to very high acceptability on the 5 domains of REX (Table). Overall physical discomfort ($\beta = -0.15$ log-points, $p = 0.074$, $d = 0.34$), mental fatigue ($\beta = -0.23$ log-points, $p = 0.116$, $d = 0.18$), physical fatigue ($\beta = -0.30$ $p = 0.056$, $d = 0.20$), and sleepiness ($\beta = -0.33$ log-points, $p = 0.106$, $d = 0.14$) did not differ by condition. Mental fatigue was significantly lower (better) at 4 hours in favor of REX ($\beta = -0.48$ log-points, $p = 0.020$, $d = 0.37$). **Conclusion:** Hourly simple resistance breaks were rated as an acceptable method to interrupt prolonged sitting during work; however, REX did not improve discomfort, fatigue, or sleepiness compared to SIT. Investigating adaptations and acceptability with chronic usage are warranted.

Table. Acceptability of Simple Resistance Exercise Breaks to Interrupt Sedentary Behavior

Acceptability Questionnaire	Frequency	Percentage
Question 1: Willingness to Use REX		
Very low or Low	0	0%
Neither low or high	2	14.2%
High or Very high	12	85.8%
Question 2: Confidence to Use REX Unsupervised		
Very low or Low	0	0%
Neither low or high	0	0%
High or Very high	14	100%
Question 3: Coworker's Acceptance of REX		
Very low or Low	1	7.2%
Neither low or high	3	21.4%
High or Very high	10	71.4%
Question 4: Supervisor's Acceptance of REX		
Very low or Low	1	7.2%
Neither low or high	5	35.7%
High or Very high	8	57.1%
Question 5: Feasibility of Frequency and Amount of REX		
Very low or Low	3	21.4%
Neither low or high	2	14.3%
High or Very high	9	64.3%

D-45 Clinical Case Slide - Chest Pain and Medical Issues

Thursday, May 30, 2019, 3:45 PM - 5:25 PM
Room: CC-304E

1801 Chair: Poonam P. Thaker, FACS. *Presence Resurrection Sports Medicine Fellowship, Chicago, IL.*

(No relevant relationships reported)

1802 Discussant
Philip F. Skiba. *Advocate Lutheran General Hospital, Park Ridge, IL.*

(No relevant relationships reported)

1804 May 30 3:45 PM - 4:05 PM
Chest Injury - Horseback Riding
Philipp J. Underwood, Bryan M. McCarty, Hillary Moss. *North Shore University Hospital, Manhasset, NY.*
(No relevant relationships reported)

Chest Injury - Horseback Riding

Philipp J. Underwood, Bryan M. McCarty, Hillary Moss, North Shore University Hospital, Manhasset, NY

HISTORY: A 56 year old female fell off of her horse, causing her to land on her right shoulder. She experience immediate severe pain in her right shoulder and chest. She denied any head, neck or spine injury or pain, and denied numbness, weakness, paresthesia or headache. She reported no shortness of breath, abdominal pain or extremity injury or pain.

PHYSICAL EXAMINATION: The patient reported pain of 10/10 on arrival and had an elevated blood pressure. Other vital signs were normal. Primary survey was

unremarkable. On secondary survey, head, neck and spine were normal. Ribs and abdomen were also normal. Examination of upper extremity revealed deformity of the right shoulder girdle with tenderness and swelling over the proximal right clavicle. The neuro-vascular exam of the upper extremities were normal and symmetrical. She was not able to move the right shoulder due to severe pain. The lower extremities were normal. Neurological examination was normal as was examination of the skin.

DIFFERENTIAL DIAGNOSIS:

1. Clavicle fracture
2. Sterno-clavicular (SC) dislocation
3. Rib fracture
4. Pectoralis muscle tear

TESTS AND RESULTS:

Chest Xray, Clavicle Xray, Shoulder Xray - fracture medial right clavicle and possible dislocation of SC joint

CT of Head and Cervical spine - unremarkable and without acute injury

CT of Abdomen and Pelvis - unremarkable and without acute injury

CT of Chest - fracture and posterior dislocation of the right SC joint with compression of the brachiocephalic artery and vein

FINAL/WORKING DIAGNOSIS:

Fracture and posterior dislocation of the right SC joint with compression of the brachiocephalic artery and vein

TREATMENT AND OUTCOMES:

1. Evaluation by Trauma Surgery, Cardio-Thoracic Surgery with admission to Orthopedics for operative repair
2. Taken to OR and under general anesthesia and fluoroscopic visualization, reduction of SC dislocation
3. Reduction was unstable and ORIF performed with trans-osseous sutures and reconstruction of capsule
4. Discharged next day on Xarelto for 8 weeks and no weight bearing of right upper extremity
5. Physical therapy for 8 weeks begun 2 weeks post op.
6. Patient has returned to riding and experiences only minimal stiffness at right SC joint

1805 May 30 4:05 PM - 4:25 PM

Extremity Paralysis After Boot Camp Workout

Kulraj S. Dhah¹, Roger Mortimer², Robert Sallis, FACS¹.

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(No relevant relationships reported)

HISTORY: 37 y/o African American female with history of anemia presented to ED with severe abdominal pain, tachycardia and rapidly progressive bilateral upper and lower extremity paralysis. She reported recently starting Boot Camp style workouts with the last session two days prior to first admission. Patient admitted to using diet pills and intermittent fasting. She was admitted for 3 weeks initially and readmitted four days after being discharged with recurrence of symptoms.

PHYSICAL EXAMINATION: Vitals were within normal range. Normal respiratory effort but only able to speak 3-4 words per breath. Diffuse abdominal tenderness. Paralysis of upper and lower extremities bilaterally with minimal motor function of fingers and toes, full sensation intact, CN 2-12 intact, DTRs +2.

DIFFERENTIAL DIAGNOSIS: 1. Guillain-Barre Syndrome 2. Rhabdomyolysis 3. Amyotrophic Lateral Sclerosis (ALS) 4. Porphyria 5. Progressive Peripheral Neuropathy

TEST AND RESULTS: MRI Head and Spine negative for lesions, nerve root compression or myelopathy. Creatine Kinase levels were mildly elevated. CT Abdomen/Pelvis was negative. CSF analysis and EMG testing suggested variant of Guillain-Barre Syndrome. Negative Inspiratory Force (NIF) testing remained within normal limits. No improvement with IVIG. Labs that were sent out during first admission came back during her second admission (4 weeks later) with dramatically elevated Urine porphobilinogens at 1529 mg/L (ref: <2mg/L). Stool porphobilinogens were also elevated.

FINAL WORKING DIAGNOSIS: Variegate Porphyria

TREATMENT AND OUTCOMES: The patient was started on high volume D10 IV (125ml/hr) for 2 days until IV Hemin was obtained from the only lab in the US that manufactures it. The patient showed mild improvement in motor function within one hour of starting IV Hemin drip. She required a full 7 day course of IV Hemin with gradual increase in motor function but not back to baseline. She underwent a second course of IV Hemin with further improvement in motor function. NGT was replaced by PEG tube for adequate nutrition. Four weeks later, she was discharged from Medicine Service to Acute Inpatient Rehab floor. She continued to improve and was able to return to oral diet and perform ADLs with assistance from family. She was discharged home after two months and moved out of town to live with family.

1806 May 30 4:25 PM - 4:45 PM

Muscle Weakness: Boxing

Belmarie Rodriguez-Santiago, David Atkins, Brenda Deliz-Roldan, William Micheo, FACSM. *University of Puerto Rico, San Juan, Puerto Rico.*

(No relevant relationships reported)

History: A 50-year-old right-handed retired male boxer with no past medical history presented progressive weakness and muscle wasting of bilateral upper extremities. He denied any numbness, tingling or paresthesia, bowel or bladder incontinence, lower extremity weakness or dysphagia. Three weeks before symptoms started, he suffered a fall with impact in the forehead. The patient has a 17-year history of boxing career with a total of 250 combats.

Physical Examination: Generalized muscle atrophy and fasciculations observed in bilateral upper extremities. Full passive range of motion in bilateral upper extremities but limited active shoulder flexion and abduction and incomplete handgrip bilaterally. Strength was 2/5 in shoulder abduction, 3/5 in elbow flexion and extension, and in right wrist flexion and 0/5 in wrist extension. Sensation was intact to pinprick, soft touch and vibration. Deep tendon reflexes 1+ throughout upper and lower extremities.

Differential Diagnosis:

1. Cervical Polyradiculopathy
2. Central Cord Syndrome
3. Motor Neuron Disease: Brachial Amyotrophic Diplegia
4. Chronic Traumatic Encephalopathy

Tests and Results:

Cervical Spine MRI: Multilevel degenerative disc disease. Anterior cervical cord compression at C3-C4 and less prominent at C5-C6 without myelomalacia. No neural foraminal stenosis.

Electrodiagnostic Study: Normal sensory nerve conduction study (NCS). Motor NCS showed low amplitude in the right Median and Ulnar nerves. Electromyographic study revealed active denervation and reinnervation potentials in bilateral upper extremities. Fibrillation and positive sharp waves were observed in cervical and thoracic paraspinal muscles.

Brain MRI: Mild cerebral cortical atrophy. No other intracranial abnormality.

Final Working Diagnosis:

-Motor Neuron Disease: Brachial Amyotrophic Diplegia.

Treatment and Outcomes:

1. Physical therapy for light strengthening and aerobic training.
2. Occupational therapy for assistive device and activities of daily living evaluation and training.
3. Referred to Neuromuscular Clinics for multidisciplinary management.
4. Started in Riluzole.
5. Referred to Speech and Swallow evaluation.
6. Followed up every 3 months to monitor neurological symptoms and remained stable with no signs of neurological deterioration.

1807 May 30 4:45 PM - 5:05 PM

Syncopal On The Green - Golf

Noor Alzarka, Mark Chassay, FACSM. *University of Texas Health Science Center at Houston, Houston, TX.*

(No relevant relationships reported)

HISTORY: 22-year-old female collegiate Division I golfer presents with intermittent dizziness, palpitations, and pre-syncope symptoms. She reports a history of syncope as well. She also describes episodes of palpitations or subjective tachycardia at rest and in association with exertion. Symptoms worsen during strenuous weight training exercises. She does not use any prescription medications, supplements, or recreational drugs. Her father has a history of a cardiac arrhythmia and cardiac arrest. She seeks a cardiology referral for diagnostic evaluation.

PHYSICAL EXAMINATION: BP 122/80, HR 91, RR 16, SpO2 99%, BMI 30.5.

Well-appearing female. Unlabored respirations, lungs clear to auscultation bilaterally. Regular heart rate and rhythm, non-displaced PMI, without murmurs. Normal pulses in all extremities. Steady station and gait.

DIFFERENTIAL DIAGNOSIS: Reflex syncope. Arrhythmia. Structural cardiopulmonary disease. Dehydration. Orthostatic hypotension. Drug reaction. Dysautonomia. Seizure.

TEST AND RESULTS: EKG: normal sinus rhythm.

7-day Holter monitor: Average HR 93 BPM. No ventricular or supraventricular ectopics noted.

Tilt Table Test: Passive phase is non-diagnostic. Drug provocation phase with nitroglycerin challenge is positive for syncope, a HR decrease from 136 to 40, and then sinus arrest with a 6.1 second pause while blood pressure remains stable.

FINAL WORKING DIAGNOSIS: Vasovagal syncope with sinus arrest consistent with cardio-inhibitory component.

TREATMENT AND OUTCOMES: 1. The cardiac electrophysiologist cleared her for participation in golf and to work out with activity modifications in order to moderate her physical workload and avoid excessive strain that might trigger vasovagal syncope.

2. She was advised to self-monitor for pre-syncope symptoms; to modify activities as needed, including using lighter weights, taking more breaks, and lying down to recover when needed; and to avoid pushing through symptomatic episodes.
3. The cardiac electrophysiologist also recommended optimizing hydration, including increased salt and electrolyte intake.
4. She was counseled about the possibility of serious injury resulting from syncope.

1808 May 30 5:05 PM - 5:25 PM

Assisted Breathing Manual Therapy for Soccer Chest-Trap Anterior Chest Wall Injury

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(No relevant relationships reported)

Chest wall injury—Soccer

John C. Hannon, private practice, San Luis Obispo, CA

HISTORY: A 17-year-old high school senior soccer left back, during the last quarter of a late-season game, chest-trapped a long and hard soccer ball experiencing instant breathlessness and incapacitating anterior chest pain aggravated by deep breathing, head, spine and arm movement. At the ED, she experienced less intense symptoms. Later, she, and her parents, worried her continued chest pain (which increased with exertion, coughing, and difficulty breathing when running) would ruin her chances to be seen favorably by college soccer scouts. The next day she presented for manual therapy.

PHYSICAL EXAMINATION: Examination revealed a mild pectus excavatum with bilaterally painful 2nd and 3rd sterno-chondral joints and diminished respiratory excursion, accessory breathing muscle activity and elevated shoulders. Muscle splinting interfered with overhead reaching and spinal twisting. Interestingly, marked pain relief occurred with manual skin stretch tangentially applied in the left midaxillary line along the path of the 5th rib with the stretch directed posterior-to-anterior. Similar relief was obtained by firm pressure over the left costal diaphragm muscle attachments. Pain-free palpation of spinal, costo-chondral and costo-vertebral joints. SC, AC and GH joint-play intact.

DIFFERENTIAL DIAGNOSIS: 1. Fracture 2. Sprain/strain 3. Infection 4. Primary tumor 5. Tietze's syndrome 6. Costochondritis 7. Myofascial trigger points 8. Panic disorder 9. Exercise-induced asthma 10. Cardiovascular, gastrointestinal disease 11. Fibromyalgia 12. Seronegative spondyloarthropathies

TEST AND RESULTS: Normal AP and Lateral chest-xray

FINAL WORKING DIAGNOSIS: Sternocostal sprain-Diaphragm strain

TREATMENT AND OUTCOMES: 1. Tangential skin stretch resolved the breathing distress and relieved most of the chest pain. 2. Manually patterned breathing allowed pain-free but apprehensive ROM spinal twisting and arm overhead reaching. 3. Reassurance, explanation of the mechanics of injury, breathing exercises.

4. Symptom-free return to play 5 day post-injury. 1 month later, accepted 4-year athletic scholarship.

D-46 Clinical Case Slide - Knee II

Thursday, May 30, 2019, 3:45 PM - 5:25 PM
Room: CC-105B

1809 Chair: Matthew R. Gammons. *VT Ortho Clinic/Killington Medical Center, Rutland, VT.*

(No relevant relationships reported)

1810 Discussant

Mary Lloyd Ireland, FACSM. *University of Kentucky, Lexington, KY.*

(No relevant relationships reported)

1811 Discussant

Pierre L. Viviers, FACSM. *Stellenbosch University, Stellenbosch, South Africa.*

(No relevant relationships reported)

1812 May 30 3:45 PM - 4:05 PM

Knee Pain and Effusion in a Medically Complex Patient

Aubrey Armento. *University of Colorado Denver, Denver, CO.*
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(No relevant relationships reported)

HISTORY: An 8-year old female presents with a chief complaint of left knee pain and swelling. The pain started one month ago with no acute inciting injury. The pain is located over the anterior knee and is exacerbated with running and bike riding and alleviated with rest and ice. The knee swelling worsens after activity. She has no warmth or erythema of the joint. She denies fever, rash, or other joint complaints. The patient has a history of isolated Langerhans cell histiocytosis of the pituitary stalk and diabetes insipidus, which was diagnosed a year ago. She takes an oral steroid burst and receives vinblastine for chemotherapy every three weeks.

PHYSICAL EXAMINATION: There is a palpable joint effusion of the knee without erythema or warmth. There is diffuse peripatellar tenderness to palpation. She has limited knee flexion to 110 degrees but full extension. Patellar grind test is negative. There is no patellar apprehension. The Lachman test, anterior and posterior drawer tests, varus and valgus stress testing, and McMurray's test are all negative.

DIFFERENTIAL DIAGNOSIS:

1. Musculoskeletal lesion of Langerhans cell histiocytosis
2. Osteochondritis dissecans of the knee
3. Septic arthritis of the knee in an immunocompromised patient
4. New-onset juvenile idiopathic arthritis (JIA)

TESTS AND RESULTS:

- X-rays of the knee showed no acute bony abnormality.
- MRI of the left knee with and without contrast revealed a large joint effusion with enhancing synovitis but otherwise no abnormality.
- Labs including a complete blood count (CBC), erythrocyte sedimentation rate (ESR), and C-reactive protein (CRP) were within normal limits other than the a slightly elevated CRP.

-The patient had an ophthalmologic evaluation and was diagnosed with right anterior uveitis, so she was referred to Rheumatology.

-Knee joint aspiration was performed, with synovial fluid analysis consistent with an inflammatory arthritis. Cultures had no growth.

FINAL/WORKING DIAGNOSIS: Juvenile idiopathic arthritis

TREATMENT AND OUTCOMES: The patient underwent a steroid injection of the left knee. Hopefully, her arthritis can be managed with naproxen and intermittent steroid injections. If not, further discussion must be had between Rheumatology and the Oncology teams about the risk and benefits of disease modifying anti-rheumatic drugs (DMARDs).

1813 May 30 4:05 PM - 4:25 PM

Knee Pain - Swimming in Dangerous Waters

Lauren Nadkarni¹, Kate Quinn². ¹Maine Medical Center, Portland, ME. ²Maine Medical Partners, Portland, ME.
(Sponsor: Heather Gillespie, FACSM)

(No relevant relationships reported)

Authors: Lauren Nadkarni, MD and Kate Quinn, DO (sponsored by Heather Gillespie, MD, MPH, FACSM)

History:

A 17-year-old male with a non-contributory past medical history developed acute pain in his left knee while swimming 3 days prior to presentation. He experienced a popping sensation with hyperextension of his knee while treading water and throwing a rope swing to his friends on the bank of a river. He had immediate swelling and felt pressure on the lateral and posterior parts of his knee, associated with sharp and stabbing pain when straightening his knee. His pain was worse with flexion beyond 90 degrees, straightening his leg, or walking, but was improved with rest and ice. He did not have any give-way or locking episodes.

Physical Exam:

Office examination of his left knee was limited by guarding but demonstrated a very subtle posterior sag sign and a positive effusion. There were no overlying skin changes. His range of motion was 5 degrees of hyperextension to 110 degrees flexion actively his flexion increased to 120 degrees passively. He also had mild posterior lateral joint line tenderness, negative patellar testing, and positive posterior drawer and lateral flexion pinch testing. His anterior drawer testing was negative, although he did exhibit guarding. His contralateral knee, ipsilateral hip/ankle, and neurovascular exams were unremarkable.

Differential diagnosis:

- PCL injury
- ACL injury
- Lateral meniscus injury
- Posterior lateral corner injury
- Patellar subluxation
- Lateral tibial plateau contusion or fracture
- Lateral femur contusion or fracture

Tests and results:Left knee x-ray:

- Normal anatomy with small effusion
- No acute fracture

Left knee MRI:

- Isolated PCL rupture

Final/working diagnosis:

- Isolated PCL rupture

Treatment and Outcomes:

- Knee immobilizer for 3-4 weeks
- Physical therapy with initial avoidance of hamstring activation for the first 4 weeks
- Over the counter analgesics as needed
- Return to sport progression

1814 May 30 4:25 PM - 4:45 PM

Osteochondritis Dissecans With Loose Body In A Golfer

Krishna Israni, Daniel Montero. *Mayo Clinic, Jacksonville, FL.*
(Sponsor: George Pujalte, FACSM)

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(No relevant relationships reported)

History:

A 63-year-old gentleman with no significant past medical history presented in sports medicine clinic due to left knee pain that began 3 months prior. He states that he stays physically active. Four months prior, he was on the golf range and noticed mild discomfort. He then noticed worsening discomfort with running. His symptoms improved with rest but then would return with activity. Mild pain relief with ibuprofen. Soon after, he started to have painful clicking and catching of the left knee. He returned to Montana where he saw an orthopedist who prescribed meloxicam and ordered x-rays that had essentially normal findings. He then underwent magnetic resonance imaging (MRI) which revealed cartilage defects. His pain improved but he still described occasional, sharp, left lateral knee pain, and less commonly, medial knee pain. He described the pain as aching, sometimes sharp, and measuring 4/10 on the pain scale. Running and walking exacerbated his symptoms; straightening his leg worsened the pain. He had occasional night pain also.

Physical Exam:

Healthy-appearing gentleman, had muscular legs, able to rise from a seated position without difficulty, with nonantalgic gait. Normal range of motion without restriction, minimally tender over the left lateral joint line, no ligament instability, no obvious effusion, positive McMurray, negative Lachman.

Differential Diagnosis:

- Meniscal tear
- Osteoarthritis
- Plica syndrome
- Osteochondritis dissecans

Tests and Results:

X-rays grossly unrevealing.

Title: Knee Pain - Swimming in Dangerous Waters

MRI: Large osteochondral defect in the left lateral femoral condyle, measuring approximately 1 cm across, with apparent loose body in the posterior fossa. Smaller osteochondral defect seen in the medial femoral condyle which appeared stable. Associated bony edema on the lateral femoral lesion.

Final Working Diagnosis:

Osteochondritis dissecans with loose body

Treatment and Outcomes:

- Patient was very active and wanted to return to playing golf. His daily activities were much improved but still limited compared to prior level of activity.

- Recommended modified activities and possible steroid injection if pain continued to limit activities.

- Repeat MRI to reassess bony edema and loose body with further consideration of knee scope and other procedures, based on clinical response and imaging.

1815 May 30 4:45 PM - 5:05 PM

Biologically Repaired, Neurologically Prepared? Rethinking Knee Injury and a Novel Rehabilitation Model - Soccer

Corey Petersen, Kersten Schwanz, Sarah Wambheim. *University of Minnesota, Minneapolis, MN.* (Sponsor: Suzanne Hecht, FACS)M

(No relevant relationships reported)

HISTORY: A 21-year-old female NCAA Division I soccer defender sustained a non-contact right knee injury while chasing a ball in the 70th minute of an international spring season game. Her right foot caught on the turf and she felt a "pop" before falling. No previous history of knee injuries.

PHYSICAL EXAMINATION: Examination on the field by an ATC revealed no effusion or deformity, non-tender to palpation, full pain free ROM, a positive Lachman's and anterior drawer test, and no laxity of the MCL or LCL.

DIFFERENTIAL DIAGNOSIS: 1. Isolated ACL tear 2. ACL with collateral ligament and/or meniscal injury 3. Transient knee dislocation

TEST AND RESULTS: Right Knee MRI- Full thickness ACL tear with intact collateral ligaments and menisci- Subchondral edema present in lateral femoral condyle and lateral tibial plateau

FINAL WORKING DIAGNOSIS: Isolated complete ACL tear

TREATMENT AND OUTCOMES: 1. ACL reconstruction with BTB Patellar Tendon graft 2. Full ROM was achieved by week 3 post-op. Rehabilitation progression included traditional rehabilitation models. Additional focus on neurological rehabilitation was initiated week 3 and maintained throughout. 3. Triphasic training and movement progressions with concurrent sensory inputs and cognitive interference were employed, resulting in a multidisciplinary 3-fold rehabilitation model designed to target 3 injury-associated areas (motor, sensory, neuroplastic). Triphasic training utilizes block periodization of multi-joint movements to target each action of the stretch shortening cycle. Isometric movements increase motor unit recruitment and rate coding while eccentrics increase corticospinal signal. The resulting program combats the motor inhibition while simultaneous sensory overload and cognitive interference oppose neuroplastic changes through neural resource competition and may accelerate return to play. 4. Cleared to play 5.5 months following ACL reconstruction by orthopaedic surgeon.

1816 May 30 5:05 PM - 5:25 PM

Bilateral Knee Pain in Pregnancy

Michelle Sriwongtong. *UCLA, Santa Monica, CA.* (Sponsor: Aurelia Nattiv, FACS)M

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(No relevant relationships reported)

HISTORY: 37F G3P2 @32w4d pregnant presents with nontraumatic right knee pain for 1 week. Right knee outside MRI showed extensive marrow edema in the medial femoral condyle, consistent with avascular necrosis. She was made non-weight bearing. Her pain progressed and she became wheelchair bound. She delivered a baby girl @39w5d via C-section. She came to our clinic 3 weeks postpartum for persistent right knee pain and 3 weeks of new left knee pain.

PHYSICAL EXAM: BMI 30. Unable to bear weight due to pain. Bilateral knee exam with tenderness to palpation on her proximal tibia, medial and lateral joint lines, ROM 0-135 degrees, no effusion. Quadriceps and hip abductor strength 3/5 bilaterally.

DIFFERENTIAL DIAGNOSIS:

- Transient osteoporosis of pregnancy
- Avascular necrosis of the femoral condyle
- Stress fractures bilateral distal femur and/or proximal tibia
- Osteoporosis with insufficiency fractures

TEST AND RESULTS:

1. MRI R knee (initial) 5/2018: Extensive marrow edema present in the medial femoral condyle extending over 2.5 cm possibly related to stress reaction or early avascular necrosis. No subchondral or cortical fracture.
2. XR knee bilateral 7/2018: patchy demineralization around the right knee. When correlating clinical history with outside MRI, findings suggest transient osteoporosis.
3. MRI L knee 7/31/18: Small subchondral insufficiency fracture of medial femoral condyle with very mild surrounding bone marrow edema. Faint bone marrow edema in the lateral femoral condyle without fracture.
4. MRI R knee (f/u) 7/31/18: New subchondral insufficiency fracture of the lateral femoral condyle with moderate surrounding bone marrow edema. Resolution of medial femoral condyle bone marrow edema.
5. Labs, 8/18: PTH 44, Free T4 1.3, TSH 5.7, BMP 143/4.7/103/21/0.83/23<88, Ca 9.7, Vit D-25 OH 35

FINAL WORKING DIAGNOSIS:

- Transient osteoporosis of pregnancy
- Left subchondral insufficiency fracture of the medial femoral condyle
- Right subchondral insufficiency fracture of the lateral femoral condyle

TREATMENT AND OUTCOMES

- Tylenol/Norco PRN
- Started weight bearing with crutches 5 months after initial injury
- PT
- Ca 500mg QD, plus 1000mg dietary for breastfeeding
- Vit D3 2000IU QD
- After discussion with her pediatrician, bisphosphonates were held because she was breastfeeding and improving on current therapy

D-47 Clinical Case Slide - Shoulder and Elbow

Thursday, May 30, 2019, 3:45 PM - 5:45 PM

Room: CC-306

1817 **Chair:** David Jewison. *University of Minnesota Orthopaedics, Maple Grove, MN.*

(No relevant relationships reported)

1818 **Discussant**

Jason Pothast. *MedStar National Rehabilitation Network, Washington, DC.*

(No relevant relationships reported)

1819 **Discussant**

Robert H. Lutz. *Davidson College, Davidson, NC.*

(No relevant relationships reported)

1820 May 30 3:45 PM - 4:05 PM

Elbow Pain - Recreational Athlete

Shawn D. Felton¹, Arie J. van Duijn². ¹*Florida International University, Miami, FL.* ²*Florida Gulf Coast University, Ft. Myers, FL.* (Sponsor: Mitchell L. Cordova, FACS)M

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(No relevant relationships reported)

HISTORY: 21-year-old recreational athlete (185.4cm, 93.44 kg) with no prior history of injury was participating at an extreme sports center performing acrobatic type activities when he completed a back flip on the trampoline and landed on his left outstretched arm. Athlete noted an audible "pop" and the inability to fully extend or flex his arm. He self referred to ED for immediate evaluation and stabilization.

PHYSICAL EXAMINATION: Athlete was examined in sports medicine research lab by licensed physical therapist and athletic trainer. Gross swelling was present on exam. Athlete unable to perform active ROM and complained of intense pain 6/10 on VAS. Athlete pt. tender along medial joint line and specifically distal attachment of the medial collateral ligament. Valgus Stress test performed revealing extreme laxity compared bilateral with minimal stress. Neurological examination and circulatory exam = WNL. Physical examination discontinued due to pain and point of care ultrasound imaging continued of the medial elbow.

DIFFERENTIAL DIAGNOSIS: 1. Medical Collateral ligament sprain 2. Medical Collateral Ligament Disruption 3. Common Flexor Tendon Pathology 4. Pronator Teres Strain 5. Medial Epicondyle Avulsion

TEST AND RESULTS: Elbow AP/Lateral/Oblique Radiographs: WNL; MRI w/o contrast: Complete tear of the proximal ulnar collateral ligament, Avulsion flexor tendon with bone marrow edema, Nondisplaced fracture of the radial head associated joint

effusion. MSK Diagnostic Ultrasound Imaging: 1.07 cm widening of the medial joint space (MJS), 1.49 cm hypoechoic disruption of the UCL, Discontinuity of the flexor pronator group

FINAL WORKING DIAGNOSIS: Grade 3 UCL Strain with pronator muscle group avulsion. **TREATMENT AND OUTCOME:** Athlete underwent surgery to repair the Grade 3 UCL Strain medial collateral ligament and reattachment of the flexor pronator group avulsion at the medial epicondyle. The diagnosis of such injuries are evident in clinical examinations and the management of the case is common among athletes suffering from traumatic UCL strains, this case clearly illustrated the use of point of care ultrasound imaging in identifying these types of lesions. It further allowed for a more detailed examination when the physical examination was limited as a result of pain. The athlete has made a full recovery.

1821 May 30 4:05 PM - 4:25 PM

Right Elbow Pain in a Teenage Softball Player

Shelby E. Johnson, Edward R. Laskowski, FACSM. *Mayo Clinic, Rochester, MN.*

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(No relevant relationships reported)

HISTORY:

A 16 year-old right-hand dominant softball player presented with right elbow pain after an overhead throw two months prior. During the initial throw she felt a pop and acute pain, swelling, and ecchymosis at her posteromedial elbow. Her pain improved with rest and range of motion exercises. However, two days prior to presentation, she performed an overhead throw and again felt a pop with immediate pain and recurrent ecchymosis. She had tingling in her fourth and fifth fingers immediately after the throw but denied ongoing sensory symptoms.

PHYSICAL EXAMINATION:

Inspection revealed ecchymosis at the medial elbow. She was tender to palpation over the ulnar nerve along the cubital tunnel and over the medial triceps with mild tenderness of the ulnar collateral ligament. Range of motion, strength, and sensation were normal. Resisted elbow extension reproduced her pain. Valgus stress testing was painful with slight asymmetric opening compared to the left. Dynamic elbow flexion and extension produced dislocation of the ulnar nerve and medial triceps. Tinel's sign at the cubital tunnel was positive.

DIFFERENTIAL DIAGNOSIS:

1. Ulnar neuritis secondary to dislocating ulnar nerve
2. Snapping medial triceps
3. Ulnar collateral ligament injury
4. Medial epicondylitis
5. Triceps tendinopathy

TEST AND RESULTS:

Elbow X-ray: Negative for effusion, fracture, or osseous abnormality.

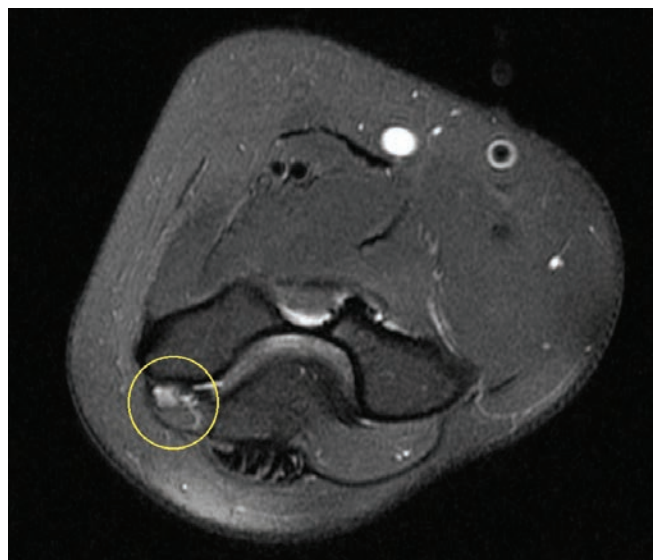
Elbow MRI: Nonspecific increased T2 signal of the ulnar nerve within and just distal to the cubital tunnel. Collateral ligaments intact.

FINAL WORKING DIAGNOSIS:

Right ulnar neuritis with a dislocating ulnar nerve and snapping medial triceps

TREATMENT AND OUTCOMES:

The patient initially tried rest and physical therapy. Due to progressive pain the patient decided to pursue more definitive treatment and underwent a right ulnar nerve transposition with partial resection of the medial triceps. One month post-operatively her symptoms had largely resolved and she gradually returned to softball.



1822 May 30 4:25 PM - 4:45 PM

Arm Injury - Crossfit

Jeremy Hreha, Mohamad K. Shaath, Joseph C. Tauro, Irfan H. Ahmed, Michael M. Vosbikian. *Rutgers New Jersey Medical School, Newark, NJ.*

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(No relevant relationships reported)

HISTORY:

A healthy, thirty-year-old male without antecedent pain presented with anterior elbow pain and elbow flexion weakness in his dominant upper extremity. At the time of injury, the patient was performing the CrossFit "butterfly pull-ups" in which the forearm is pronated while the elbows are actively flexed to bring the body up to the bar with the body swinging to build momentum. During this movement, he felt immediate pain at his distal anterior brachium but did not hear a pop. Following the injury he noted swelling and pain exacerbated by motion of the elbow. Once the swelling had resolved, the patient noticed a cosmetic defect at the proximal lateral elbow. On presentation, two weeks after the initial injury, his chief complaint was weakness during elbow flexion without any weakness during supination.

PHYSICAL EXAMINATION:

On presentation, no edema or ecchymosis were present. There was a notable defect in the lateral aspect of the arm just proximal to the elbow joint. With flexion of his elbow, the biceps tendon was clearly visualized. No "reverse popeye deformity" was present. A Ruland biceps squeeze test demonstrated intact supination of the forearm, and a hook test demonstrated an intact biceps tendon. There was no appreciable weakness with elbow flexion or supination compared to the contralateral arm. He did not demonstrate fatigability in supination. His range of motion was symmetric to the contralateral side. Neurologic examination showed that there was intact motor function throughout the arm and no sensory deficits were noted.

DIFFERENTIAL DIAGNOSIS:

1. Brachialis muscle rupture
2. Distal Biceps Brachii muscle rupture
3. Proximal Biceps Brachii muscle rupture

TESTS AND RESULTS:

1. Elbow radiographs were negative for osseous pathology
2. MR imaging demonstrated edema at the brachialis consistent with intrasubstance muscle tear. The biceps tendon was intact.

FINAL/WORKING DIAGNOSIS:

Isolated acute brachialis muscle rupture

TREATMENT AND OUTCOMES:

1. No immobilization given subacute presentation
2. Physical therapy: Initially maintenance of range of motion, then strengthening starting at 8 weeks post injury
3. At 1 year follow up, patient was pain free with full range of motion and no appreciable weakness with elbow flexion

1823 May 30 4:45 PM - 5:05 PM

Shoulder Pain-- Range of MotionNicole Messenger, Kelly Estes. *Washington University in Saint Louis, Saint Louis, MO.*

Email: messengern@wustl.edu

(No relevant relationships reported)

HISTORY: 49-year-old female with rheumatoid arthritis on methotrexate and oral prednisone presents to the walk-in orthopedic injury clinic for acute severe sharp pain in left shoulder radiating into left elbow and hand. No injury or trauma. Symptoms are constant, worse with overhead movements. She reports associated muscle spasms. She has tried acetaminophen and ice with limited relief. She notes her prednisone was increased to 10mg daily for worsening hand arthralgias recently.

Physical Exam: Patient is well appearing in no distress. Range of motion at the bilateral shoulders is 120 on the right, 110 on the left. She has 5/5 strength with supraspinatus and external rotators, as well as negative belly press and bear hug. 5/5 strength to bilateral upper extremities distally. Full range of motion of her cervical spine with pain only with left side bending. The left posterior cervical paraspinal area has a well-defined erythematous area with overlying vesicular lesions. There are few scattered lesions overlying the left shoulder extending down into the left arm.

Differential Diagnosis:

1. Cervical radiculopathy
2. Shoulder impingement syndrome
3. Varicella zoster virus
4. Herpes simplex Virus
5. Rotator cuff tendinopathy

Tests/Results:**Shoulder Xray****Final/working Diagnosis:**

Varicella zoster virus in C6 Dermatome

Treatment and Outcomes:

1. Valacyclovir prescription: 1g tablet by mouth TID for 7 days
2. Pain control with Hydrocodone-acetaminophen 5-325mg per tablet QID PRN for pain
3. Rheumatology follow-up for discussion of modification of her immunosuppression regimen
4. Primary Care follow-up

1824 May 30 5:05 PM - 5:25 PM

Neck Pain and Arm Swelling in a Professional DancerShannon Powers¹, Leda Ghannad². ¹*Rush University Medical Center, Chicago, IL.* ²*Midwest Orthopaedics at Rush, Chicago, IL.*

(No relevant relationships reported)

HISTORY: A 33-year-old female professional dancer presents to training room with three weeks of right-sided neck pain. The pain is located at base of the right neck and worsens with flexion. She denies an inciting trauma, but recently began performing new choreography involving repetitive overhead lifting. Associated symptoms include swelling in her right upper extremity and a prominence of her chest wall veins. She denies weakness or paresthesias. **PHYSICAL EXAMINATION:** Inspection reveals mild prominence of veins along the right side of the neck and chest wall, with mild swelling in the right forearm. There is tenderness to palpation at C7 spinous process, right-sided cervical paraspinal muscles, right upper trapezius muscle, and right pectoralis muscle insertion. There is full pain-free range of motion in the cervical spine, right shoulder, and right elbow. Spurling test is negative. Roos test is positive with venous engorgement in the right upper extremity after 30 seconds. Strength is 5/5, reflexes 2/4, and sensation is intact to light touch in the bilateral upper extremities.

DIFFERENTIAL DIAGNOSIS: 1. Deep venous thrombosis 2. Vascular thoracic outlet syndrome 3. Cervical muscle strain

TEST AND RESULTS: —VAS Duplex Upper Extremity Veins: No DVT —Cervical Spine anterior-posterior and lateral radiographs: unremarkable, no cervical ribs.

—VAS Functional Maneuvers Upper Extremity: Absent digital pulsatility with the right arm at 180 degrees. —VAS Duplex Upper Extremity Artery/Bypass Graft: Patent upper extremity arteries without stenosis **FINAL WORKING DIAGNOSIS:** Vascular Thoracic Outlet Syndrome/Paget-Schroetter Syndrome. **TREATMENT AND OUTCOME:** 1. Prescribed Medrol Dosepak and NSAIDs. 2. Started physical therapy and restricted arm motions in practice. 3. Consultation with cardiothoracic surgeon; recommended right first rib resection. 4. Prior to surgery, developed new occlusive DVT in right subclavian and axillary veins. Apixaban initiated. 5. Underwent transaxillary first rib resection, subclavian tenolysis and arteriolysis, and right brachial plexus neurolysis. 6. Returned to sport 6 weeks post-operatively and completed physical therapy. 7. Underwent right upper extremity venogram with angioplasty for chronic occluded central right subclavian vein 3 months post-operatively.

1825 May 30 5:25 PM - 5:45 PM

Arm Injury - CarpentryDylan Homen, Mimi Zumwalt, E.L. Domingo-Johnson, Matthew Helm, Melinda Schalow. *Texas Tech University Health Science Center, Lubbock, TX.* (Sponsor: Jacalyn McComb, FACSM)

(No relevant relationships reported)

HISTORY 70y/o M RHD presented to consultant hand clinic for R elbow evaluation 8 weeks post injury. He was building a deer hunting blind when the platform fell and landed on the posterior aspect of his right elbow. He noted immediate pain, swelling, and ecchymosis about the elbow at the initial traumatic episode. He also complained of a painful popping sensation whenever he ranged the elbow. He had difficulty straightening his arm, with pain and weakness upon attempted elbow extension. Past medical history included hand osteoarthritis and former 30-year smoker, quit in 2010. Denies history of pain, prior trauma at the site or exogenous corticosteroid use. **PHYSICAL EXAMINATION** R upper extremity-tenderness to palpation over olecranon tip, pain with elbow range of motion (ROM); unable to maintain active elbow extension against gravity or resistance. Unrestricted, passive ROM arc 0-140 with no blocks & full pronation/supination. Distally no neurological or vascular deficits. **DIFFERENTIAL DIAGNOSIS** Olecranon fracture Triceps bony avulsion Triceps tendon rupture **TESTS and RESULTS** Radiographs - elbow lateral view revealed a small osseous fragment ~5 cm proximal to the olecranon tip. MRI - showed complete tear of the triceps with hematoma at its insertion site and ~3 cm tendon retraction. **FINAL WORKING DIAGNOSIS** R triceps tendon rupture **TREATMENT and OUTCOMES** Underwent delayed primary repair 2 months post injury. Posterior splint x 2 weeks with elbow 60-70 degrees of flexion. Hinged elbow brace x 2 months with weight restriction of 5 lbs. Gradual increase in ROM progressing to strengthening exercises for another couple of months. Latest follow-up 4 months post-op after OT patient with near full elbow ROM, pain free and functional

**D-54 Free Communication/Poster - Blood Flow**

Thursday, May 30, 2019, 1:00 PM - 6:00 PM

Room: CC-Hall WA2

1845 Board #1

May 30 2:00 PM - 3:30 PM

No Relationship Between Muscle Flexibility and Blood Flow in the Lower Legs of Competitive RunnersMegan Battles¹, Rachel Bowden¹, Cameron Greene¹, Justin Stanek², Arbin Thapaliya¹, Jeffrey Williams¹. ¹*Franklin College, Franklin, IN.* ²*Illinois State University, Normal, IL.* (Sponsor: Kristen Lagally, FACSM)

(No relevant relationships reported)

Megan Battles¹, Rachel Bowden¹, Cameron Greene¹, Justin Stanek², Arbin Thapaliya¹, Jeffrey Williams¹

¹Franklin College, Franklin, IN²Illinois State University, Normal, IL

Muscular adaptations in the upper limb from training are associated with hypertrophy, inflexibility, and diminished vascular perfusion. Despite these findings in upper extremity athletes, no studies have examined the relationship between peripheral vascular adaptations and muscle flexibility in the lower legs of runners. Through a better understanding of blood flow and muscle flexibility adaptations, clinicians can more accurately assess and treat running injuries.

Purpose: To examine the relationship between blood flow in the posterior tibial artery and sagittal plane ankle range of motion (ROM) among a sample of collegiate runners.

Methods: Blood flow in the posterior tibial artery and sagittal plane ankle ROM were measured bilaterally on 25, asymptomatic collegiate track athletes (16 males, 9 females, age = 20.0 ± 1.2 years, height = 171.5 ± 10.2 cm, mass = 66.7 ± 13.7 kg). Pearson correlation analysis was used to analyze the relationship between blood flow in the posterior tibial artery and ROM of the talocrural joint.

Results: Findings revealed no significant relationship between blood flow in the dominant leg's posterior tibial artery and dorsiflexion ($r = .14$, $P = .52$) or plantarflexion ($r = -.32$, $P = .12$) and no significant relationship between blood flow in the non-dominant leg's posterior tibial artery and dorsiflexion ($r = -.02$, $P = .93$) or plantarflexion ($r = -.02$, $P = .92$).

Conclusion: Although muscle inflexibility contributes to compromised blood flow in other body regions, findings of this study demonstrated no relationship between flexibility of the plantarflexor muscles and blood flow in the posterior tibial arteries of competitive runners. Future research should continue examining blood flow in the lower limb as one, among many, physical adaptations runners may experience from training.

1846 Board #2 May 30 2:00 PM - 3:30 PM
Effect of Increased Respiratory Muscle Activation on Blood Flow to Inactive and Active Limb Muscles

Kana Shiozawa¹, Kanako Goto¹, Kaori Shimizu¹, Mitsuuru Saito², Koji Ishida¹, Luyu Zhang¹, William Sheel, FACSM³, Keisho Katayama¹. ¹Nagoya University, Nagoya-shi Chikusa-ku, Japan. ²Toyota Technological Institute, Nagoya-shi Tenpaku-ku, Japan. ³University of British Columbia, Vancouver, BC, Canada. (Sponsor: A. William Sheel, FACSM)
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(No relevant relationships reported)

It is unclear whether blood flow to inactive and active limb muscles are altered when the respiratory muscle activation is increased during submaximal exercise. **PURPOSE:** The purpose of this study was to clarify the effect of increasing inspiratory muscle work on blood flow to inactive and active limbs. **METHODS:** Healthy young men ($n=7$, 20 ± 2 yrs) performed two mild bilateral dynamic knee-extension and -flexion exercises for 10 min. The trials consisted of spontaneous breathing for 5 min followed by voluntary hyperventilation either with or without inspiratory resistance for 5 min (40% of maximal inspiratory mouth pressure, inspiratory duty cycle of 50% and a breathing frequency of 40 breaths/min). Mean arterial blood pressure (MAP) was monitored using finger photoplethysmography. Blood flow to the brachial artery (inactive limb) and in femoral artery (active limb) were recorded using Doppler ultrasound. **RESULTS:** MAP during exercise was higher ($P < 0.05$) with inspiratory resistance (121 ± 6 mmHg) than without resistance (98 ± 6 mmHg). Brachial artery blood flow increased during exercise without inspiratory resistance (127 ± 38 ml/min) as compared with resting level, while it decreased with inspiratory resistance (69 ± 31 ml/min). Femoral artery blood flow increased at the onset of exercise and was maintained throughout exercise without inspiratory resistance (2426 ± 573 ml/min) and was unchanged when inspiratory resistance was added (2517 ± 663 ml/min) ($P > 0.05$). **CONCLUSIONS:** These results suggest that sympathetic control of blood redistribution to active limbs is promoted, partly, by respiratory muscle-induced metaboreflex.

1847 Board #3 May 30 2:00 PM - 3:30 PM
The Effects of Recumbent Angle on Cardiac Responses and Hemodynamics during Bicycle Ergometer Exercise in Patients with Atrial Fibrillation

Ilgyu Jeong¹, Hee-Hyeok Lee¹, Myunghwa Kim², Jae-Hyun Lee¹, Seongdae Kim¹. ¹Hannam University, Daejeon, Korea, Republic of. ²Woosong University, Daejeon, Korea, Republic of.
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(No relevant relationships reported)

Recumbent cycling is well-established mode of exercise that is used in patients with cardiovascular disease to rehabilitate. However, through more hemodynamic researches for patients with atrial fibrillation, the necessity to establish the safety and availability of recumbent bicycle exercise has been required. **PURPOSE:** To determine the effects of recumbent bicycle ergometer exercise on hemodynamics in patients with atrial fibrillation. **METHODS:** In randomized, double-blind, crossover study,

three female and eight male patients with atrial fibrillation (63.3 ± 6.1 yrs) were asked to perform the incremental bicycle ergometer exercise three times in the upright, 60° recumbent (R), and 30°R postures with a week interval, respectively. Exercise intensity was set initially at 10W and increased by 15W every 2 minutes to 70W. Cardiac output (CO) and systemic vascular resistance (SVR) measured at rest, 5 minutes during exercise and 10 minutes during exercise using electrical cardiometry. Rate pressure product (RPP) was calculated by systolic blood pressure (SBP) and heart rate (HR). All data were analyzed using two-way ANOVA (3 postures \times 3 times) with repeated measures. **RESULTS:** HR in 30°R and 60°R was significantly lower than in upright postures at 5 minutes during exercise (88 ± 6 and 84 ± 12 vs. 98 ± 16 bpm, $p < .05$) and 10 minutes during exercise (95 ± 11 and 94 ± 13 vs. 113 ± 18 bpm, $p < .05$). RPP in 30°R and 60°R was significantly lower than in upright postures at 5 minutes during exercise (10414 ± 1480 and 10620 ± 2754 vs. 15115 ± 5174 bpm \times mmHg, $p < .05$) and 10 minutes during exercise (11757 ± 1680 and 12195 ± 2367 vs. 16186 ± 3228 bpm \times mmHg, $p < .05$). However, CO, SVR and stroke volume were not significant different between three postures. **CONCLUSIONS:** These results suggest that recumbent bicycle exercise have the advantage of reducing myocardial workload by regulating HR and SBP in patients with atrial fibrillation.

1848 Board #4 May 30 2:00 PM - 3:30 PM

The Influence of EMG-based MVC Intensity on Middle Cerebral Artery Velocity, Cardiac Output and Respiratory Variables

Hee-Hyeok Lee¹, Seongdae Kim¹, Myungjin Oh², Jae-Hyun Lee¹, Ilgyu Jeong¹. ¹Hannam University, Daejeon, Korea, Republic of. ²Baekseok University, Cheonan, Korea, Republic of.
 (No relevant relationships reported)

It has been reported that cerebral blood flow velocity (CBFV) might be reduced according to the increase of exercise intensity determined by %EMG-based maximal voluntary contraction (MVC_{EMG}) during a static exercise test. But, how %MVC_{EMG} induced-changes of CBFV might be associated with cardiac output (CO) and respiratory response remains unclear. **PURPOSE:** To evaluate the influence of %MVC_{EMG} on middle cerebral artery velocity (MCA V_{mean}), CO and respiratory variables during isometric strength type exercise. **METHODS:** Eight healthy male (21.3 ± 0.9 yrs) were asked to perform the 45° knee extension isometric contraction during 60 seconds. All participants performed four times in random order at the isometric intensity of 100%, 90%, 80% and 70% MVC with a week interval. The intensity of %MVC was determined by root mean square (RMS) of EMG at right rectus femoris muscle. Each participant was asked to conduct and maintain the predetermined intensity of % MVC_{EMG} confirming the figures on a monitor. MCA V_{mean} was measured at rest, 30 and 60 seconds during exercise, 30 seconds recovery, 150 seconds recovery using transcranial-Doppler sonography. CO and respiratory variables were measured by electrical cardiometry monitor and gas analyzer. All data were analyzed using two-way ANOVA (4 intensities \times 5 times) with repeated measures. **RESULTS:** MCA V_{mean} in 70% MVC_{EMG} was significantly higher than MCA V_{mean} in 100% and 80% MVC_{EMG} at 60 seconds during exercise (92 ± 9 vs. 68 ± 15 and 78 ± 11 cm/s, $p < .05$). On the other hand, CO were not significant different between 100%, 90%, 80% and 70% MVC_{EMG}. Vco₂ in 70% MVC_{EMG} was significantly lower than in 100% MVC_{EMG} at 60 seconds during exercise (0.49 ± 0.22 vs. 1.23 ± 0.86 L/min, $p < .05$) and had significantly negative correlation with the changes of MCA V_{mean} ($r = -.524$, $p < .01$). **CONCLUSIONS:** These results suggest that MCA V_{mean} might have the tendency of decrement over the intensity of 70% isometric MVC_{EMG} and negatively relate to Vco₂.

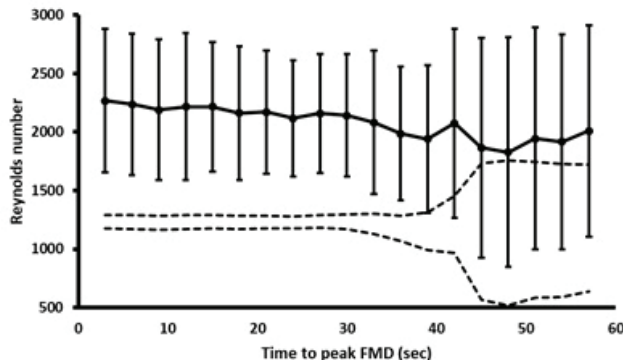
1849 Board #5 May 30 2:00 PM - 3:30 PM

Blood Flow Patterns during Flow-Mediated Dilation

Francisco Morales-Acuna, Carolina Valencia, Alvaro N. Gurovich, FACSM. The University of Texas at El Paso, El Paso, TX.
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 (No relevant relationships reported)

PURPOSE: Flow mediated dilation (FMD) has been the most common assessment of endothelial function in research but it has failed in obtaining a widespread use in clinical setting due to a lack of standardization and a large inter-subject variability. Normalization of FMD to endothelial shear stress (ESS) has been proposed to solve its technical limitations. However, studies have not considered the characteristic of the blood flow during FMD under pulsatile conditions in their ESS estimations. Therefore, the aims of this study were to quantify the magnitude of FMD-induced ESS and to characterize the blood flow under pulsatile conditions during FMD testing. **METHODS:** A total of 26 young healthy subjects (15 females and 11 males) underwent FMD testing. Microhematocrit measurement was used to determine blood density (ρ) and viscosity (μ). ESS was calculated by Womersley's approximation, $ESS = \mu * 2K * Velocity/Diameter$, where K is a function of Womersley's parameter (α). The presence of turbulent flow was determined by comparing Reynolds number (Re

$= (V \cdot D \cdot \rho) / \mu$, to critical Reynolds ($Re_{peak(er)} = 169 \cdot \alpha^{0.83} \cdot St^{0.27}$, $St = freq \cdot D \cdot V$). Statistical analysis included repeated measures ANOVA to detect ESS differences during FMD until peak dilation. Significance was established at $p < 0.05$. **RESULTS:** The mean (SD) FMD% and time to peak dilation were 7.4 (3.1) % and 35 (9.3) seconds, respectively. ESS was significantly reduced from ischemia release until peak dilation, ($F(3.83, 80.43) = 6.51$, $p < 0.001$, two-tailed). Turbulent blood flow was the only type of flow observed until peak dilation in 96.15% of the sample (Figure).



CONCLUSIONS: Peak dilation of the brachial artery during FMD testing in a young healthy population is triggered mostly by antegrade, high-ESS under turbulent flow conditions. Due to the pulsatile nature of blood flow and the appearance of a turbulent pattern during FMD, ESS should be estimated by Womersley's approximation rather than Poiseuille's law.

1850 Board #6 May 30 2:00 PM - 3:30 PM
Relationship Between Increased Resting Muscle Blood Flow And Muscle Force Loss After Repeated Eccentric Contractions

Hisashi MAEDA¹, Mitsuru SAITO², Koji ISHIDA¹, Hiroshi AKIMA¹. ¹Nagoya University, Nagoya, Japan. ²Toyota Technological Institute, Nagoya, Japan. (Sponsor: Dr. Katsumi ASANO, FACSM)
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 (No relevant relationships reported)

Unaccustomed eccentric contractions (ECs) induce muscle force reduction and increased resting muscle blood flow. Whereas muscle force reduction has been well accepted as an index of exercise-induced muscle damage (EIMD), physiological meaning of increased resting muscle blood flow is not fully understood. **PURPOSE:** The purpose of the present study was to assess the relationship between the increased resting muscle blood flow and muscle force reduction after repeated ECs in healthy individuals. **METHODS:** Eight young healthy men (age, 20.9 \pm 1.7 years; height, 172.1 \pm 3.9 cm; weight, 64.5 \pm 5.2 kg; body mass index, 21.8 \pm 1.7 kg/m²) participated in this study. Maximal voluntary contraction (MVC) force of isometric elbow flexion at elbow joint angle of 90°, heart rate, and blood pressure were measured before and after 24 h of repeated ECs task. Resting forearm blood flow as an index of muscle blood flow was also measured by plethysmography. Subjects performed five sets of 20 repetitions of eccentric contractions of elbow flexors (no contractions at concentric phase) with a load equal to 60% of MVC force with the use of dumbbells. Each action was performed through the same range of motion at a rate of 4-s. **RESULTS:** MVC force significantly decreased by 44% (17.4 \pm 2.2 kg to 9.7 \pm 3.2 kg, $p < 0.01$) after 24 h of repeated ECs. Resting forearm blood flow increased by 22% (5.8 \pm 1.2 ml/min/100 g to 7.4 \pm 1.9 ml/min/100 g, $p < 0.05$) after 24 h of repeated ECs. Resting heart rate and blood pressure were not significantly different between before and after 24 h of ECs. The change of resting forearm blood flow was negatively correlated with the change of MVC force ($r = -0.88$, $p < 0.01$). **CONCLUSION:** Increased resting muscle blood flow was associated with muscle force reduction after repeated ECs. Our results suggested that increased resting muscle blood flow could result from EIMD-induced inflammatory vasodilation after repeated ECs.

1851 Board #7 May 30 2:00 PM - 3:30 PM
Effects of Capsaicin on Leg Blood Flow in Response to Passive Limb Movement

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 (No relevant relationships reported)

Given the high rates of cardiovascular disease morbidity and mortality in the United States, and worldwide, finding strategies that might mitigate CVD is paramount. Vascular dysfunction is a critical component and likely precursor measure to CVD. Recently, the passive leg movement (PLM) method has been developed to assess nitric oxide (NO)-dependent vascular function. The nutraceutical Capsaicin has been shown to have cardioprotective effects, enhancing vasorelaxation and attenuating sympathetic vasoconstriction in an endothelium dependent manner via activation of transient receptor potential vanilloid type 1 (TRPV1) channels; this however has only been demonstrated using *in vitro* or animal models. **PURPOSE:** In this study, a single-blind, crossover design was used to examine the potential effects of capsaicin-induced improvement of leg blood flow in response to PLM. **METHODS:** Femoral artery blood flow and microvascular perfusion of the vastus lateralis were examined in 12 young, healthy men, using Doppler ultrasound and multi-distance frequency domain based near-infrared spectroscopy. Central hemodynamics (stroke volume, SV; heart rate, HR; cardiac output, CO; and mean arterial pressure, MAP) were measured using finger photoplethysmography. Hemodynamic measurements were continuously taken at rest and during a single bout of PLM (sPLM), a variant of PLM which minimizes the central hemodynamic response. **RESULTS:** A significant hyperemic response was recorded in response to PLM under both conditions (Capsaicin and Placebo); however the microvascular perfusion response to PLM was not significantly altered ($p > 0.05$) following ingestion of Capsaicin compared to Placebo (Capsaicin: 10.4 \pm 3.1%, Placebo: 14.1 \pm 3.9%). Femoral artery blood flow was also not significantly augmented ($p > 0.05$) under Capsaicin (Capsaicin: 362 \pm 119% Placebo: 295 \pm 61% in response to PLM). Expectedly, there were no significant differences in basal microvascular perfusion, basal femoral blood flow, and central hemodynamic responses (HR, SV, CO, MAP) between conditions ($p > 0.05$). **CONCLUSION:** These results indicate Capsaicin does not further augment hyperemia in response to sPLM in young healthy males. Further study of this nutraceutical is warranted in populations at high risk, or prevalence, of cardiovascular disease.

1852 Board #8 May 30 2:00 PM - 3:30 PM
Does Capsaicin Ingestion Affect Functional Sympatholysis And Vascular Functions?

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 (No relevant relationships reported)

During exercise, heat and metabolites (e.g. H⁺, etc.) attenuate sympathetically-mediated vasoconstriction in contracting muscle, known as functional sympatholysis, remains poorly understood. Previous work has shown that activation of transient receptor potential vanilloid type 1 channels (TRPV1) with Capsaicin (CAP, spicy ingredient in peppers), elicits a sympatholytic effect *in vitro* in humans. **PURPOSE:** To determine if acute ingestion of CAP elicits or enhances sympatholysis at rest and during exercise *in vivo* in humans. **METHODS:** In a single blind crossover design, in 10 young healthy males we measured forearm microvascular responses (oxyhemoglobin and myoglobin HbO₂+MbO₂) using near infrared spectroscopy (NIRS) and central/peripheral hemodynamic (cardiac output, CO, and mean arterial pressure, MAP, via Finometer) responses at rest, lower body negative pressure at rest (rLBNP), rhythmic handgrip (HG) exercise at 30% MVC and during HG with LBNP (HG+LBNP) under placebo (PL, 800 mg fiber) and Capsaicin (780 mg pepper extract). **RESULTS:** No differences ($P > 0.05$) were found between PL and CAP in microvascular and central hemodynamics at rest. At rest the LBNP-induced change in HbO₂+MbO₂ (-1.5 \pm 2.3 vs 0.3 \pm 2.3 %Δ) or conductance index (HbO₂+MbO₂/MAP: 5.5 \pm 2 vs 6.0 \pm 3 %Δ) were not different ($P > 0.05$). During exercise, HbO₂+MbO₂ were not different (105 \pm 28 vs 105 \pm 21 uM), though tissue oxygen saturation tended to be higher (64 \pm 16 vs 70 \pm 13 %, $P = 0.07$), and deoxyhemoglobin lower in CAP (44 \pm 5 vs 37 \pm 4 uM, $P = 0.05$). The LBNP-induced change during exercise in HbO₂+MbO₂ (-0.1 \pm 7.1 vs 1.3 \pm 7.2 %Δ) or conductance (5.6 \pm 3 vs 2.8 \pm 4 %Δ) were not significant ($P > 0.05$), but tended to be better in CAP. Systemic vascular conductance was not significant different at rest between conditions (5.3 \pm 0.2 vs. 4.8 \pm 0.4 L/min/mmHg). The LBNP-induced change in SVC at rest (5.6 \pm 5.5 vs 6.1 \pm 5.7 %Δ) and during exercise (5.2 \pm 2.4 vs 1.7 \pm 5.2 %Δ), were not different, despite a tendency to be attenuated during exercise with CAP. **CONCLUSION:** Acute CAP does not affect resting hemodynamics or the response to sympathoexcitatory LBNP. During exercise, CAP seems to improve microvascular responses, but does not impact the response to LBNP, despite trends for CAP to mitigate the LBNP-induced reductions in both systemic and local conductance.

- 1853** Board #9 May 30 2:00 PM - 3:30 PM
The Effect Of The Speed And Range Of Motion Of Movement On The Hyperemic Response To Passive Leg Movement
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(No relevant relationships reported)

PURPOSE: Passive leg movement (PLM)-induced hyperemia is used to assess the function of the vascular endothelium. This study sought to determine the impact of movement speed and ROM on the hyperemic response to PLM and determine if the currently recommended protocol of moving the leg through a 90° ROM at 180°/s provides an optimal peak hyperemic response to PLM.

METHODS: 11 healthy adults underwent multiple bouts of PLM, in which either movement speed (60-240°/s) or ROM (30-120° knee flexion) were varied. Femoral artery blood flow (Doppler Ultrasound) and mean arterial pressure (MAP; photoplethysmography) were measured throughout.

RESULTS: Movement speed generally exhibited positive linear relationships with the hyperemic response to PLM, eliciting ~20-30% increase in hyperemia and conductance for each 60°/s increase in speed ($P < 0.05$). However, increasing the movement speed above 180°/s, which was physically difficult, did not elicit significant increases in hyperemia in many cases. ROM exhibited curvilinear relationships ($P < 0.05$) with hyperemia and conductance, which peaked at 90°, such that a 30° increase or decrease in ROM from 90° resulted in a 10-40% attenuation ($P < 0.05$) in the hyperemic response. Alterations in the balance of antegrade and retrograde flow appear to play a role in this attenuation.

CONCLUSIONS: Movement speed and ROM have a profound impact on PLM-induced hyperemia, as well as the feasibility of the test. When using PLM to assess vascular endothelial function, it is recommended to perform the test at the traditional 180°/s with 90° ROM, which offers a large hyperemic response, while maintaining test feasibility.

- 1854** Board #10 May 30 2:00 PM - 3:30 PM
The Relationship Between Left Ventricular Systolic Function And Cerebral Blood Flow
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(No relevant relationships reported)

PURPOSE: The positive relationship between cardiac output and cerebral blood flow (CBF) has been indicated in healthy individuals and patients with cardiovascular diseases. Previous studies reported that the reduced cardiac output was related with a low brain volume and an increased risk for Alzheimer's disease. Also, compromised left ventricular (LV) diastolic function was reported to be associated with a cerebral white matter lesions. Therefore, cardiac function may play an important role for the maintenance of CBF. However, the relationship between LV systolic function and CBF is still unclear. The purpose of this study was to test our hypothesis that the LV systolic function would be associated with CBF.

METHODS: Sixty-three outpatients who presented to our hospital due to transient loss of consciousness were enrolled (59 ± 22 years old, range 17 to 93 years old, 31 females). LV function was assessed by stroke volume (SV), LV ejection fraction (LVEF) and mass (LVmass) by echocardiography, and pre-ejection period (PEP), ejection time (ET) and ET/PEP by phonocardiogram. ET was corrected by heart rate (ETc). On the other hand, CBF was estimated from systolic, diastolic and mean blood flow velocity in middle cerebral artery (MCA), measured by transcranial Doppler ultrasound. The multiple linear regression analysis was performed using MCA blood flow velocities (MCAv) as independent variables, and age, sex and each LV function as dependent variables.

RESULTS: SV, LVEF, LVmass and PEP were not correlated with MCAv. In contrast, ETc was significantly correlated with both systolic ($\beta = 0.32$, $P = 0.01$) and mean ($\beta = 0.25$, $P = 0.02$) MCAv. ET/PEP was significantly correlated with systolic MCAv ($\beta = 0.22$, $P = 0.04$) only.

CONCLUSIONS: These results indicated that LV systolic function evaluated by phonocardiogram may play more significant role for regulating CBF as compared with that by echocardiography such as LVEF.

- 1855** Board #11 May 30 2:00 PM - 3:30 PM
Differential Cardiovascular Responses to Acute Exercise in Children with Autism Spectrum Disorder
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(No relevant relationships reported)

Autism Spectrum Disorder (ASD) is a complex neurological disorder identified in early childhood and is characterized by impaired social interaction and atypical behaviors. A very few studies reported that children with ASD tend to have higher heart rate (HR) and blood pressure (BP) at rest compared to typically developing children (TDC). Although structural abnormalities have been identified in the brain stem where cardiovascular control center is located, the physiological basis for ASD has not been established. Furthermore, whether there are alterations in cardiovascular responses to exercise in ASD is unidentified. **PURPOSE:** To determine differential cardiovascular responses to acute handgrip exercise in children with ASD. **METHODS:** Total of 23 adults, TDC and children with ASD participated in the study. HR from ECG, beat to beat arterial BP from Finapres and brachial BP, and respiration from pneumobelt were continuously measured before, during and after 2 minutes of dynamic handgrip exercise at 50% of maximal voluntary contraction. In addition, diameter, blood flow velocity, and flow of the brachial artery were measured using Doppler Ultrasound on the contracting arm throughout the experiment. **RESULTS:** Mean BP was significantly increased to exercise from resting baseline in all groups with no group differences ($\Delta 10.0 \pm 1.5$ adults, $\Delta 8.2 \pm 1.4$ TDC, and $\Delta 6.9 \pm 1.8$ ASD mmHg; $P > 0.05$). HR was significantly increased to exercise from rest in adult and TDC groups (58 ± 2 adult vs. 78 ± 2 TDC at rest, 65 ± 2 adult vs. 85 ± 2 TDC exercise bpm; $P < 0.05$); however, there was no change in HR to exercise from rest in children with ASD (77 ± 4 at rest, 78 ± 5 exercise bpm). Both adult and TDC groups had similar increase in blood flow velocity during exercise compared to rest ($\Delta 17.6 \pm 3.2$ adult vs. $\Delta 13.5 \pm 2.2$ TDC cm/s; $P < 0.05$). However, blood flow velocity in ASD did not change from rest to exercise ($\Delta 0.6 \pm 2.2$ ASD cm/s). **CONCLUSION:** While HR increased to exercise in both adult and TDC groups in similar fashion, HR did not change in children with ASD. It suggests that higher total peripheral resistance may contribute to increase BP during exercise in ASD. Such increase in BP can be attributed to attenuated vasodilation in contracting skeletal muscles during exercise in children with ASD. Supported by CASA RSCA Infusion and Undergraduate Research Grant, SJSU

- 1856** Board #12 May 30 2:00 PM - 3:30 PM
Altered Blood Flow in Lower Legs of Runners Over the Course of a Competitive Season
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(No relevant relationships reported)

Forceful and repetitive motions in sport lead to adaptations in various tissues. Hypertrophy and inflexibility of muscle tissue are common adaptations associated with decreased vascular perfusion and injury. Such findings have been validated in the upper limbs of throwers over the course of competitive seasons. To date, no studies have examined the influence of a competitive season of running on blood flow in the lower legs of runners. A more comprehensive understanding of blood flow adaptations may advance clinicians' abilities to predict and prevent running related injuries.

Purpose: To examine blood flow in lower legs of collegiate runners over the course of a competitive season.

Methods: Blood flow in the posterior tibial artery was measured bilaterally on 25 asymptomatic collegiate track athletes (15 males, 10 females, age = 20.0 ± 1.2 years, height = 171.5 ± 10.2 cm, mass = 66.7 ± 13.7 kg). Measurements were performed in one session at pre-season and immediately following the season. An independent t-test was used to compare blood flow in dominant versus non-dominant limbs at the start of season. Repeated measures t-tests were used to compare changes in blood flow from pre- to post-season in the dominant and non-dominant limbs.

Results: At pre-season, blood flow in the dominant (123.34 ± 43.73) and non-dominant (112.64 ± 40.31) posterior tibial arteries was not significantly different ($t_{18} = .90$, $P = .373$). Blood flow in the dominant legs, however, significantly decreased from pre- (118.26 ± 46.52) to post-season (102.99 ± 30.76) ($t_{19} = 2.089$, $P = 0.05$). No significant difference was seen in blood flow in the non-dominant leg between pre- (109.53 ± 42.03) and post-season (102.55 ± 33.21) ($t_{19} = 1.1017$, $P = 0.322$).

Conclusion: This study reveals blood flow significantly decreased in the dominant posterior tibial arteries among runners over the course of a competitive season. Such findings support the idea of limb lateralization and asymmetrical adaptations among this population. Changes in blood flow may predispose runners to injury. These changes may be due to factors in running gait and potentially disproportionate use of one limb during the stabilization and propulsive phases of gait. Further research should examine mechanisms underlying changes in blood flow and its influence on injury incidence among runners.

- 1857** Board #13 May 30 2:00 PM - 3:30 PM
The Temperature Surface Radiation Pattern - A non-invasive Insight into Skin Blood Flow Response to Exercise
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 (No relevant relationships reported)

Infrared thermography (IR-T) is a non-invasive and mobile tool to measure and portray changes of the body surface radiation (T_{sr}) or the surface radiation pattern (T_{srp}) in real-time. **PURPOSE:** The comparison and examination of the T_{srp} of the back of the legs during an exercise test, between endurance athletes and patients with cystic fibrosis (CF). **METHODS:** 7 CF patients (G1) and 14 male endurance athletes (G2) performed a step-wise incremental exercise test on a treadmill. T_{sr} was measured via IR-T with a high-resolution detector. T_{srp} was calculated as the difference in temperature ($^{\circ}\text{C}$) between the 10% of the darkest and 10% of the lightest pixels in the region of interest. T_{srp} data were analyzed at "resting condition" (rest), "individual anaerobic threshold" (IAT) and "maximum load" (max), by repeated measures ANOVA. **RESULTS:** By looking at the complete optical information of temperature patterns over time in high-resolution, we were able to recognize the anatomy of subcutaneous arterioles and their sensitive adjustments due to exercise over time. For G1 global testing for T_{srp} was significant across all measuring points (rest: 2.1 $^{\circ}\text{C}$; IAT: 2.7 $^{\circ}\text{C}$; max: 3.0 $^{\circ}\text{C}$ SD: 0.2 $^{\circ}\text{C}$; $p < 0.05$), with a significant group difference between rest and max, only ($p = 0.022$). For G2 global testing was highly significant (rest: 2.3 $^{\circ}\text{C}$; IAT: 3.4 $^{\circ}\text{C}$; max: 3.8 $^{\circ}\text{C}$ SD: 0.1 $^{\circ}\text{C}$; $p < 0.01$), and all between-group comparisons were highly significant ($p < 0.01$). The course of the T_{srp} during the load does not differ significantly between G1 and G2 ($p = 0.124$). **CONCLUSION:** The T_{srp} increases across groups during an exercise test. The T_{srp} can be distinguished between rest, IAT and max for endurance athletes. In the chronically ill patients, the increase in the difference in T_{srp} appeared to be less pronounced, which could be due to the limited capacity of the patients. The adjustment of arterioles during exercise was therefore dependent on the intensity of exercise and on individual prerequisites. High-resolution IR-T measurement has the potential to become a performance diagnostic tool, to generate sensitive insights into individual exercise physiology. Technological innovations like improved algorithms, automated data processing as well as deep learning should be applied in further research studies to improve IR-T diagnostics and the detection of the T_{srp} .

- 1858** Board #14 May 30 2:00 PM - 3:30 PM
Effects of External Calf Compression on Microvascular Oxygenation in the Lower Limb of Young Men
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 (No relevant relationships reported)

Compression garments are used in clinical and sports settings to improve blood flow. Pressure applied by the compression garments varies widely with some garments applying as little as 5 mmHg and as much as 60 mmHg of pressure. Although compression can increase blood flow, compression to a pressure of 60 mmHg for short periods of time (~30 min) has been shown to cause endothelial damage. This is important because endothelial dysfunction is a precursor of atherosclerosis and may impair microvascular oxygenation. **PURPOSE:** Examine the effect of lower versus higher external compression pressures on microvascular oxygenation in healthy, young men. **METHODS:** Near-infrared spectroscopy (NIRS) was used to measure vastus medialis muscle oxygen saturation (SMO_2) and total hemoglobin (THB) in 29 healthy, young men (22 ± 5 years of age, body mass index $23 \pm 2 \text{ kg}\cdot\text{m}^{-2}$). Oxygenation was measured continuously for 10 min at rest and during external compression, which consisted of inflation of a cuff applied to the calf to 5 mmHg and 60 mmHg in a randomized order. There was a 5 min recovery period between conditions. Each compression condition was maintained for 30 minutes. Data were binned into 5 min epochs and analysed using a 2 (condition) \times 9 (time points) ANOVA with repeated measures. **RESULTS:** A significant time effect was detected for SMO_2 . When comparing the final epoch (min 25-30) to baseline, SMO_2 increased 5.75% and 5.86% with compression to 5 mmHg and 60 mmHg, respectively ($p < 0.001$). No condition by time interaction was detected ($p = 0.89$). A significant time effect was detected for THB. When comparing the final epoch (min 25-30) to baseline, THB increased 1.08% and 1.15% with compression to 5 mmHg and 60 mmHg, respectively ($p < 0.001$). No condition by time interaction was detected ($p = 0.76$). **CONCLUSION:** Although previous studies suggest that higher compression pressures of 60 mmHg lead to endothelial dysfunction, our findings suggest that there were no subsequent detrimental effects on microvascular oxygenation. Compression increased microvascular oxygenation and increases were similar between the 5 mmHg and 60 mmHg conditions. These findings suggest that both lower and higher compression pressures may have similar modest beneficial effects on microvascular oxygenation.

- 1859** Board #15 May 30 2:00 PM - 3:30 PM
Blood Pressure, Body Composition, and Plasma Lipids Are Not Related to Indices of Vascular Health
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 (No relevant relationships reported)

Blood pressure, body composition and plasma lipoprotein concentrations are important markers for cardiovascular disease (CVD) risk.

PURPOSE: To examine potential relationships between blood pressure, body composition, plasma lipoprotein concentrations and indices of vascular health as assessed with carotid-femoral pulse wave velocity (PWV) and flow mediated dilation (FMD).

METHODS: Fourteen male subjects (age 32 ± 13 yrs, height 177.6 ± 6.6 cm, weight 83.3 ± 9.0 kg, lean mass 61.7 ± 6.3 kg, fat mass 18.4 ± 6.8 kg) volunteered for lab testing as part of a health assessment program, which included resting blood pressure, dual energy x-ray absorptiometry (DXA), FMD, PWV, and blood analysis. All testing was completed on the same day after an overnight fast. The vascular measures were taken via ultrasound, in a temperature controlled room with dim lighting. Each subject would lay supine for 10 minutes prior to the vascular measures. FMD was assessed in the brachial artery in response to a 5-minute distal occlusion. FMD results are given as a percent change from baseline. The PWV measure was assessed on the carotid and femoral arteries using 80% of the total distance between measure sites. PWV results are given in meter per second. All PWV and FMD measures were completed according to previously published procedures (Bortel, 2011; Corretti, 2002.). Body composition was assessed via DXA. Relationships among the data were analyzed with Pearson's r ($\alpha = 0.05$).

RESULTS: No significant relationships were found with PWV or FMD and any of the CVD risk factors measured. The strongest correlations for PWV and FMD are listed in Table 1.

Table 1.

	Lean Mass	% Body Fat	% Android Fat	LDL Particle Size
PWV	R = -0.32	R = 0.26	R = 0.28	R = 0.27
	Lean Mass	Triglycerides	LDL	HDL
FMD	R = 0.23	R = -0.37	R = 0.31	R = -0.34

CONCLUSION: Based on our results, accepted risk factors for CVD, including blood pressure, plasma lipoproteins, and body composition, are not related to indices of vascular health as assessed with PWV and FMD.

- 1860** Board #16 May 30 2:00 PM - 3:30 PM
Greater Forearm Blood Flow is Associated with Better Walking Economy and Gait Speed in Older Adults
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Gait speed decline is a well-established predictor of disability and mortality in older adults. Compromised energetic efficiency (i.e. walking economy) is a strong contributor to gait speed decline, but the underlying mechanisms influencing walking economy are undefined. Impaired vascular function is common with aging and thus may be an important contributor to the development of compromised walking economy and slow gait speed, yet the relationships among blood flow within skeletal muscle, walking economy, and gait speed in older adults are unknown. **PURPOSE:** To examine the relationship between measured forearm blood flow and (i) walking economy and (ii) gait speed in older men and women. **METHODS:** Resting arterial inflow and reactive hyperemic blood flow (RHBF) of the left forearm was measured in 55 participants of the Longitudinal Aging Study at Towson (LAST; 53% male, mean age 70, range 51-91 years) using venous occlusion plethysmography. Walking economy was measured as the average rate of oxygen consumption during the final 2 minutes of a 5 minute standardized treadmill-based walking test at 1.5 mile per hour. Gait speed was assessed during 2.5 minutes of normal-paced walking over a 20-meter course. The association between RHBF and walking economy and RHBF and gait speed was modeled using linear regression, adjusting for age, height, and fat-free mass. Sobel tests were used to assess possible mediating effects. **RESULTS:** In fully adjusted models, RHBF (mean RHBF: $18.0 \pm 5.9 \text{ mL}\cdot 100\text{mL tissue}^{-1}\cdot\text{min}^{-1}$) was negatively associated with oxygen consumption ($\beta = -7.5$, $p < 0.01$), indicating that walking economy was 7.5 mL/min lower for each one-unit increase in blood flow. Gait speed (mean $1.3 \pm 0.2 \text{ m/s}$) was positively associated with blood flow ($\beta = 0.01$, $p = 0.05$), indicating that gait speed was 0.01 m/s faster for each one-unit increase in blood flow. Mediation analyses further suggested that blood flow may mediate the association between walking economy and gait speed ($p = 0.06$). **CONCLUSION:** RHBF is

a significant predictor of both walking economy and gait speed in older adults, suggesting that better overall vascular health is related to enhanced walking economy and gait speed. Therefore, interventions aimed at improving vascular health in the aging population may be beneficial in maintaining gait speed and mobility with age.

1861 Board #17 May 30 2:00 PM - 3:30 PM
Racial Differences In Vascular Function And Blood Flow Responses During Upper And Lower Limb Exercise

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 (No relevant relationships reported)

PURPOSE: Recently, it has been shown that young African American males display lower hyperemic responses, but preserved shear-induced dilation, in response to dynamic handgrip exercise when compared to Caucasian American counterparts; however, it is unknown whether this blunted exercise hyperemia is also present in the lower limbs.

METHODS: Young African American (AA) (n = 4) and Caucasian American (CA) (n = 3) males performed two separate incremental exercise bouts of rhythmic handgrip and plantar flexion exercise while blood flow and diameter were evaluated in the brachial and superficial femoral arteries, respectively. Mean arterial pressure (MAP) and blood flow/vascular function variables (blood flow, shear rate, flow-mediated dilation) were measured in the last minute of each 3-minute workload.

RESULTS: The data revealed no significant group differences during handgrip exercise when examining blood flow (e.g. 24 kg: AA: 666 ± 52 ; CA: 711 ± 60 mL·min⁻¹; p = 0.5), MAP (e.g. 24 kg: AA: 109 ± 5 ; CA: 99 ± 6 mmHg; p = 0.3), or vascular conductance (e.g. 24 kg: AA: 6.2 ± 0.7 ; CA: 7.4 ± 0.8 mL·min⁻¹·mmHg⁻¹; p = 0.3) across all workloads. During plantar flexion exercise, no group differences were reported when evaluating blood flow (e.g. 32 kg: AA: 993 ± 83 ; CA: 713 ± 97 mL·min⁻¹; p = 0.2), MAP (e.g. 32 kg: AA: 104 ± 4.9 ; CA: 106 ± 4.8 mmHg; p = 0.3), or vascular conductance (e.g. 32 kg: AA: 9.6 ± 0.8 ; CA: 7.1 ± 0.8 mL·min⁻¹·mmHg⁻¹; p = 0.6) across all workloads. Slopes derived from the relationship between shear rate and arterial dilation across all exercise workloads were not different between groups when examined in the brachial (AA: 0.00136 ± 0.00034 ; CA: 0.00004 ± 0.00003 ; p = 0.7) or superficial femoral artery (AA: 0.0013 ± 0.0003 ; CA: 0.0002 ± 0.0007 ; p = 0.6).

CONCLUSIONS: Preliminary data revealed no differences in exercise-induced blood flow or vascular responses in the upper or lower limbs when comparing young African American and Caucasian American males.

1862 Board #18 May 30 2:00 PM - 3:30 PM
Improved Maximal Oxygen Uptake Following High-Intensity Interval Training Relates To An Increase In Blood Volume

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Improved maximal oxygen uptake following high-intensity interval training relates to an increase in blood volume

High-intensity interval training (HIT) is an effective training mode for improving maximal oxygen uptake (VO₂max). As past research has focused on peripheral adaptations to HIT, little is known about central factors governing cardiac output and thus VO₂max. **PURPOSE:** The aim of this study was to test the hypothesis that HIT-induced improvements in VO₂max are accompanied by increases in blood volume (BV) and cardiac stroke volume. Further, we investigated if inter-individual differences in the increase in in VO₂max could be attributed to changes in BV. **METHODS:** Twenty subjects (10 females, 10 males) participated in a 6-week long training intervention consisting of 3 HIT sessions per week. Each session comprised of three 30 s all-out sprints against a breaking force equivalent to 7.5% of body weight. The sprints were separated by 2 min rest. VO₂max, peak exercise cardiac output and BV (measured with carbon monoxide rebreathing) was assessed before (PRE) and after (POST) the intervention. **RESULTS:** VO₂max increased by 9% (44.9 ± 7.9 to 48.7 ± 7.8 mL/min/kg) from PRE to POST (P < 0.05) and the increase in BV was 5% (5.4 ± 0.8 to 5.7 ± 0.9 L, P < 0.05) with a corresponding increase in peak exercise stroke volume. Accounting for inter-individual variance, approximately 60% of the change in VO₂max could be attributed to changes in BV. **CONCLUSION:** This is the first study to show that improvements in VO₂max with HIT are associated with increased blood volume. This suggest that a large part of HIT-induced improvements in VO₂max are mediated by increased oxygen delivery, which at least in part is due to increased blood volume.

1863 Board #19 May 30 2:00 PM - 3:30 PM
Visceral Adiposity is Associated with Lower Cerebral Blood Velocity in Older Adults

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(No relevant relationships reported)

Aging is associated with an increased prevalence of obesity and preferential increase in visceral adiposity. Visceral adiposity has detrimental effects on vascular function, which may contribute to reductions in brain blood flow with aging, thereby contributing to stroke risk and cognitive decline. The impact of visceral fat and other components of body composition (total body fat, lean mass) on cerebral blood velocity in older adults has yet to be elucidated. **Purpose:** To evaluate the effects of lean mass (LM), fat mass (FM), and visceral fat (VF), on middle cerebral artery (MCA) mean velocity and conductance in older adults. **Methods:** Twenty-five older adults (60 ± 6 years; 30 ± 5 kg/m²) completed body composition assessments via dual x-ray absorptiometry (Lunar iDXA, GE, Waukesha, WI). Absolute LM, FM, and VF values were obtained and also made relative to total body weight, i.e. LM (kg)/total body weight (kg). Mean MCA velocity (MCav) was assessed using a 2-MHz transcranial Doppler ultrasound probe on the right temporal window. Mean MCA conductance (MCAC) was calculated as MCav/mean arterial pressure (MAP), with MAP obtained from finger photoplethysmography. **Results:** The range of values for this sample were: MCav ($30 - 105$ cm/s), MCAC ($0.30 - 1.05$ cm/s/mmHg), MAP ($79 - 116$ mmHg), LM ($30.73 - 68.80$ kg), FM ($15.55 - 63.25$ kg), VF ($0.20 - 3$ kg), and body weight ($51 - 123$ kg). Absolute LM and VF were negatively associated with MCav and MCAC, however, only VF remained after controlling for body weight (p < 0.05; Table). No relationship was observed for relative LM or FM (either absolute or relative). **Conclusion:** These results indicate that increased visceral adiposity is negatively related to cerebral blood flow in older adults, whereas whole body fat mass was not as sensitive. This suggests the importance of visceral adipose interacting with cerebrovascular physiology in contrast to whole body fat mass among older adults.

	MCav	MCAC	MAP
	r	r	r
Lean Mass	-0.53**	-0.54**	0.15
Lean Mass relative	-0.14	-0.18	0.22
Fat Mass	-0.35	-0.33	-0.03
Fat Mass Relative	-0.098	-0.11	-0.07
Visceral Fat	-0.47*	-0.46*	0.06
Visceral Fat relative	-0.41*	-0.41*	0.05
MCav, mean cerebral artery velocity; MCAC, mean cerebral artery conductance; MAP, mean arterial pressure.	**p<0.01	*p<0.05	

D-55 Free Communication/Poster - Cardiorespiratory Disease

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

1864 Board #20 May 30 2:00 PM - 3:30 PM
An Exaggerated Muscle Metaboreflex In Diabetic Rats Is Mediated By Potentiated Skeletal Muscle Afferent Responsiveness

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 (No relevant relationships reported)

Patients with type 2 diabetes (T2D) exhibit an excessive increase in blood pressure during exercise. Evidence suggests that the skeletal muscle metaboreflex is exaggerated in T2D. However, the underlying mechanisms remain poorly understood. Metaboreflex sensory signals from exercising muscles are generated by activation of chemically-sensitive group IV afferent neurons. It is logical to suggest, therefore, that heightened metaboreflex function in T2D may be caused by enhanced muscle afferent responsiveness to chemical stimulation. **PURPOSE:** The purpose of this study was to

1) examine whether the heightened cardiovascular response to exercise in T2D results from muscle metaboreflex overactivity *in vivo*, and 2) investigate the impact of T2D on neuronal responses to chemical stimulation in skeletal muscle afferents *in vitro*. **METHODS:** For 14-16 weeks, rats were given either a normal diet (control group) or a high fat diet in combination with a low dose (35 mg/kg) of streptozotocin (T2D group). *In vivo*, we measured changes in renal sympathetic nerve activity (RSNA) and mean arterial pressure (MAP) in response to capsaicin administration (0.3 and 1.0 µg/100 µl) in the hindlimb arterial supply. *In vitro*, the function of chemically (1 µM capsaicin) activated group IV neurons were assessed by obtaining single-fiber recordings using a muscle-nerve preparation. **RESULTS:** T2D rats exhibited hyperglycemia after overnight fasting (104±5 vs. 161±10 mg/dL, $P<0.05$). Compared to control, capsaicin administration evoked significantly greater increases in RSNA (0.3 µg: 36±25 vs. 92±17 %; 1.0 µg: 55±26 vs. 246±72 %, $P<0.05$) and MAP (0.3 µg: 15±8 vs. 45±9 mmHg; 1.0 µg: 23±9 vs. 70±5 mmHg, $P<0.01$) in T2D rats. The discharge of group IV muscle afferents to 1 µM capsaicin exposure was likewise significantly greater in T2D rats compared to control (0.8±0.3 vs. 2.9±0.7 Hz, $P<0.05$). **CONCLUSIONS:** These findings suggest that the heightened cardiovascular response to exercise in T2D may be caused by an exaggerated muscle metaboreflex made overactive via a potentiation in muscle afferent responsiveness to chemical stimulation. Supported by Lawson & Rogers Lacy Research Fund in Cardiovascular Disease and the Southwestern School of Health Professions Interdisciplinary Research Grant Program.

1865 Board #21 May 30 2:00 PM - 3:30 PM
Change In Cardiorespiratory Fitness And Prevalence Of Metabolic Syndrome After An Exercise Program
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 (No relevant relationships reported)

Metabolic syndrome (MetSyn) is defined as the clustering of multiple risk factors associated with an increased risk for cardiovascular disease (CVD) and type II diabetes. We, and others, have shown that cardiorespiratory fitness (CRF) is associated with the prevalence of MetSyn, however, it is unknown if a change in CRF with exercise training is related to reduced prevalence of MetSyn. **PURPOSE:** To examine the relationship between the change in CRF and the change in number of MetSyn risk factors following a self-referred exercise program. **METHODS:** Maximal cardiopulmonary exercise (CPX) tests and MetSyn risk factors were analyzed prospectively from 364 adults aged 46.1 years (45% women). MetSyn was defined according to the National Cholesterol Education Program- Adult Treatment Panel III criteria as updated by the American Heart Association/National Heart, Lung, and Blood Institute. Correlations and logistic ordinal regression were used to assess the relationship between the change in CRF and the change in number of MetSyn risk factors following ~6 months of participation in a self-referred, community-based exercise program. **RESULTS:** Overall prevalence of MetSyn decreased from 25% to 15%, while CRF improved 15% (30.9 ±8.1 vs. 35.5 ±8.9 mL/kg/min, $P<0.001$) following the exercise program. Measured change in CRF had a significant, inverse relationship with the change in number of MetSyn risk factors ($r=-0.211$; $P<0.001$). Subjects who improved CRF had a 52% reduction in likelihood of gaining MetSyn risk factors when compared to subjects who did not improve CRF (Odds ratio=0.474; $P=0.030$). **CONCLUSION:** This prospective analysis indicates that there is an inverse relationship between the change in CRF and the change in MetSyn risk factors in a self-referred cohort participating in an exercise program for approximately 6 months. Participating in a community-based, self-referred exercise program yields significant improvements on CRF, the MetSyn risk factors, and the overall prevalence of the MetSyn and therefore should be emphasized as a primary prevention strategy for MetSyn.

1866 Board #22 May 30 2:00 PM - 3:30 PM
Effects of High Intensity Resistance Training on Cardiac Autonomic Modulation in Hypertensive Women
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Individuals with arterial hypertension often have an autonomic nervous system (ANS) imbalance with predominance of sympathetic ANS. This predominance can lead to injury of several organs affecting its functioning. There is evidence that performing high intensity resistance training (RT) with heavier loads and a lower number of repetitions results in lower cardiovascular stress when compared with lighter loads and a higher number of repetitions. However, the effects of different protocols of RT in autonomic modulation are not known specially using nonlinear analyses methods.

PURPOSE: Analyze and compare the effects of different protocols of high intensity of effort RT on autonomic cardiac modulation of hypertensive women using nonlinear methods. **METHODS:** A randomized crossover design clinical trial was conducted with 15 postmenopausal hypertensive women who underwent a control session and two high intensity RT protocols involving 6 and 15 repetition maximum (RM). The nonlinear variables that compose Heart Rate Variability (HRV) were collected pre, immediately post, 1 h post, and 24 h post each protocol. Repeated-measures ANOVA were used.

RESULTS: The SD1 indices that represent parasympathetic activity in the system were lower in 15RM protocol immediately after the exercise (9.32±11.40) when compared with 6RM (16.38±13.15) and control (19.39±13.40) ($p<0.05$). The SD2 indices that represent a global variability in the system also were lower in 15RM protocol especially immediately after (13.84±9.57) the exercise when compared with 6RM (24.19±17.50) and control (29.32±17.41) ($p<0.05$). For the 6RM protocol no relevant clinical changes were observed.

CONCLUSIONS: Performing high intensity RT with lower loads and a higher number of repetitions decreases parasympathetic ANS activity, which may be related to an increased cardiovascular stress. On the other hand, heavier load and lower repetition RT did not have a significant impact upon autonomic modulation when compared to a control session.

1867 Board #23 May 30 2:00 PM - 3:30 PM
Effects Of Sleep-inducing Mixed Juice On Sleep Quality And Cardiac Vagal Regulation In Adults With Disturbed Sleep
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 (No relevant relationships reported)

PURPOSE: To investigate whether the consumption of sleep-inducing juice would effect on sleep quality and cardiac vagal regulation in adults with sleep disorders.

METHODS: This randomized and cross-over design study was conducted on twenty-three adults (24.26±1.39 yrs; 15 females, 8 males) who complained with difficulty in initiating and/or maintaining sleep (PSQI ≥ cutoff score of 5). On feeding session (FS), subjects had received sleep-inducing juice (250ml) twice a day for 8 wks while non-feeding session (N-FS) maintained usual daily life without no juice intake. 2 wks washout was given between two sessions. Anthropometrics and hemodynamic index were taken before and after FS and N-FS. Sleep parameters (e.g. sleep latency) and amount of physical activity had recorded through Actigraph GTX3+ while Pittsburgh sleep diary has completed for consecutive 7 days. For evaluation of cardiac autonomic regulation, heart rate variability (HRV) at resting and during sleep had recorded through Polar RS800CX. In addition, self-reported Pittsburgh sleep quality index (PSQI) and fatigue severity scale (FSS) had completed before and after FS and N-FS. **RESULTS:** Anthropometrics, hemodynamic index, and amount of physical activity had no significant differences between sessions including baseline. Sleep latency, total counts/night, and sleep fragmental index had significant decreases after FS whilst total sleep time and sleep efficiency had significant increase ($p<0.001$, respectively) compared to post N-FS. Moreover, PSQI had significantly decreased after FS ($p<0.001$) coincided with significant decline of FFS ($p<0.001$). Furthermore, vagal activity index (e.g. HF, rMSSD, and SD1) had significant improvement followed by FS ($p<0.05$, respectively) yet there were no significant differences in N-FS. On the contrary, sympathetic nerve activity index (LF/HF ratio) had significant decrease after FS while there was no significant difference after N-FS. **CONCLUSIONS:** Major findings has suggested that consumption of sleep-inducing juice is effective to improve sleep quality accompanied with enhancement of cardiac vagal tone at resting and during sleep. Thus, sleep-inducing juice might be of benefit for managing sleep in adults with disturbed sleep.

D-56 Free Communication/Poster - Basic Science Applications in Skeletal Muscle

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

- 1868** Board #26 May 30 2:00 PM - 3:30 PM
Effect of Short-Term Concurrent Exercise Training on Skeletal Muscle Exosomal miRNAs in Lean and Obese
Brian P. Sullivan¹, Yaohui Nie¹, Sheelagh Evans¹, Chris K. Kargl¹, Zach R. Hettinger¹, Monica J. Hubal², Shihuan Kuang¹, Julianne Stout³, Timothy P. Gavin, FACSM¹. ¹Purdue University, West Lafayette, IN. ²Indiana University-Purdue University Indianapolis, Indianapolis, IN. ³Indiana University School of Medicine- West Lafayette, West Lafayette, IN.
(No relevant relationships reported)

Obesity is associated with chronic inflammation characterized by increased levels of inflammatory cytokines. Exosomes are small microvesicles secreted by cells that contain a variety of molecules including microRNAs (miR), mRNAs, and proteins. Typically, miRs act through post-transcriptional regulation of mRNA targets via mRNA degradation and/or translational repression. Exercise training reduces chronic inflammation. **PURPOSE:** The current study examined if obesity and concurrent exercise training alter skeletal muscle: (1) exosomal miR content, and (2) inflammatory signaling. **METHODS:** Vastus lateralis biopsies were obtained from sedentary lean (LN) and obese (OB) (N=8/group) men and women for analysis of targeted whole skeletal muscle mRNA, miR, and protein; and skeletal muscle derived exosomal miR (via small RNA-seq) before and after seven days of concurrent aerobic and resistance training. Significance at $p \leq 0.05$. **RESULTS:** Pathway analysis of skeletal muscle derived exosomal miR indicated: 1) obesity increases miR targeting cancer, Wnt/ β -catenin, and neuroinflammation in which transforming growth factor β receptor 1 (TGF β R1) is common; 2) exercise training decreases miR targeting IL-10, IL-8, toll like receptor signaling (TLR), and NF- κ B pathways in which RELA, an NF- κ B subunit, is common. In whole skeletal muscle, IL-8 mRNA was reduced 50% (LN: Pre=1.0, Post=0.57; OB: Pre=0.89, Post=0.37) and Jun mRNA was reduced 25% after exercise training (LN: Pre=1.0, Post=0.75; OB: Pre=0.98, Post=0.76) consistent with the anti-inflammatory effects of exercise on skeletal muscle. **Conclusion:** These data suggest that obesity and seven days of exercise training both alter skeletal muscle-derived exosomal contents. The target cells for skeletal muscle derived exosomes and the physiological relevance requires further investigation.

- 1869** Board #25 May 30 2:00 PM - 3:30 PM
Acute Alcohol Ingestion After Resistance Exercise Does Not Alter Phosphorylation Of Upstream Proteins In The mTOR Signaling Pathway
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Consumption of alcohol after resistance exercise (RE) is a common practice and might have negative effects on muscle recovery. Separately, alcohol and RE have opposite effects on signaling through mTOR complex 1 in skeletal muscle, a key pathway involved in muscle protein synthesis. **Purpose:** To investigate the effect of alcohol consumption after heavy RE on the phosphorylation of key proteins upstream of mTOR in skeletal muscle of resistance trained men. **METHODS:** Eleven recreationally resistance-trained men (24 ± 2 y, 178 ± 7 cm, 78.3 ± 8.6 kg) completed 2 sessions of 6 sets of 10 repetitions of Smith machine back squats at 80% of 1 repetition maximum with 2 min of rest between sets. Immediately after exercise participants consumed 30 g of whey protein, followed by a drink (10 min after exercise) containing either alcohol (ALC: 1.09 g EtOH/kg fat free body mass⁻¹) or no alcohol (PLA). Muscle samples were obtained using biopsy before exercise (PRE) and 2 hrs after exercise (2H) and analyzed for phosphorylation at mTOR^{S2448}, TSC2^{S939}, TSC2^{S1387}, and AMPK^{T172} using western blotting. Blood was collected at PRE and 24 hours after exercise (24H) and analyzed for creatine kinase (CK) activity. **RESULTS:** Significant ($p < 0.05$) main effect of time was observed for mTOR^{S2448}, mTOR phosphorylation was (2.9 ± 1.3) times greater at 2H compared to PRE ($F_{(1,10)} = 77.758$, $p < 0.001$, $\eta^2 = 0.774$). No significant main or interaction effect was observed for TSC2^{S939}, TSC2^{S1387}, or AMPK^{T172}. A significant main effect of time with a large eta squared effect size was observed for CK activity. CK activity was greater at 24H (312 ± 137 U·L⁻¹) compared to PRE (135 ± 69 U·L⁻¹) ($F_{(1,10)} = 28.856$, $p < 0.001$, $\eta^2 = 0.558$) indicating that the exercise protocol effectively induced a modest amount of muscle damage on both trials. **CONCLUSION:** Ingestion of a large bolus of alcohol after heavy resistance

exercise did not affect phosphorylation at mTOR^{S2448}, TSC2^{S939}, TSC2^{S1387}, or AMPK^{T172} at 2 hours after exercise in resistance-trained men. Supported in part by grants from the National Strength and Conditioning Association Foundation and the Texas Chapter of the American College of Sports Medicine

- 1870** Board #26 May 30 2:00 PM - 3:30 PM
Autophagy is Stimulated by Acute High-Intensity Interval Training Exercise in Human Skeletal Muscle
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Autophagy is an evolutionary conserved cellular degradation system implicated in maintaining health and promoting longevity. Few human data exist investigating the autophagic response to exercise; however, acute moderate-intensity, continuous exercise (MICT) has been shown to stimulate autophagy in skeletal muscle. Presently, it is unknown whether high-intensity interval training (HIIT) exercise induces autophagy. **PURPOSE:** The purpose of this study was to compare the autophagy response of an acute bout of HIIT exercise (treadmill running) to MICT exercise in human skeletal muscle. **METHODS:** Using a crossover design, ten recreationally-active males (n=5) and females (n=5) performed a bout of MICT (60 minutes at 55% of max velocity [V_{max}]) and HIIT (6 bouts of 1 minute at 100% V_{max} and 1 minute at 3 MPH, followed by 5 minutes at 3 MPH, followed by 6 bouts of 1 minute and 100% V_{max} and 1 minute at 3 MPH). Muscle biopsies from the vastus lateralis were taken pre- and 3 hours post-exercise. Exercise bouts were separated by ≥ 72 hours and performed after abstaining from alcohol for ≥ 24 hours and food and caffeine for ≥ 8 hours. Subjects also refrained from food, energy-containing beverages, and caffeine during the 3-hour post-exercise period prior to the muscle biopsy. Muscle tissue was analyzed for protein expression of markers of autophagy (LC3I, LC3II) and autophagy signaling (p38MAPK) via western blot analysis. **RESULTS:** No differences were detected for LC3I, LC3II, and p38MAPK protein content measured 3 hours post-exercise compared to pre-exercise in both HIIT and MICT bouts ($p > 0.05$). LC3II:LC3I ratio increased 3 hours post-exercise in HIIT ($162.4 \pm 45.9\%$), which was significantly higher than MICT at 3 hours post-exercise which decreased from pre-exercise ($48.8 \pm 9.4\%$; $p < 0.05$). **CONCLUSION:** Our findings show that despite discrepant durations and intensities, HIIT stimulates autophagy in human skeletal muscle, however, in a distinct fashion compared to MICT. Our data also add to the current literature demonstrating that autophagy is activated by continuous (≥ 60 minutes), moderate-intensity ($55 - 70\% \text{VO}_{2max}$) exercise.

- 1871** Board #27 May 30 2:00 PM - 3:30 PM
Senescent Skeletal Muscle Satellite Cell Exosomes Induce Endothelial Cell Senescence and Impair Angiogenesis
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(No relevant relationships reported)

Introduction: Cellular senescence is a state of irreversible cell cycle arrest associated with aging that occurs in many cell types including endothelial cells (EC) and skeletal muscle satellite cells (SC). Senescent cells exhibit an increase in secretion of cytokines and chemokines, often referred to as the senescence associated secretory phenotype (SASP). SCs and ECs co-exist in the muscle niche and cross-talk occurs between the two cell types. Small extracellular vesicles (exosomes) have been implicated as important contributors to the SASP. **Purpose:** Determine if exosomes from human, primary, senescent muscle satellite cells impact human endothelial cell growth, angiogenesis, and senescence. **Methods:** Senescence in primary human skeletal muscle satellite cells (n=6) was induced via incubation with 200 μ m hydrogen peroxide (H_2O_2). Exosomes were collected from normal and H_2O_2 treated satellite cells (NML-EXO and SEN-EXO, respectively). Human umbilical vein endothelial cells (HUVECs) were treated with 50 μ g/ml of NML-EXOs or SEN-EXOs. HUVEC growth and senescence was evaluated using EdU and β -galactosidase staining. HUVEC angiogenesis was measured via matrigel tube formation, wound healing and transwell migration assays. **Results:** After 48-hours, there was a decrease in proliferation (NML-EXOS: 22% vs SEN-EXOS: 18% EdU⁺ cells) and an increase in senescence (NML-EXOS: 40% vs SEN-EXOS: 53% β -gal⁺ cells) in the SEN-EXO treated HUVECs. SEN-EXOs also impaired HUVEC wound healing following a scratch assay by 32.4%. There were no differences in HUVEC tube formation or transwell migration between the two EXO treatments. **Conclusion:** Exosomes harvested from senescent muscle satellite cells appear to transfer a senescent phenotype to HUVECs, resulting in impaired growth and

migration. This study provides evidence that exosomes function as part of the SASP in satellite cells and may propagate a senescent phenotype to neighboring endothelial cells in skeletal muscle with aging.

1872 Board #28 May 30 2:00 PM - 3:30 PM
Effects Of Different Doses Of D-galactose On Skeletal Muscle In C57bl/6j Mouse

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 (No relevant relationships reported)

PURPOSE: Pharmacologically inducible models of aging could help to understand the pathogenesis of sarcopenia and to establish better exercise prescriptions for the elderly. Administration of D-galactose (50-150 mg/kg) has been used to induce aging phenotype including accumulation of oxidative stress, muscle atrophy, and cognitive impairment. A recent paper has shown that a higher dose of D-galactose (500 mg/kg/day) accumulated greater oxidative stress, compared with the commonly used dose (100 mg/kg/day). These observations suggest that there might be room to reconsider the optimal dose of D-galactose. We hence examined whether higher dose of D-galactose (above 100 mg/kg/day) exacerbate skeletal muscle atrophy. **METHODS:** Male C57BL/6J mice (8 weeks old) were divided into 4 groups as follow: 1) Control (0 mg/kg/day, n=10), 2) D-Galactose (150 mg/kg/day, n=10), 3) D-Galactose (1000 mg/kg/day, n=10), and 4) D-Galactose (2000 mg/kg/day, n=10). We intraperitoneally injected D-galactose solution at indicated dose every day for 8 weeks. On the day before tissue collection, we performed grip strength measurement. Twenty-four hours after the final injection, we collected and weighed gastrocnemius muscle, and then conducted histochemical analysis to measure cross-sectional area. **RESULTS:** We first confirmed that body weight and food intake during the intervention were not different among any doses of D-galactose. There were also non-detectable changes in muscle mass and grip strength among groups. We found that D-galactose injection decreased muscle fiber cross-sectional area at 150 mg/kg/day (-13.7%, $P=0.03$), but not at 1000 mg/kg/day (-11.5%, $P=0.10$) and 2000 mg/kg/day (-9.8%, $P=0.19$). **CONCLUSIONS:** Daily injection of D-galactose at 150 mg/kg/day sufficiently induces muscle fiber atrophy. Even if the dose was increased up to 1000 or 2000 mg/kg/day, the muscle fiber atrophy was not aggravated but rather alleviated.

1873 Board #29 May 30 2:00 PM - 3:30 PM
Exercise Activate Tendon Cells through HGFA

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Regular exercise enhances the musculoskeletal systems including tendon strengthening. Tendon cells, consisting of tendon stem/progenitor cells (TSCs) and tenocytes, are essential for the maintenance and repair of tendinous tissues when injured. Previously, we showed that TSCs increase in their number and quality after mice underwent moderate treadmill running. However, the molecular mechanisms underlying the activation of tendon cells by exercise are unknown. Hepatocyte growth factor activator (HGFA) is known to be a systemic factor that can activate skeletal muscle stem cells. **PURPOSE:** To test the hypothesis that HGFA is elevated and activates tendon cells in response to exercise. **METHODS:** Total 18 mice were equally divided into cage control and exercise groups. Exercise was mimicked by one-time treadmill running (OTR), with which mice ran at 13 meter/min for 6 hrs. Twelve hours before OTR, both groups of mice were injected with 1 mg of bromodeoxyuridine (BrdU) per mouse to determine cell proliferation. One day after OTR, all mice were sacrificed and Achilles and patellar tendons were harvested. The HGFA levels in both tendons and serum were measured using ELISA, and BrdU incorporation was assayed by immunofluorescence staining. Student *t*-test was performed to assess statistical significance. **RESULTS:** OTR increased HGFA levels in both Achilles and patellar tendons of OTR mice compared to cage control mice (Fig. 1A). HGFA levels in serum were also significantly increased after OTR (data not shown). Moreover, more BrdU positive cells were present in patellar tendons in OTR group than control group (Fig. 1B), indicating that quiescent tendon cells were activated from G_0 to G_{Alet} by exercise, possibly through HGFA. **CONCLUSION:** Exercise-elevated HGFA possibly may be responsible for the activation of tendon cells. This new molecular mechanism may explain the beneficial effects of exercise on tendon strengthening by stimulating synthesis.

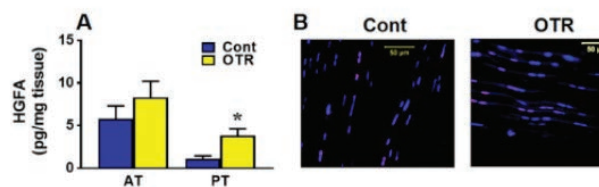


Fig. 1 (A) HGFA is elevated by exercise (OTR) in Achilles (AT) and patellar (PT) mouse tendons (* $p < 0.05$); **(B)** OTR increases the number of tendon cells that incorporated BrdU, indicating that many tendon cells are activated from G_0 to G_{Alet} at one day after exercise.

1874 Board #30 May 30 2:00 PM - 3:30 PM
Ischemia-reperfusion Injury Remodels Skeletal Muscle Motor Unit, Myonuclear-, And Mitochondrial-domains

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Peripheral artery disease (PAD) is a significant medical condition caused by blockages in the arteries of the leg. Some PAD patients progress to critical limb ischemia (CLI) and major amputation. While recent regenerative medicine approaches on collateral vessel formation have made some progress, the myopathy and dysregulation of the skeletal muscle in CLI have not been thoroughly investigated. **PURPOSE:** To determine the regenerative mechanism of the muscle stem cell (MuSC) and its niche components in response to ischemic insults, we assessed interactions between MuSC, vascular- and neural-network, and myofibers at different times points. **METHODS:** The femoral artery ligation mouse model of PAD on different reporter mice were used in the study. Immunofluorescence, single fiber staining, and biochemistry blotting from harvested hindlimb muscles were used for data analysis. One-way ANOVA with Tukey's *post hoc* test and a paired two-tailed *t*-test were performed to determine differences following CLI injury. **RESULTS:** Skeletal muscle regeneration persisted up to 56 days while the number of eMHC⁺ fibers ($p < 0.01$) was highest 14 days following CLI surgery compared to the contralateral sham control. In addition, muscle regeneration was accompanied by significant alterations in the motor unit, as demarcated by the presence of denervated synapses, regeneration of the neuromuscular junction (NMJ), and increased number of subsynaptic nuclei ($p < 0.05$). Furthermore, the size of the myonuclear domain was decreased at 7 and 14 days ($p < 0.01$), corresponding to greater RNA content ($p < 0.001$) and MuSC frequency ($p < 0.05$) while the mitochondrial domain was increased 28 days ($p < 0.01$) following CLI injury. **CONCLUSION:** Overall, these data indicate that as a regenerative response to critical limb ischemia, the neurovascular network of myofibers are remodeled and newly regenerated myofibers exhibit MuSC-derived myonuclear expansion to allow enhanced transcriptional support and an increase in mitochondrial content for a bioenergetic need of the energy-demanding tissue regeneration. Supported by NIH R21AR072287 (YJC) and Regenerative Engineering and Medicine research grant.

1875 Board #31 May 30 2:00 PM - 3:30 PM
Increased Muscle 5alpha-dihydrotestosterone By Acute Resistance Exercise Contributes To Muscle GLUT4 Signaling In Diabetic Rats

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 (No relevant relationships reported)

Our previous study showed that 5 α -dihydrotestosterone (DHT), an active androgen, can be synthesized in skeletal muscle by 5 α -reductase. Recently, we revealed that the increase in muscle DHT level by resistance training was associated with improvement of glycemic control in type 2 diabetic rats. Acute resistance exercise activates signaling pathway such as AMPK/TBC1D1 and Akt/AS160 in skeletal muscle, resulting in enhancement of GLUT4 translocation. However, it is still unclear whether an increase in muscle DHT secretion by acute resistance exercise contributes to up-regulation of

these signaling pathways in type 2 diabetes. **PURPOSE:** This study aimed to clarify whether acute resistance exercise-induced increase in muscle DHT level contributes to muscle glucose metabolism-related signaling pathway in type 2 diabetic rats.

METHODS: Male 20-week-old type 2 diabetic (OLETF) rats were randomly divided into 8 groups: resting control and immediately, an hour and three hours after acute resistance exercise (climbing ladder) with and without treatment of 5 α -reductase inhibitor (N=6 each group).

RESULTS: Muscle 5 α -reductase protein expression and DHT level were significantly increased immediately and an hour after acute resistance exercise ($p<0.05$), whereas these exercise responses were significantly suppressed by the treatment of 5 α -reductase inhibitor ($p<0.05$). Muscle AMPK^(Thr172), TBC1D1^(Ser237) and Akt^(Ser473) phosphorylation were significantly increased at immediately and an hour after acute resistance exercise ($p<0.05$). In addition, muscle AS160^(Thr642) phosphorylation and GLUT4 translocation were significantly increased one and three hours after resistance exercise ($p<0.05$). However, the treatment of 5 α -reductase inhibitor was significantly suppressed the up-regulations of GLUT4 translocation and Akt/AS160 phosphorylation ($p<0.05$), but did not alter the AMPK/TBC1D1 phosphorylation.

CONCLUSIONS: These results suggest that the increase in DHT secretion by acute resistance exercise may partially contribute to enhancement of muscle GLUT4 translocation via activation of Akt/AS160 phosphorylation in type 2 diabetic rats. Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13059, M. Iemitsu).

1876 Board #32 May 30 2:00 PM - 3:30 PM
The Development of Cancer Cachexia Negatively Impacts Skeletal Muscle Extracellular Matrix Remodeling

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(No relevant relationships reported)

Cancer-cachexia is the largely irreversible wasting of lean body mass as a result of cancer progression, affecting ~80% of all cancer patients with as much as ~40% of cancer-related deaths being attributed directly to cachexia. Cachexia has been associated with increased fibrosis and reduced physiological function in cardiac muscle, but the possible role and development of fibrosis and associated extracellular matrix (ECM) remodeling in skeletal muscle has lacked evaluation. **PURPOSE:** To examine the effects of cancer cachexia on ECM remodeling and the development of fibrosis in skeletal muscle. **METHODS:** 40 C57BL/6J mice were injected with either Lewis Lung Carcinoma cells or a PBS control into their hind-flank at 8 wks of age. The tumor was allowed to develop for 1, 2, 3, or 4 wks (n=8 per group). Tibialis anterior (TA) muscle was extracted and immediately frozen for morphology and mRNA abundance analysis using RT-qPCR. **RESULTS:** There were no changes in TA muscle weight until 4 wks post-tumor implantation which resulted in a ~22% lower muscle wet weight compared to PBS control ($p<0.05$). Sirius Red staining of TA muscle sections resulted in no change in collagen abundance in all groups with the exception of a 2-3-fold increase at 4 wks relative to all other groups ($p<0.05$). Collagen 1 gene expression was ~50 % and ~60 % lower than control at 3 and 4 wks post tumor injection, respectively. ($p<0.05$). Collagen 1 gene expression was ~2-fold higher at 1 and 2 wks but there was no difference at 3 or 4wks, all relative to control ($p<0.05$). The ratio of Collagen 3:1 gene expression decreased ~30-50% from 1-3wks compared to control ($p<0.05$), but there was no difference at 4-wks. MMP-2 gene expression was ~50% higher at 1-wk compared to control ($p<0.05$), but was not different 2-4wks from control ($p<0.05$). MMP-9 gene expression was 3 and 6-fold greater than control at 3 and 4-wks post-injection, respectively ($p<0.05$). There was a main effect of tumor implantation to reduce TIMP-1 gene expression ~20-70% ($p<0.05$). **CONCLUSION:** The development of cancer cachexia results in dysregulation of ECM remodeling and increased collagen deposition within skeletal muscle. This dysregulation could negatively affect skeletal muscle's ability to maintain muscle mass and respond to other environmental stressors.

1877 Board #33 May 30 2:00 PM - 3:30 PM
Skeletal Muscle Kir6.2 Protein Expression Correlates To Ion Transport Capacity And Exercise Performance In Athletes

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(No relevant relationships reported)

Skeletal muscle ion regulation may affect exercise tolerance during intense muscle work. However, the inter-play between different sarcolemmal ion transport proteins is not well described in trained skeletal muscle. **PURPOSE:** To examine associations between protein expression of Kir6.2, a key subunit of the ATP-sensitive K⁺ channel (K_{ATP} channel), and exercise performance, as well as different ion regulators and fiber type profile in trained skeletal muscle. **METHODS:** Seventeen competitive women soccer players (age; 23 \pm 4 yrs; height; 166 \pm 5 cm, weight; 60.2 \pm 7.5 kg; VO_{2max}; 50.5 \pm 5.1 ml·min⁻¹·kg⁻¹), participated. Participants has a muscle biopsy obtained from m. vastus lateralis. The Western Blot technique was applied to determine muscle protein expression of Kir6.2, different ion transporters involved in Na⁺, K⁺, Cl⁻, H⁺ and La⁺ sarcolemmal transport, a myriad of metabolic enzymes and muscle fiber type character. Finally, exercise performance capacity was assessed with a VO_{2max} test, a repeated sprint test (RST), as well as the Yo-Yo Intermittent Endurance, level 1 (YYIE1). Inter-individual relationships between selected variables were evaluated by Pearson's product-moment correlation coefficients. **RESULTS:** Muscle Kir6.2 and monocarboxylate transporter 4 (MCT4) correlated ($r=0.59$; $P<0.05$) with MCT4 explaining 35% of the variance in Kir6.2 protein. Moreover, the ratio of MCT4/Kir6.2 muscle protein expression correlated ($P<0.50$; $P<0.05$) to YYIE1 performance. Kir6.2 protein expression also correlated ($P<0.05$) with muscle Na⁺-K⁺ATPase β 1 and the FXVD1 subunits ($r=0.42$ and 0.50 , respectively). Kir6.2 correlated to the expression of Myosin Heavy Chain I (MHCI; $r=0.51$) and Phosphofructokinase (PFK) protein ($r=0.45$). In contrast, no relationship was observed between Kir6.2 and oxidative enzymes. Σ Na⁺-K⁺ATPase subunits correlated ($r=0.46$; $P<0.05$) to Kir6.2 protein expression. The sum of all ion transporters correlated to VO_{2max} ($r=0.58$), RST ($r=0.45$) and YYIE1 performance ($r=0.42$). **CONCLUSIONS:** Skeletal muscle K_{ATP} channel abundance appears to associate with the capacity to regulate ions such as H⁺ and K⁺. Moreover, the capacity to regulate ion homeostasis is associated with exercise tolerance in trained human skeletal muscle.

1878 Board #34 May 30 2:00 PM - 3:30 PM
LINE-1 Retrotransposition Increases with Age in Rodent Skeletal Muscle

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Long interspersed nuclear element-1 (LINE-1 or L1) is termed a genomic parasite due to its ability to randomly copy and paste itself back into the genome. Studies have shown that L1 accounts for roughly 17-18% of the total human genome. However, due to various mutations in most of the L1 elements, only approximately 100 copies are functionally active. L1 has been shown to increase with age in mice skeletal muscle tissue. However, there is no data regarding the effects of aging on L1 activity in rat skeletal muscle tissue. **PURPOSE:** To identify the effects of aging on L1 expression in rat skeletal muscle tissue. **METHODS:** Sedentary male fischer 344 rats were fed ad libitum and were aged to 3, 12, and 24 months (mo) (n=9 per age group) and then sacrificed. Primer sets for qPCR were designed for the youngest most active form of L1 (L1.3), and older L1 elements (L1.Tot). Gastrocnemius skeletal muscle was harvested and then processed for RNA and DNA isolation. Thereafter, the following analysis ensued: L1 mRNA expression, L1 DNA copy number, L1 promotor methylation and ORF1 protein. Additionally, a subset of the tissues from 3 mo (n=8) and 24 mo (n=8) were shipped to LC Sciences for RNA sequencing to analyze L1 related genes. **RESULTS:** Primer sets designed for both L1.3 and L1.tot significantly increased with age (L1.3, $p=0.003$; L1.Tot, $p=0.003$), and was higher at 24 mo compared to 3 mo ($p<0.01$). L1.3 integration into the genome was significantly higher at 24 mo compared to 3 mo ($p=0.021$). ORF1 protein expression significantly increased with age ($p<0.001$), and was higher in both the 12 and 24 mo compared to 3 mo ($p<0.05$). There was no statistical difference for L1 promotor methylation. From RNA sequencing CTCF was significantly higher in 24 mo compared to 3 mo ($p=0.011$). **CONCLUSION:** L1 gene expression appears to increase with age, which leads to more random insertions back into the genome. This may be a result of an increase in

CTCF binding, acting as a co-activator at the L1 promotor, but this hypothesis needs validation. Additionally, L1 promotor methylation, while not statistically significant, was numerically lower with age and this decrease could be contributing to the increase in L1 gene expression. Thus, we provide novel insight as to how L1 gene regulation is altered with age, but more research is needed to test how L1 is affecting skeletal muscle health.

- 1879** Board #35 May 30 2:00 PM - 3:30 PM
Exercise-induced Changes In Circulating Follistatin And GDF-15 Are Intensity- And Duration-dependent
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 (No relevant relationships reported)

Follistatin inhibits the actions of the TGF β family to oppose inhibition of skeletal muscle growth, whereas growth and differentiation factor (GDF) 15 may inhibit muscle growth. The **PURPOSE** of this project was to determine if predominantly aerobic exercise can induce changes in concentrations of circulating follistatin and GDF-15, and if these changes are dependent on exercise intensity and/or duration. **METHODS:** Fifteen recreationally trained young (28.3 \pm 2.0 years) males (n=8) and females (n=7) participated in two bouts of treadmill running: a vigorous intensity/short duration (ViSd) bout at +15% ventilatory threshold for 30 minutes and a moderate intensity/long duration (MiLd) bout at -5% ventilatory threshold for 90 minutes. Blood was collected pre-exercise, 15 minutes from the start of exercise, mid-exercise, and immediately, 1hr-, 2hr-, and 3hr-post exercise. Serum was analyzed with commercially available ELISA kits for follistatin and GDF-15.

RESULTS: At 15 minutes into the exercise bout follistatin was higher (p<0.0001) in MiLd (8.12 \pm 4.7 ng/mL) than ViSd (5.28 \pm 4.3 ng/mL), and GDF-15 was higher (p=0.0002) in MiLd (209.3 \pm 40.8 ng/mL) than ViSd (183.7 \pm 31.2 ng/mL). Follistatin was higher in ViSd 1hr post-exercise (MiLd 9.7 \pm 3.1 ng/mL vs. ViSd 12.1 \pm 7.3 ng/mL; p<0.0001), and higher in MiLd 2hr post-exercise (MiLd 11.2 \pm 3.4 ng/mL vs. ViSd 7.6 \pm 4.2 ng/mL; p=0.0008) and 3hr post-exercise (MiLd 10.1 \pm 3.3 ng/mL vs. ViSd 8.8 \pm 4.9 ng/mL; p<0.0001). GDF-15 was higher in MiLd immediately post-exercise (MiLd 335.0 \pm 75.9 units vs. ViSd 193.5 \pm 34.0 units; p=0.0265), 1hr post-exercise (MiLd 461.0 \pm 84.7 ng/mL vs. ViSd 225.2 \pm 45.7 ng/mL; p<0.0001), and 3hr post-exercise (MiLd 338.2 \pm 70.2 ng/mL vs. ViSd 224.3 \pm 44.8 ng/mL; p<0.0001).

CONCLUSIONS: The differences at the 15 minutes into exercise time point suggest that the exercise-induced follistatin and GDF-15 response is intensity-dependent. The differences post-exercise imply that there may also be a duration effect. Intensity and duration need to be considered to increase follistatin in response to running.

- 1880** Board #36 May 30 2:00 PM - 3:30 PM
Effect of Mechanical Loading of Aged Myotubes on their Myogenic Lineage Progression and Apoptosis
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 (No relevant relationships reported)

PURPOSE: The process of myogenesis is gradually declined and cells apoptosis increases with aging. However, mechanical loading of aged skeletal muscle can ameliorate its impaired myogenic and survival potential. Yet, the molecular responses of aged muscle cells to mechanical loading are still elusive. This study examined the effects of mechanical loading of aged differentiated myoblasts (myotubes) on the signaling and gene expression responses associated with the progression of their myogenic lineage and survival. **METHODS:** C2C12 myoblasts were cultured for 50 consecutive days (68 cell cycles) in order to acquire aging properties, while normal myoblasts were used as a control condition. Subsequently, control and aged C2C12 cells were cultured on elastic membranes until their 9th day of differentiation (myotubes) and then underwent a passive, cyclic stretching (2.2% elongation, at a frequency of 0.25Hz, for 12h). Phosphorylation of signaling proteins ERK1/2 and Akt, as well as the expression of the myogenic factor MyoD were determined by immunoblotting of cell lysates derived from stretched and non-stretched myotubes. Real Time-PCR was used to measure changes in expression levels of the myogenic regulatory factors (MRFs; MyoD, Myogenin, MRF4), growth factors (IGF-1 isoforms: IGF-1Ea, IGF-1Eb), apoptotic factors (Foxo, Fuca, p53) and atrophy factors (Murf1, Atrogin, Myostatin) in response to mechanical loading of the differentiated C2C12 cells. **RESULTS:** Mechanical loading of the myotubes resulted in significant activation of Akt and increase in MyoD protein levels (p<0.05). mRNA expression levels of IGF-1 isoforms (IGF-1Ea: 2.1-fold, IGF-1Eb: 1.2-fold) and MRFs (Myogenin: 11-fold, MRF4 1.2-fold) were increased significantly (p<0.05), while MyoD (0.8-fold), apoptotic factors (FOXO: 0.7-fold, FUCA: 0.3-fold, p53: 0.6-fold) and atrophy factors (Atrogin: 0.09-fold, Myostatin: 0.7-fold, Murf1: 0.09-fold) decreased (p<0.05).

CONCLUSIONS: Upregulation of myogenic and anabolic factors, along with the downregulation of apoptotic and atrophy factors by mechanical loading suggests an amelioration of myogenic and survival ability of the aged myotubes.

- 1881** Board #37 May 30 2:00 PM - 3:30 PM
Nutrients Stimulate Mitochondrial Biogenesis Via PGC-1 α -targeting miRNAs In C2C12 Myotubes.
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 (No relevant relationships reported)

Purpose: Several studies have demonstrated that small nutrients, such as Caffeine (CAFF) and branched chain amino acids, especially Leucine (Leu), induce mitochondrial biogenesis through diverse mechanisms that converge in the activation of PGC-1 α , leading to enhancing transcriptional activity and mitochondrial remodeling. Micro-RNAs (miRNAs) have been known to act as powerful negative modulators of gene expressions involved in essential cellular processes. Recent evidence suggests that miR-494, miR-696, and miR-761 are involved in mitochondrial biogenesis by negative modulation of PGC-1 α signaling. However, it remains unclear whether these miRNAs are regulated individually or cooperatively by nutrients stimulation. Therefore, our study was focused on the effect of Leu and CAFF on these miRNAs functions and how it affected its downstream effectors, and ultimately, mitochondrial biogenesis. **Methods:** Following 5 days of differentiation period, C2C12 myotubes were treated with Leu (1 and 3mM) or CAFF (3mM) containing Dulbecco's modified Eagle's medium (DMEM) without serum and Leu for 24h. The serum and Leu-Free DMEM with a 2% H₂O was used as a control. After 24h of each treatment, the cells were harvested and then, DNA, RNA, and protein (whole fraction) were isolated for immunoblotting and qPCR analyses. Micrographs of four fields per condition were randomly captured before and 24h after treatment to measure myotube diameter. **Results:** Mitochondrial DNA copy number increased significantly 24h after Leu addition, and especially in the CAFF treatment (p < 0.05), compared with the control cells. Similarly, myotube diameter was significantly larger in two Leu-treated groups ($\geq 20\%$, p < 0.05), as well as CAFF supplementation ($\sim 10\%$, p < 0.05), than in control and pre-treatment groups. PGC-1 α protein level and phosphorylation rate of p70S6K were also augmented in both treatment groups. Conversely, miR-494, miR-696, and miR-761 levels were downregulated in the Leu-treated groups, but only miR-761 levels were decreased in the CAFF-treated group. **Conclusion:** These results suggested that nutrients such as Leu or CAFF can regulate the expression of PGC-1 α -targeting miRNAs, which then leads to inducing mitochondrial biogenesis.

- 1882** Board #38 May 30 2:00 PM - 3:30 PM
Changes In Phb1 Modulate Effects Of Different Exercise Modes On Skeletal Muscular Mitochondrial Function in rats
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 (No relevant relationships reported)

PURPOSE: ATP synthesis plays the most important role. ATP synthesis is closely related to the structural and functional integrity of mitochondria. To investigate the effects of PHB1 expression changes on skeletal muscle mitochondrial function in rats of different exercise modes. **METHODS:** 160 healthy male SD rats were randomly divided into four groups: normal control (NC), moderate intensity exercise (MIE), excessive fatigue exercise (EFE), and acute exhaustive exercise (AEE) groups. NC and AEE: routinely raised. MIE: 10 minutes per day at 10m/min for the first week and increased for 10 minutes every day until the end of the second week. From the third week, rats run at 15m/min for 60min every day until the end of the 8th week. Slope: 10%. EFE: From the first week of training, the speed of the running platform is 15m/min, increased by 5m/min per week to 30m/min. Training time is 30 minutes and increased by 20 minutes per week until 110 minutes. Slope: increase by 5% per week until 15%. The EFE and AEE groups were trained for 6 days per week for 8 weeks. AEE: The rats were subjected to acute exhaustive exercise after 8 weeks. They were killed after 48h of the last experiment. Mitochondrial respiratory control rate (RCR), ATP content, ROS level, complex V activity and PHB1 expression were measured. **RESULTS:** Compared with NC, in MIE group, RCR (+73%, P<0.001), ATP content (+48%, P<0.05), complex V activity (+79%, P<0.05), PHB1 expression (+42%, P<0.01) were increased, and ROS level (-75%, P<0.001) was reduced; In OFE group, RCR (-39%, P<0.01), ATP content (+50%, P<0.05), complex V activity (+293%, P<0.001), PHB1 expression (+28%, P<0.01) and ROS level (+62%, P<0.001) were increased; In AEE group, the RCR (-58%, P<0.05), ATP content (-55%, P<0.05), complex V activity (-56%, P<0.001), PHB1 expression (-31%, P<0.01) decreased, and ROS (+79%, P<0.05) level increased. Correlation analysis showed that PHB1 expression was positively correlated with ATP content in three groups. **Conclusion:** Changes in PHB1 expression were consistent with changes in mitochondrial function under different motion modes.

It is suggested that there may be interaction between PHB1 and ATP synthase. PHB1 participates in the stabilization of mitochondrial structure, changes mitochondrial function and affects the body's ability to exercise.

1883 Board #39 May 30 2:00 PM - 3:30 PM
Resistance Exercise And Doxorubicin Treatment: Effects On Antioxidant Enzyme Expression In Type II Muscle

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Doxorubicin (DOX) is a chemotherapy drug used to effectively treat a variety of cancers. Its clinical use, however, is limited by its toxicities commonly attributed to increased oxidative stress in cardiac and skeletal muscle. The DOX-induced rise in oxidative stress can overwhelm endogenous antioxidants yet exercise (both endurance and resistance) has shown promise in attenuating this decline. Little information, however, is available on how DOX and resistance exercise affect antioxidant enzymes in type II skeletal muscle. **PURPOSE:** To determine the effects of resistance training before and during DOX treatment on superoxide dismutase (SOD) 1 and SOD2 expression in the primarily type II extensor digitorum longus (EDL) muscle. **METHODS:** Thirty-six male Sprague-Dawley rats were randomly assigned to one of four groups: sedentary+saline (SSS), sedentary+DOX (SSD), resistance training+saline (RRS), or resistance training+DOX (RRD). The resistance training protocol incorporated a raised cage model where food and water were elevated progressively which provided hind limb loading 10 weeks prior to DOX injection and 4 weeks during DOX treatment. Groups treated with DOX received 3 mg/kg DOX weekly for 4 weeks (12 mg/kg cumulative), and saline-treated groups received 0.9% NaCl as a placebo. Five days following the final DOX or saline injection, EDL muscles were excised, and Western blotting was performed to quantify SOD1 and SOD2 expression. **RESULTS:** Although no significant drug effects, activity effects, or drug x activity interactions were observed with SOD1 and SOD2 expression ($P > 0.05$), a trend toward SSD expressing less SOD1 and SOD2 than SSS was observed (-25% and -37%, respectively). This same trend in SOD1 and SOD2 expression, however, was not observed in RRD (+3% and -3%, respectively vs SSS). **CONCLUSIONS:** The DOX dosing regimen used in the current study had no effect on SOD1 and SOD2 expression in the EDL muscle, and the resistance training protocol also did not affect SOD1 and SOD2 expression. These results suggest that resistance exercise may play a limited role in modulating oxidative stress of DOX in type II skeletal muscle.

1884 Board #40 May 30 2:00 PM - 3:30 PM
Mechanisms Through Which Agents Of Muscle Fatigue, Acidosis And Phosphate, Inhibit Muscle Myosin Function.

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 (No relevant relationships reported)

PURPOSE: During muscle fatigue from intense activity, elevated concentrations of hydrogen ions (acidosis) and inorganic phosphate (Pi) inhibit muscle's ability to generate force and motion. However, it is not clear exactly how these metabolic by-products reduce the force and enzymatic function of muscle's molecular motor, myosin. **METHODS:** To determine these mechanisms we directly measured the effect of these fatigue agents on the force generating capacity of isolated myosin in a laser trap assay and on its ability to hydrolyze ATP in an ATPase assay. **RESULTS:** Acidosis (pH 7.4 vs. 6.5) in a mini-ensemble laser trap assay reduced myosin's average force production by 20% ($p < 0.05$) due to a slowed rate of actomyosin binding. This conclusion was supported by the observation that acidosis slowed myosin's ability to hydrolyze ATP by roughly 90% ($p < 0.05$) in a solution assay. By contrast elevated levels of Pi (0 vs. 10-15mM), in the presence of low pH (6.5), caused a similar reduction in force. However, this was likely due to an accelerated rate of myosin's detachment from actin, because myosin's ATPase rate also recovered back toward the control value (pH 7.4, no Pi) when Pi was added. **CONCLUSION:** Thus, these data provide unique insight into the molecular mechanisms that underlie the loss of muscle function during fatigue. In our current work we are using these findings to explore methods to mitigate these effects *in vitro* in a first step toward attenuating fatigue in diseases such as chronic heart failure.

1885 Board #41 May 30 2:00 PM - 3:30 PM
Molecular Implications of Active and Passive Recovery Following High Volume Resistance Training

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PURPOSE: Deloading is widely practiced in the strength and conditioning community as a method to augment recovery; however, there is little molecular signaling data to fully explain the details of why this practice is beneficial.

METHODS: Recreationally-trained, college-aged males ($n = 30$) underwent 6 weeks of volume based training, after which the participants were split into active recovery (AR) and passive recovery (PR) groups with deload lasting 7 days. Participants donated a muscle biopsy from the vastus lateralis prior to week 1 (PRE), post training (POST), and post deload (DL). Protein expression for mTOR, AMPK, 4EBP1, and p70S6k was evaluated via western blotting. Additionally, blood was obtained via venipuncture, and serum levels of creatine kinase (CK), testosterone (TEST), and cortisol (CORT) were evaluated using commercially available assay kits.

RESULTS: There was an effect of time for phosphorylated (p) 4EBP1 ($p = 0.014$) where PRE ($p = 0.003$) and POSTDL ($p = 0.004$) expression of p-4EBP1 were significantly higher than POST. CK activity also had an effect of time ($p = 0.016$) where CK at POST was significantly higher than at DL ($p = 0.007$). There was a significant group*time interaction of proteasome activity ($p = 0.040$) where post-hoc analysis revealed the AR group exhibited higher proteasome activity DL than the PR group ($p = 0.051$). Differences in protein expression for pan and phosphorylated mTOR, AMPK, p70S6K, and pan 4EBP1 were not significant ($p > 0.05$). Additionally, there were no significant differences in serum testosterone and cortisol levels ($p > 0.05$).

CONCLUSION: AR may stimulate the PI3K/AKT pathway resulting in the phosphorylation of 4EBP1 potentially allowing hypertrophic adaptation to occur. Additionally, proteasome activity being upregulated with AR POSTDL may be beneficial in cleaving damaged protein structures. More research is needed to further investigate molecular signaling after deloading paradigms.

1886 Board #42 May 30 2:00 PM - 3:30 PM
PGC-1/ERR-Induced Regulator in Muscle (PERM1) Increases Mitochondrial Respiratory Capacity in Culture Muscle Cells

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 (No relevant relationships reported)

Peripheral arterial disease is the third leading cause of death of atherosclerotic cardiovascular mortality in the United states and the incidence of PAD increases age. Previous studies have shown that PAD displays impaired mitochondrial respiration, decreased expression of mitochondrial enzymes, increased oxidative stress, and mitochondrial DNA mutations within their ischemic limb muscles. We identified a potential transcriptional regulator of mitochondrial gene expression, PGC-1/ERR-induced regulator in muscle (PERM1) which is reduced 85% in patients with severe PAD. Interestingly, PERM1 regulates the expression of only a subset of genes induced by PGC-1a or ERRs expression in C2C12 myotubes, suggesting that PERM1 selectively functions in specific PGC-1/ERR-driven pathways. **Purpose:** The purpose of this study is to determine whether PERM1 is a potential gene target to aid in tissue recovery and regeneration from hypoxia in C2C12 myotubes. **Methods:** We generated AAVs to overexpress the PERM1 gene or a green fluorescent protein (ZsGreen1). Following AAV infection, C2C12 myoblasts were differentiated into mature myotubes for assessments of mitochondrial biogenesis, mitochondrial respiration, and myogenesis were performed. To determine if PERM1 plays a role in recovering myotube respiration and myotube atrophy from hypoxia, C2C12 myotubes infected AAV-PERM1 were placed in hypoxia for 6-hours and mitochondrial respiratory function, content, and myosin heavy chain area were assessed during the recovery from hypoxic insult. **Results:** AAV-PERM1 resulted in a ~16-fold increase in mRNA expression which drove a ~20% increase in complex I-supported respiration compared to the control cells ($P < 0.05$, $n=6$). Increased Expression of PERM1 did not change the myotube fusion index (an indicator of myogenesis) ($P=0.32$, $n=4$). **Conclusion:** Our results indicate that PERM1 is a strong regulator of mitochondrial biogenesis in skeletal muscle cells, capable of increase both mitochondrial content and respiratory function. Based on these observations, future studies should be aimed at understanding the therapeutic potential of PERM1 for improving muscle energetics in conditions with impaired muscle metabolism, including peripheral arterial disease. Partially supported by AHA Grant 18CDA34110044 to TER.

1887 Board #43 May 30 2:00 PM - 3:30 PM

Xbp1 Promotes Skeletal Muscle Regeneration And Growth In A Cell Non-autonomous MannerKyle R. Bohnert^{1,2}, Ashok Kumar². ¹St. Ambrose University, Davenport, IA. ²University of Louisville, Louisville, KY.

(No relevant relationships reported)

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Purpose: Skeletal muscle exhibits a remarkable capacity for regeneration following injury. However, the molecular mechanisms governing skeletal muscle regeneration remain poorly understood. X-box binding protein (XBP1) is a downstream target of the endoplasmic reticulum (ER) stress inducer inositol-requiring enzyme 1 (IRE1). The purpose of this study was to determine the role of XBP1 in regulation of skeletal muscle regeneration and growth.

Methods: To investigate the role of XBP1 in the regulation of skeletal muscle regeneration and growth, we generated muscle-specific knockout (KO) mice of XBP1. Control and KO mice were then injected with 100 µl of 1.2% BaCl₂ into the tibialis anterior muscle to induce a necrotic injury. In a separate experiment, control and KO mice were subjected to the synergistic ablation model of overload hypertrophy of the plantaris muscle. Skeletal muscle was collected and analyzed using histological and biochemical techniques.

Results: Protein levels of XBP1 are increased in regenerating muscle fibers (1 ± 0.21 vs. 17.66 ± 13.9 , $p < 0.05$). Moreover, genetic deletion of XBP1 inhibits regeneration due to reducing the number 2 or more centrally nucleated fibers (44.2 ± 2.8 vs. 30.7 ± 1.7 , $p < 0.05$) and the number of satellite cells per 100 myofibers (26.5 ± 2.4 vs. 19.3 ± 1.4 , $p < 0.05$). Furthermore, targeted ablation of XBP1 inhibits increases in cross-sectional area of myofibers due to a functional overload in adult mice (2266.3 ± 304.4 µm² vs. 1779.5 ± 150.9 µm², $p < 0.05$). Interestingly, XBP1 does not affect the rate of protein synthesis during muscle growth. Rather, deletion of XBP1 prevents skeletal muscle hypertrophy through reducing the total number of satellite cells per 100 myofibers (9.5 ± 1.1 vs. 5.8 ± 0.8 , $p < 0.05$).

Conclusions: The results of the present study suggest that XBP1 is necessary for skeletal muscle regeneration and adult skeletal muscle hypertrophy. Furthermore, XBP1-mediated signaling in myofibers promotes satellite cell proliferation and fusion in a non-cell autonomous manner. More investigations are needed to further understand the mechanisms, especially gene network that XBP1 regulates during skeletal muscle formation and growth.

1888 Board #44 May 30 2:00 PM - 3:30 PM

Effects of Obesity and Acute Resistance Exercise on Skeletal Muscle Intercellular Communication PathwaysRon T. Garner¹, Yaohui Nie², Shihuan Kuang², Timothy P. Gavin, FACSM². ¹Husson University, Bangor, ME. ²Purdue University, West Lafayette, IN.

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(No relevant relationships reported)

Obesity (OB) disrupts cellular communication consistent with lower skeletal muscle capillarization. Exosomes, small microvesicles, transport and deliver mRNA, miRNA, and proteins in an endocrine manner and are released by muscle during aerobic exercise. The effects of resistance exercise (REx) on exosome biogenesis is unknown.

PURPOSE: Investigate if resistance exercise increases skeletal muscle exosome biogenesis pathways and if this response is impaired in obesity.

METHODS: Lean (LN) and obese (OB) (n=8/group) sedentary men and women performed 3 sets of 8-12 repetitions/set of acute, single leg knee extension resistance exercise at 80% of 1-RM. Vastus lateralis biopsies were obtained at rest and at 15 min, and 3 hr post-exercise. Muscle mRNA, protein expression, fiber typing, and capillary staining were measured.

RESULTS: The gene expression of the exosome biogenesis components hepatocyte growth factor-regulated tyrosine kinase (HGS) and vacuolar protein sorting mutant (VPS4a) were lower in OB than LN at rest (~25%) and at 15 min post- (~20%), but not 3 hr post-exercise. Expression of exosome surface markers apoptotic linked gene-2 interacting protein X (Alix) was lower (OB ~35% and LN ~20% 15min post-exercise) and tumor susceptibility gene-101 (TSG-101) was higher (OB ~50% and LN ~40% 3hr post-exercise) in response to REx in both groups. Acute resistance exercise increased vascular endothelial growth factor (VEGF) mRNA similarly in LN and OB. Interestingly, anti-angiogenic thrombospondin-1 (TSP-1) mRNA was increased by acute REx only in OB (~230% 3hr post-exercise). miR-130a (angiogenesis), miR-206 (myoblast to myotube differentiation) and miR-503 (repressor of cell proliferation) were increased in OB at rest and following exercise. Type II fiber size was greater and capillary density was lower in OB.

CONCLUSION: Obesity alters skeletal muscle exosome biogenesis, angiogenic, and muscle differentiation pathways possibly contributing to greater muscle fiber size and lower muscle capillarization. Resistance exercise alters skeletal muscle exosome marker expression similarly in both lean and obese.

1889 Board #45 May 30 2:00 PM - 3:30 PM

Preliminary study: Leucine Supplementation Exacerbates Muscle Wasting Independent of the Ubiquitin-Proteasome System

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(No relevant relationships reported)

Cancer Cachexia is a devastating syndrome that affects around 50-80% of cancer patients and is characterized by a rapid, drastic fat and muscle mass loss. The APC^{Min/+} mouse strain is a well-studied mouse model of human colorectal cancer and cancer cachexia. The branched-chain amino acid leucine is known to stimulate muscle growth/maintenance through activation of mTOR and protein synthesis.

PURPOSE: To examine the effects of chronic leucine supplementation on cancer cachexia development in APC^{Min/+} mice. **METHODS:** 7 APC^{Min/+} mice (APC) and 11 wild-type (WT) were used for this study. The animals were assigned to the following groups: WT no leucine (WTNL, n=5), WT leucine (WTL, n=5), APC^{Min/+} no leucine (APCNL, n=5) and APC^{Min/+} leucine (APCL, n=2). Mice were given ad libitum access to food and water. Mice in the leucine groups received 1.5% leucine-rich water. Plantaris muscles and tibias were excised at 20 weeks of age. Tissue was immediately frozen for morphology and gene expression analysis using RT-qPCR. **RESULTS:** The number of polyps increased in APC^{Min/+} compared to WT (46.57 ± 2.44 vs 0.00 ± 0.00). The number of polyps < 1 mm was increased (14.33 ± 1.45 vs. 7.75 ± 2.05) in APCL compared to APCNL ($p < .05$). There was a main effect for APC^{Min/+} to have lower body mass than WT ($p < .0001$). There was a main effect of genotype to decrease plantaris weight/tibia length in APC^{Min/+} mice vs. WT mice ($p < .0001$) and a main effect of leucine to decrease plantaris weight/tibia length in APC^{Min/+} mice ($p < .05$), which appeared to be driven by the APC (interaction $p = .0841$). There was an ~8-fold increase in *atrogin-1* gene expression in APCNL compared to WTNL ($p < .05$). *Atrogin-1* gene expression was ~7-fold lower in APCL compared to APCNL ($p < .05$). There was a main effect of genotype to increase *MuRF1* expression in APC^{Min/+} mice compared to WT ($p < .05$) and a main effect of leucine to decrease *MuRF1* expression ($p < .05$), which appeared to be driven by the APC genotype (interaction $p = .0560$). No difference was found in *MyoD* or *Myogenin* gene expression. **CONCLUSION:** The preliminary data suggest deleterious effects of leucine in cancer cachexia, which need to be affirmed by further studies. Based on gene expression of the E3 ubiquitin ligases, this loss in muscle mass may be independent of protein degradation. Supported by the Arkansas Biosciences Institute

1890 Board #46 May 30 2:00 PM - 3:30 PM

Skeletal Muscle Antioxidant Capacity Correlates With Both Oxidative And Glycolytic Profile In Trained Women AthletesATHANASIOS Z. JAMURTAS, FACSM¹, Magni Mohr², Ioannis Fatouros¹, Georgios Ermidis³, Dimitrios Draganidis¹, Martin Thomassen⁴, Morten B. Randers⁵, Peter Krstrup⁶, Lars Nybo⁷. ¹UNIVERSITY OF THESSALY, DEPARTMENT OF PHYSICAL EDUCATION & SPORT SCIENCE, TRIKALA, Greece. ²University of the Faroe Islands, Tórshavn, Faroe Islands. ³Università degli Studi di Napoli "Parthenope", Napoli, Italy. ⁴University of Copenhagen, Copenhagen, Denmark. ⁵University of Southern Denmark, Odense, Denmark. ⁶University of Southern Denmark, Odense, Denmark. ⁷University of Copenhagen, Copenhagen, Denmark.

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(No relevant relationships reported)

Muscle antioxidant enzymes may be upregulated in parallel with increased exercise training status and capacity for reactive oxygen species (ROS) formation. **PURPOSE:** To examine associations between antioxidant protein expression and different physiological markers of endurance exercise in trained women athletes. **METHODS:** Seventeen competitive women soccer players (age; 23 ± 4 yrs; height; 166 ± 5 cm, weight; 60.2 ± 7.5 kg; $\dot{V}O_{2max}$; 50.5 ± 5.1 ml·min⁻¹·kg⁻¹) participated. Participants had a muscle biopsy taken from m. vastus lateralis, which was analyzed for protein expression of superoxide dismutase 1 and 2 (SOD1 and 2), several metabolic enzymes and muscle fiber type profile. Participants also performed a $\dot{V}O_{2max}$ test, a repeated sprint test (RST), as well as the Yo-Yo Intermittent Endurance, level 1 (YYIE1) and Recovery test, level 1 (YYIR1). Inter-individual relationships between selected variables were analysed using Pearson's product-moment correlation coefficients. **RESULTS:** $\dot{V}O_{2max}$ and SOD2 correlated ($P < 0.05$) with $\dot{V}O_{2max}$ explaining 24% of the variance in SOD2 protein expression. Myosin Heavy Chain I (MHCI) and IIa (MHCIIa) explained 26 and 25%, respectively, of the variance in SOD2 protein. Oxidative enzymes such as citrate synthase, isocitrate dehydrogenase and cytochrome

c oxidase correlated ($P < 0.05$) with SOD2 explaining 24, 31 and 17% of the variance, respectively. Finally, SOD2 protein expression correlated ($P < 0.05$) to monocarboxylate transporter 4 (MCT4; $r = 0.67$) and phosphofructokinase (PFK; $r = 0.62$). No statistical relationship was observed between SOD2 protein and neither Na^+/K^+ ATPase subunits, Na^+/H^+ exchanger, Acetyl-CoA carboxylase, PECAM-1, nor YYIE1, YYIR1 and RST performance. SOD1 protein expression displayed an inverse correlation with MHCIIa ($r = 0.61$; $P < 0.05$), but did not correlate with any other variable assessed in muscle or physical capacity. **CONCLUSIONS:** Skeletal muscle antioxidant capacity associates with markers of endurance exercise such as maximal aerobic power, type I and IIa muscle fibers, and mitochondrial function. However, strong relationships were additionally observed between antioxidant profile and lactate production as well as transport capacity, supporting a link between lactate and ROS generation.

1891 Board #47 May 30 2:00 PM - 3:30 PM

Determining The Role Of Cellular Senescence In Skeletal Muscle Regeneration

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Satellite cells drive skeletal muscle regeneration in response to injury, a process regulated by factors released into the local muscle environment. However, the cellular sources of this trophic support are poorly defined. In this regard, recent work on skin and bone repair has revealed a surprising supportive role for cells termed "senescent cells" which are commonly associated with aging and pathology. However, the role of senescence in skeletal muscle repair is currently unknown. The **PURPOSE** of this study is to determine the presence and contribution of senescent cells in skeletal muscle repair following acute injury. **METHODS:** The tibialis anterior (TA) of C57BL/6 mice was injured with cardiotoxin (CTX) and collected 5, 7, 10, 14, and 21 post-injury for histological/immunohistochemical (IHC) and gene expression analysis. To examine the function of senescent cells during muscle repair, mice were treated with a senolytic compound (ABT-263) following injury to selectively ablate senescent cells. **RESULTS:** Senescent cell number (as revealed using the senescence-associated beta-galactosidase (SA- β -gal) assay) increased significantly following injury ($p < 0.05$) and returned to baseline by day 21 post-injury, a time-course that is coincident with the repair process. In agreement with this, qPCR analysis of putative senescence pathways including p16 and p21 and p53 as well as secreted factors commonly secreted by senescent cells such as IL1 and MMP13 were significantly upregulated in injured compared to control tissue ($p < 0.05$). Preliminary IHC analysis demonstrated that at 5 days post-injury, 58% of senescent cells were positive for macrophage marker F480, while at 10 days post-injury, 43% of senescent cells were F480+ and 9% were CD31 positive; an endothelial cell marker. Identification of other cell types is under investigation. Senolytic treatment was effective at removing senescent cells as a significant 44% reduction in the number of SA- β -gal+ cells was observed, the consequences of which on muscle repair are currently under analysis. **CONCLUSION:** Senescent cells are a newly identified component of the muscle repair environment which may influence skeletal muscle repair and satellite cell function.

Supported by NSERC discovery grant and The Canadian Foundation for Innovation and ACOA.

1892 Board #48 May 30 2:00 PM - 3:30 PM

Skeletal Muscle Stress Protein mRNA Response to Aerobic Exercise in Different Environmental Temperatures

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(No relevant relationships reported)

Stress proteins protect skeletal muscle from internal and external stress. Heat shock proteins respond to temperature, exercise and oxidative stress. Cold shock proteins respond to temperature and hypoxia in animals or in cell cultures but have not been studied in humans. The response of cold shock proteins to exercise and physiologically-relevant environmental temperature in human skeletal muscle is not known. **PURPOSE:** The purpose of this study was to determine the early mRNA response of human cold shock and heat shock stress proteins to endurance exercise and environmental temperatures. **METHODS:** Seven recreationally trained males (age: 24 ± 1.2 years; height: 178 ± 1.7 cm; weight: 76.8 ± 1.9 kg; $\text{VO}_{2\text{peak}}$: 4.5 ± 0.2 L $\cdot\text{min}^{-1}$; \dot{W}_{peak} : 290 ± 7.8 W) cycled for 1 hour at 60% \dot{W}_{peak} in 7 °C, 20 °C, and 33 °C environmental temperature. Gene expression for heat shock and cold shock proteins were analyzed using qRT-PCR on muscle biopsy samples taken from the *vastus lateralis* pre- and 3 hours post-exercise. **RESULTS:** RBM3 mRNA was reduced 1.43 ± 0.10 fold ($p = 0.006$) and there was a trend for CIRP to decrease 1.27 ± 0.14 fold ($p = 0.059$) from pre- to 3 h post-exercise. CIRP and RBM3 mRNA were not different between temperatures ($p = 0.273$ and $p = 0.686$, respectively). HSP70 mRNA was 2.27 ± 0.23 fold higher 3 h post-exercise when compared to pre-exercise ($p = 0.002$) but was not significantly different between temperatures ($p = 0.103$). HSP27, HSP90, and HSF1 mRNA did not change from pre- to post-exercise ($p = 0.052$, $p = 0.324$, $p = 0.795$) and were not different between temperatures ($p = 0.247$, $p = 0.134$, $p = 0.808$). **CONCLUSIONS:** These data indicate that exposure to mild heat and cold during aerobic exercise have limited effect on the skeletal muscle mRNA expression of heat shock and cold shock proteins. However, this novel study found cold shock protein mRNA of skeletal muscle decreases, whereas HSP70 mRNA increases in response to a low to moderate intensity aerobic exercise bout. Supported by the National Institute for General Medical Science, Nebraska IDeA Networks for Biomedical Research Excellence (INBRE), and the University of Nebraska at Omaha Committee on Research and Creative Activity.

2.27 \pm 0.23 fold higher 3 h post-exercise when compared to pre-exercise ($p = 0.002$) but was not significantly different between temperatures ($p = 0.103$). HSP27, HSP90, and HSF1 mRNA did not change from pre- to post-exercise ($p = 0.052$, $p = 0.324$, $p = 0.795$) and were not different between temperatures ($p = 0.247$, $p = 0.134$, $p = 0.808$).

CONCLUSIONS: These data indicate that exposure to mild heat and cold during aerobic exercise have limited effect on the skeletal muscle mRNA expression of heat shock and cold shock proteins. However, this novel study found cold shock protein mRNA of skeletal muscle decreases, whereas HSP70 mRNA increases in response to a low to moderate intensity aerobic exercise bout. Supported by the National Institute for General Medical Science, Nebraska IDeA Networks for Biomedical Research Excellence (INBRE), and the University of Nebraska at Omaha Committee on Research and Creative Activity.

1893 Board #49 May 30 2:00 PM - 3:30 PM

Elucidation for Underlying Mechanisms of Chronic Diseases and Potential Applications through Exercise-induced Autophagy

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Purpose: It is well known that "Exercise is Medicine". Exercise is a publically recognized and effective intervention strategy for a series of chronic diseases including obesity, diabetes, sarcopenia, and aging-related cognitive dysfunction. However, its molecular mechanisms for the beneficial prevention and treatment of chronic diseases and health promotion have not been systematically explored and elucidated. Since autophagy has been gained extensive attention in the field of medical science, the Nobel Prize in Medicine has been awarded to Yoshinori Ohsumi in 2016 as the pioneer scientist due to his achievements of autophagy in the prevention and treatment of diseases, health promotion, anti-aging, and lifespan extension. Therefore, elucidating the mechanisms of chronic diseases through exercise-induced autophagy and exploring its potential applications are highly desired.

Methods: A series of animal models were established for evaluating exercise intervention efficacy of chronic diseases, and exploring the underlying mechanisms and potential applications through western blotting, RT-PCR and TSM techniques.

Results: Our studies have confirmed that appropriate exercise intervention is a promoter of autophagy, which can rescue the dysfunctional status of autophagy and abnormal mitochondrial energy metabolism in chronic diseases. The autophagy or microRNA-mediated autophagy regulates insulin sensitivity and increases mitochondrial quality control, thereby realizing the prevention, treatment and rehabilitation of chronic or aging-related diseases.

Conclusion: Exercise-induced autophagy is benefit for the prevention and treatment of chronic diseases and health promotion. These promising studies also provide clear targets to develop novel drug candidates, food supplements, or mimic exercise pills for the prevention and treatment of chronic diseases, and health promotion.

1894 Board #50 May 30 2:00 PM - 3:30 PM

Mitochondrial Ant2 And Ucp2 Expression In Mouse Liver During Colon-26 Tumor-induced Cachexia

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(No relevant relationships reported)

Cancer cachexia is a life-threatening paraneoplastic condition characterized by unintended weight loss and skeletal muscle atrophy. Recent frameworks describe cancer cachexia as a systemic disease in which several non-muscle organs are reprogrammed or remodeled. The liver exerts major control over systemic metabolism yet has been relatively unexplored in cancer cachexia. Previous reports indicate loss of oxidative phosphorylation (OXPHOS) coupling efficiency in the cachectic liver, through currently undefined mechanisms. **PURPOSE:** To investigate mitochondrial Ant2 and Ucp2 expression in the liver during colon-26 tumor-induced cachexia, and their relationship to OXPHOS coupling efficiency. **METHODS:** Balb/c males (10 wks) were assigned to receive an injection of sterile PBS or 10⁶ colon-26 (C26) tumor cells. Tissues were collected from PBS-injected weight-stable mice (PBS-WS), C26 mice that were weight-stable (C26-WS), and C26 mice with moderate (10% weight loss, C26-MOD) and severe cachexia (20% weight loss, C26-SEV) ($n = 4-7$ per group). The liver was analyzed by high-resolution respirometry and immunoblotting to determine mitochondrial respiration and protein expression, respectively. Citrate

synthase activity was assayed as a proxy for mitochondrial density. The respiratory control ratio (RCR), an index of OXPHOS coupling efficiency, was determined in the complex I-linked state. **RESULTS:** RCR was ~25-60% lower in all C26 groups compared to PBS-WS ($p<0.05$). C26-SEV also had lower RCR than C26-MOD ($p<0.05$). Together this may signify an early loss of liver OXPHOS coupling efficiency due to cancer, that subsequently worsens when severe cachexia develops. Citrate synthase activity was not different between groups ($p>0.05$), suggesting the impairment of respiratory function to be independent of mitochondrial mass. Ucp2 expression was not different between groups ($p>0.05$). However, Ant2 expression was greater in C26-SEV compared to PBS-WS, C26-WS, and C26-MOD, by 15-30% ($p<0.05$). Ant2 expression related inversely with RCR in the liver ($r=-0.547$, $p<0.05$), implying higher liver Ant2 content to be associated with uncoupling of OXPHOS. **CONCLUSION:** We highlight an under-recognized role of liver mitochondria in cancer cachexia, and suggest hepatic mitochondrial function to be a therapeutic target.

1895 Board #51 May 30 2:00 PM - 3:30 PM
Leptin Gene Polymorphism, Plasma Leptin Levels And Aerobic Capacity In Response To Intense Exercise

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 (No relevant relationships reported)

PURPOSE: The aim of the present study was to determine the association between single nucleotide polymorphisms (SNPs) in the leptin (LEP) and leptin receptor (LEPR) genes, and body composition, plasma leptin levels, and aerobic capacity in response to 48 h of intense exercise. **METHODS:** Male Brazilian Army cadets ($n=163$; 21.6 ± 0.4 years) were genotyped for the LEP 19G>A (rs2167270) and -2548G>A (rs7799039), and LEPR 668A>G (rs1137101) polymorphisms. Anthropometric, hormonal and aerobic capacity parameters were measured 48 h after intense military exercise. **RESULTS:** Sixty-seven percent of participants were classified as having superior aerobic conditioning ($VO_{2max}=55.2\pm0.2$ mL·kg⁻¹·min⁻¹), and had lower plasma leptin levels (36%, $P=0.008$) than subjects classified as having excellent aerobic conditioning. Considering all subjects VO_{2max} correlated negatively with fat mass ($r=-0.212$; $P=0.007$), whereas plasma leptin level correlated positively with body fat ($r=0.642$, $P=0.005$) and fat mass ($r=0.723$, $P=0.001$), and negatively with VO_{2max} ($r=-0.223$, $P=0.005$). Only individuals homozygous for the wild-type homozygote for LEP -2548G>A SNP had higher plasma leptin values (59%), body fat (85%), and fat mass (82%) ($P<0.05$) compared to those with a GA genotype. LEP -2548G>A SNP was a positive predictor for plasma leptin levels ($B=0.217$, $P=0.02$), after adjusting for fat mass, and therefore, genotype effects may affect leptin levels. **CONCLUSIONS:** Polymorphism in the leptin promoter gene may influence plasma leptin levels, but not aerobic capacity, in response to intense physical exercise. Additional studies are needed to show the precise contribution of the SNPs on aerobic capacity. Financial support FAPERJ.

D-57 Free Communication/Poster - Body Composition and Integrative Physiology

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

1896 Board #52 May 30 2:00 PM - 3:30 PM
Agreement Between Dual-Energy X-Ray Absorptiometry and a New Standing Bioimpedance Spectroscopy Device for Detecting Changes in Fat-Free Tissue

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 (No relevant relationships reported)

Dual energy X-Ray absorptiometry (DXA) determined lean tissue mass has long been regarded as a criterion method for determining and monitoring changes in whole body and appendicular skeletal muscle mass. However, its utility is limited and restrictive due to patient size limitations, cost, specialized operator training and patient radiation exposure. **PURPOSE:** Herein, we sought to compare measurements of whole-body fat free tissue mass (FFTM) determined by a new standing bioimpedance spectroscopy

(BIS) device as well as DXA before and after six weeks of progressive resistance training. **METHODS:** Twenty-three resistance-trained males (mean \pm SD, age: 21.6 ± 2 , height: 178.4 ± 7.8 cm, weight: 80.9 ± 10.5 kg) underwent six weeks of resistance training. DXA (Lunar Prodigy iDXA, G.E.) and BIS (SOZO, ImpediMed Inc.) were administered pre and post-intervention with participants in a fasted and normally-hydrated state wearing a t-shirt and athletic shorts for determination of whole body FFTM. Agreement between methods for determination of whole body FFTM at each time point and across time were determined by Bland and Altman plot analysis (mean difference and 95% limits of Agreement), bivariate linear regression analysis and dependent samples t-tests with statistical significance set at $p<0.05$. **RESULTS:** Bland and Altman plot analysis revealed good agreement between methods producing a mean difference and 95% LOA of 1.9 ± 2.3 kg, respectively. Regression analysis revealed a strong and significant relationship ($r=0.96$, $r^2=0.92$, $SEE=2.2$ kg, $p<0.001$) between DXA and BIS-derived FFTM. Both DXA and BIS-derived FFTM significantly ($p<0.001$) increased post-training (pre vs post, 63.2 ± 7.9 vs 65.8 ± 7.4 and 65.2 ± 8.3 vs 67.6 ± 7.2 kg, respectively). Importantly, mean FFTM delta scores were not statistically different between DXA and BIS (2.6 ± 1.4 vs 2.4 ± 2.6 kg, $p=0.57$). Furthermore, regression analysis revealed a significant relationship between DXA and BIS-derived FFTM delta scores ($r=0.72$, $r^2=0.52$, $SEE=1.01$ kg, $p<0.001$). **CONCLUSIONS:** BIS-derived FFTM agrees well with DXA-derived FFTM for single measurements as well as following resistance training-induced skeletal muscle hypertrophy and is an accurate and acceptable alternative to DXA. Funding provided by ImpediMed, Inc. Jordan R. Moon is an employee of ImpediMed Inc

1897 Board #53 May 30 2:00 PM - 3:30 PM
Body Composition and Aerobic Capacity in NCAA Division I Cross-country Athletes Across a Season

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Body composition has several implications for the overall health and performance of athletes. Changes in body composition can serve as indication of the physical demands of a competitive season as well as provide valuable feedback of the training adaptations from different training regimens. **PURPOSE:** To evaluate the pre- to post-season changes in body composition and maximal aerobic capacity in male (MXC) and female (WXC) Division I cross-country athletes. **METHODS:** Eleven MXC (age: 18 ± 1 yrs; body fat: $9.8\pm4\%$) and 13 WXC (age: 18 ± 1 yrs; body fat: $19.8\pm4\%$) participated. Body composition [(lean mass, LM; leg lean mass (LLM); fat mass, FM, body fat%) and bone mineral density, BMD] were measured pre- and post-season by DXA. Regional BMD of the total body, lumbar spine (L1-L4), hip (femur), LM and FM were obtained for analysis. The appendicular skeletal muscle adjusted by squared height (ASM index; kg/m²) and the lean mass index (LMI = (LMpost-LMpre)/(FMpre-FMpost)) were calculated to assess body composition changes. A self-paced maximal oxygen uptake (VO_{2MAX}) test was used to assess aerobic capacity. Participants completed 5 \times 2-min stages at a self-selected speed for each stage corresponding to ratings of perceived exertions of 11, 13, 15, 17 and 20, respectively. ANOVAs were used for analysis with significance accepted at $p<0.05$. **RESULTS:** Total body LM increased significantly in both MXC and WXC, with MXC increasing to greater extent than WXC ($+1.37\pm0.9$ vs $+0.56\pm0.9$ kg; $p<0.05$). The ASM and LLM increased significantly in both MXC and WXC from pre- to post-season ($p<0.05$), with no differences between genders. Further, the LMI did not differ between groups ($+2.15\pm3.9$ vs $+1.33\pm3.7$ kg). There were no gender by time and no time effects for FM, body fat% and regional BMD. There were no pre- to post-season changes in VO_{2MAX} for both MXC (70.3 ± 4.3 to 69.5 ± 3.9 mL/kg/min) and WXC (56.6 ± 3.9 to 58.3 ± 5.3 mL/kg/min). **CONCLUSIONS:** Results suggest highly trained cross-country athletes experience positive changes in total and regional LM with no changes in FM, body fat% and BMD. Aerobic capacity was maintained across the season despite increases in LM. Results highlight the seasonal changes in body composition in collegiate distance runners that may inform strength and conditioning coaches and athletic trainers.

1898 Board #54 May 30 2:00 PM - 3:30 PM
Low Carbohydrate Diet On Body Composition Of Trained Crossfit Individuals

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 (No relevant relationships reported)

Effects of low carbohydrate diet on body composition of trained Crossfit individuals

Purpose: To evaluate the influence of low carb diet on body composition of trained individuals. **Methods:** Twenty eight CrossFit practitioners (M:13, W:15, age range: 19-59 years) for at least 6 months followed a personalized diet plan for 2 months. The diet had 27% of energy from carbohydrate, 50% of energy from fat and 23% of energy from protein, and consisted of 5 meals per day, comprising mainly of fruits and vegetables, complex carbohydrates (cereals and tubers) and animal proteins (red meat limited to 3 times/week). The body weight was measured to the nearest 0.01 kg using electronic scales and body composition (including percent body fat, muscle, and fat mass) was evaluated by portable ultrasound during the days 1, 30 and 60 of the dietetic program. The collected measures were chest, triceps, subscapular, medial axillary, suprailiac, abdomen and medial thigh. The equations developed by Jackson and Pollock were used for the calculation of body density. Waist and hip circumference were also measured. Samples were tested for normal distribution and groups were compared by either paired Student's t-test or Mann-Whitney test. The type 1 error was set at $p < 0.05$. **Results:** There was a significant reduction in body weight and hip circumference after 30 (weight: 79.8 ± 15.4 vs 77.5 ± 14.4 , $p < 0.001$; hip circumference: 107.6 ± 6.9 vs 104.9 ± 7.3 , $p = 0.007$) and 60 days (weight: 79.8 ± 15.4 vs 77.0 ± 14.6 , $p < 0.001$; hip circumference: 107.6 ± 6.9 vs 105.58 ± 8.3 , $p = 0.007$) of dietary intervention. Additionally, was observed a significant reduction of total fat and %body fat after 30 (total fat: 23.8 ± 16.1 vs 20.4 ± 15.6 , $p = 0.004$; % body fat: 25.1 ± 6.5 vs 21.5 ± 5.3 , $p < 0.001$) and after 60 days (total fat: 23.8 ± 16.1 vs 19.9 ± 15.3 , $p < 0.001$; %body fat: 25.1 ± 6.5 vs 20.0 ± 5.5 , $p < 0.001$) and a significant gain of body fat-free mass after 60 days (59.1 ± 12 vs 60.9 ± 13 , $p = 0.01$). When subgroup analyses were performed by sex, it was found that the relative loss of body fat was similar. Thus, there was no difference between lean mass gain between men and women. **Conclusion:** The low carbohydrate diet promoted body weight, total fat and % body fat reduction and fat-free mass gain, independently of sex, after 30 and 60 days, in trained Crossfit individuals.

1899 Board #55 May 30 2:00 PM - 3:30 PM
Body Composition and Muscle Contractile Properties in Male Professional Soccer Players
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 (No relevant relationships reported)

PURPOSE: Lower limb muscle injury accounts for >50% of all injuries in professional soccer. Despite this, there is an absence of body composition and muscle function reference ranges in professional players. The purpose of this study was to generate lower limb reference ranges for lean tissue mass (LTM) and muscle contractile properties, which could be used to monitor associations with injury risk in prospective cohort studies. **METHODS:** Professional soccer players ($n=193$; age: 21.6 ± 4.4 years, height: 180.2 ± 10 cm, weight: 78 ± 11.2 kg), free from illness and injury, from the English Soccer League participated in this study. Whole body and lower limb LTM ($n=130$) was estimated using Dual X-Ray Absorptiometry (DXA; Lunar iDXA™; GE Healthcare, WI). Lower limb (Adductor Magnus (AM), Bicep Femoris (BF), Gastrocnemius Lateralis (GL), Gastrocnemius Medialis (GM), Gluteus Maximus (GT) and Rectus Femoris (RF)) muscle contractile properties ($n=193$) were assessed using Tensiomyography (TMG); GK 40, Panoptik d.o.o., Ljubljana, Slovenia). Maximal muscle displacement (Dm) and contraction time (Tc) were estimated for all muscles. **RESULTS:** Soccer players were homogenous in whole body (76.7 ± 8.8) and lower limb (21.7 ± 2.5 kg) LTM. Midfielders had lower RF-Tc than Goalkeepers (29.2 ms vs 32.8 ms; $P=0.034$). Forwards had lower GT-Dm than Defenders (9.1 mm vs 10.7 mm; $P=0.042$). There was no difference in lower limb LTM or contractile properties between dominant and non-dominant limbs ($P>0.05$). Increasing lower limb LTM was associated with a reduction in Dm (right= $-.375$, left= $-.394$; $P<0.05$). Lower limb muscle contractile properties normalised to lower limb LTM were higher in forwards compared to other outfield playing positions ($P<0.05$). **CONCLUSIONS:** Our findings suggest players are homogenous in terms of the total amount of LTM and contractile function regardless of leg (dominant vs. non-dominant) studied. Differences in muscle contractile properties between playing positions may represent differences in positional demands. Increasing LTM might have been expected to produce increasing Dm; however, an increase in LTM is associated with an increase in non-contractile tissue that may lead to an overall reduction in contractile mass.

D-58 Free Communication/Poster - Musculoskeletal Mechanics and Modeling

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

1900 Board #56 May 30 2:00 PM - 3:30 PM

Electromyographic Evidence of Excessive Achilles Tendon Elongation During Isometric Contractions After Achilles Tendon Repair

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PURPOSE: Increased tendon elongation after Achilles repair is thought to contribute to selective weakness in end-range plantarflexion (PF). Excessive tendon elongation during maximum voluntary contraction (MVC) means greater muscle fiber shortening. Since mean frequency (MF) of the electromyogram (EMG) increases with decreasing fiber length, it was hypothesized that MF would be higher on the involved (Inv) versus non-involved (Non) side during isometric PF MVCs. The purpose of this study was to examine MF during isometric MVCs in patients with Achilles tendon repairs. **METHODS:** Isometric PF MVC was measured at 20°, 10°, 0° dorsiflexion (DF), and 10°, 20° PF, in 17 patients (age, 39 ± 9 years; 15 men, 2 women) 43 ± 24 months after surgery. Surface EMG signals were recorded during MVCs. MF was calculated from Fast Fourier Transforms of medial gastroc (MG) lateral gastroc (LG) and soleus (S) EMG signals. Effect of weakness on MF was assessed using analysis of variance. **RESULTS:** Patients had weakness in 20° PF (deficit $28 \pm 18\%$, $P < 0.01$; 14 of 17 deficit >20%) but no weakness in 20° DF (deficit $8 \pm 15\%$, $P = 0.20$; 4 of 17 deficit >20%). MF increased moving from DF to PF ($P < 0.001$) but was not different between Inv and Non ($P = 0.22$). At 10° PF 8 of 17 patients had weakness (>20% deficit). MF was significantly higher on Inv versus Non, across all angles, in patients with weakness versus no weakness at 10° PF (side by group $P = 0.014$; Table 1). MF was 13% higher on Inv versus Non in patients with weakness ($P = 0.012$) versus 3% lower in patients with no weakness ($P = 0.47$). **CONCLUSIONS:** Higher MF for Inv versus Non in patients with PF weakness is consistent with greater muscle fiber shortening. This indicates that weakness was primarily due to excessive lengthening of the repaired Achilles tendon. If weakness were simply due to atrophy, a lower MF would have been expected.

Table 1	MG MF (Hz)			S MF (Hz)			LG MF (Hz)		
	Inv	Non	Inv/Non	Inv	Non	Inv/Non	Inv	Non	Inv/Non
Weak (n=8)	193±34	169±34	P=0.02	181±21	168±23	P=0.13	185±47	157±27	P=0.04
Strong (n=9)	165±31	170±23	P=0.63	165±20	168±24	P=0.70	154±26	162±38	P=0.54

1901 Board #57 May 30 2:00 PM - 3:30 PM

Spatial Resolution Of The Medial Gastrocnemius Mechanomyograph Resolved By Time-frequency And Principle Pattern Analysis

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 (No relevant relationships reported)

PURPOSE: The purpose of the present study was to examine the mechanomyograph of the medial gastrocnemius spatially using a grid of nine accelerometers during electrically-invoked contractions. **METHODS:** 16 (8M, 8F) moderately-active volunteers (mean age = 21 ± 3 y) with measurable H-reflexes participated. The tibial nerve was stimulated in 2V increments with 10-second rest intervals, and data where the peak-to-peak M-wave amplitude exceeded the H-reflex were analyzed. Peak-to-peak MMG (MMG_{p-p}) data were subjected to the intensity analysis, and total intensity, the peak total intensities (Max), and time to Max (TTMax) were determined. Maps of the dependent variables were plotted across a 9-accelerator grid for each stimulus for each participant to be analyzed. The MMG intensity analyses were subjected to a principle pattern analysis (p-space) and p-values ($P, n = 5$) were compared intra-subject. Pearson's r among the dependent variables and repeated measures ANOVA were calculated for P, MMG_{p-p} , Max, and TTMax, by stimulus (Stim) and accelerometer (ACC) using R open source software (www.r-project.org). Statistical significance was set at $\alpha = 0.05$. **RESULTS:** A significant correlation existed only for MMG_{p-p} and Max ($r = 0.9434$, $p < 0.0001$). RM-ANOVA demonstrated significant effects of Stim for MMG_{p-p} and Max; ACC for MMG_{p-p} , Max, and TTMax; and Stim by ACC for TTMax ($p < 0.001$). Progression of the MMG acceleration maps varied across individuals and ACCs. P-space analysis revealed significant differences between p-values for all participants ($p < 0.001$), significant effects for ACC ($p < 0.01$) in

eight participants, and Stim ($p < 0.05$) in five participants. In addition, there were significant interactions for Stim by P ($n = 6$, $p < 0.01$) and ACC by P ($n = 1$, $p < 0.01$). **CONCLUSIONS:** MMG varies spatially for the medial gastrocnemius and between individuals. Mapping the MMG acceleration may allow researchers to identify characteristic differences among individuals, as well as individual muscles (e.g., soleus). More research is suggested to identify such differences.

1902 Board #58 May 30 2:00 PM - 3:30 PM
Effect Of Ballet Dance On Knee Joints Muscle Strength Based On The Isokinetic Research

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PURPOSE: Several researches have revealed that dance training increases muscle strength. By comparing the muscle strength of knee joints of ordinary college students with ballet dance students', the differences between the two groups were analyzed and the influence of dance on muscle strength was explained.

METHODS: 48 healthy college students volunteered to participate in the study. Experimental group consisted of 24 Ballet students (12 male, 21.5±0.9years; 12 female, 20.9±1.8years); control group consisted of 24 non-dance students (12male, 20.7±0.9years, 12 female, 20.6±0.8years). German ISOMED2000 Isokinetic test device was used to test the knee joints strength of all participants, with the concentric contraction test going first and then following the eccentric contraction test, with the testing angular of 60°/s, 180°/s. The test variables include peak torque, relative peak torque and the peak torque ratio of flexion and extension. **RESULTS:** The result showed that the female and male Ballet students have significantly higher peak torque (N·m) and relative peak torque (Nm/Kg) at all angular of knee flexion and extension than non-dance students (All peak torque flexion at 60°/s and 180°/s: 81.805±10.84 vs. 58.725±7.34 and 68.055±9.22 vs. 46.875±8.78; both $p < 0.01$. All peak torque extension at 60°/s and 180°/s: 178.335±25.88 vs. 124.2±19.54 and 128.465±14.96 vs. 92.505±16.41; both $p < 0.01$. All relative peak torque flexion at 60°/s and 180°/s: 1.29±0.14 vs. 1.02±0.14 and 1.08±0.14 vs. 0.81±0.13; both $p < 0.01$. All relative peak torque extension at 60°/s and 180°/s: 2.84±0.43 vs. 2.17±0.38 and 2.04±0.25 vs. 1.61±0.28; both $p < 0.01$). However, there is no significant difference in peak torque ratio of flexion and extension between two groups ($P > 0.05$).

CONCLUSIONS: The results indicated that long-term ballet training can obviously improve the control strength and outbreak power of knee flexion and extension. Ballet training leads to a balanced effect impact on hamstring and quadriceps, which helps to avoid knee injuries and improve the dance movements. **Acknowledgements:** This work was supported by Beijing philosophy and social science foundation research (Grants No.14JDWYB011).

1903 Board #59 May 30 2:00 PM - 3:30 PM
Ankle Related Musculotendinous Stiffness in Individuals With and Without Chronic Ankle Instability

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Chronic ankle instability (CAI) is a multifaceted condition linked to life-long residual symptoms and post-traumatic ankle osteoarthritis. Musculotendinous stiffness (MTS) is a vital component of joint stability but to date, only passive joint stiffness has been quantified in those with CAI. **PURPOSE:** To compare ankle related musculotendinous stiffness between CAI patients and uninjured controls. **METHODS:** 20 CAI (18F, 2M; 20±1 years, 172±7cm, 68±13kg) and 20 uninjured healthy controls (18F, 2M; 20±1 years, 69±8cm, 60±8kg) volunteered to participate. CAI participants had experienced at least one lateral ankle sprain (3±1 sprains), at least two episodes of giving way within the past 6 months (6±4 episodes), ≥ 11 on the Identification of Functional Ankle Instability, $\leq 90\%$ on the Foot & Ankle Ability Measure (FAAM) (87.3±8.9%), and $\leq 80\%$ FAAM-Sport (73.3±14.9%). Active plantar flexor and peroneal muscle stiffness were estimated using the damped oscillation method. Participants were seated on a custom-made loading device with the hip, knee, and ankle joints at 90°. Participants were instructed to maintain the ankle in a neutral position by activating the plantar flexors or evertors isometrically to a level only strong enough to support the applied load which was adjusted to produce 30 ± 5% MVIC. A perturbation was then applied by dropping a ball onto the loading device from the height of 110cm in order to produce the series of oscillations of the shank about the ankle. Torsional stiffness (k) was calculated using the equation $k = 4\pi^2 r^2 m f^2$, where f is the damped frequency of oscillation, r is the system radius, and m is the total mass of the system. Independent t-tests assessed group differences with an alpha level of $p < 0.05$. **RESULTS:** Plantar flexor stiffness was lower in CAI group (123.6 ± 20.5 N/m/kg) compared to healthy control (141.6 ± 28.0 N/m/kg) group ($p = 0.04$). However, there was no difference in peroneal muscle stiffness between CAI (5.85 ± 1.2 N/m/kg) and control (5.84

± 1.4 N/m/kg) groups ($p = 0.98$). **CONCLUSION:** Those with CAI have reduced plantar flexor stiffness compared to the uninjured controls, which may be a potential underlying factor for CAI associated sensorimotor impairments. This lower plantar stiffness may influence ankle joint stiffness during activities, which may be a risk factor for recurrent ankle sprains.

1904 Board #60 May 30 2:00 PM - 3:30 PM
Influence Of Plyometric Training On Tendinous Tissue Elongation During Initial Phase Of Explosive Power Exertion

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PURPOSE: The sharp rise of the ground reaction force due to high pre-activation of muscles upon drop jump (DJ) contributes to increases in the reactive strength index (RSI). In our previous studies, in a comparison between athletic long jumpers and general men, the long jumper showed a significant increase in Achilles tendon tissue elongation immediately after DJ contact due to high pre-activation of the gastrocnemius muscle. In this study, we aimed to clarify the influence of plyometric training on Achilles tendon tissue elongation dynamics immediately after DJ contact.

METHODS: Five men (age, 21.0 ± 0.7 y; height, 172.2 ± 4.6 cm; weight, 67.6 ± 3.8 kg) volunteered to participate in this study. The subjects were asked to undergo plyometric training (maximum hopping 10 reps × 3 sets, 3 times a week, 12 weeks). Experiments were conducted before and after training and after 12 weeks of detraining. Changes in the Achilles tendon tissue length of the gastrocnemius medialis (the distance from the muscle tendon junction to the calcaneus along the line of action of the tendon) during DJs from a height of 0.3 m were measured using a high-speed camera and ultrasonography equipment. Electromyographic parameters and ground reaction force were measured in synchrony with the camera and ultrasonography equipment.

RESULTS: The RSI increased significantly after training (1.89 ± 0.35) and after detraining (1.78 ± 0.46) compared to that before training (1.49 ± 0.43). The elongation of Achilles tendon tissue immediately after the grounding of DJ was significantly increased by training (+ 2.99 ± 2.36 mm), and the training effect disappeared after detraining (- 0.23 ± 2.50 mm). On the other hand, there was no significant effect on the maximum elongation of tendon tissue in the push-off phase. In other words, the elongation of tendon tissue during the initial phase of explosive power exertion is more important than the maximum elongation of the tendon tissue.

CONCLUSIONS: Plyometric training increases tendon tissue elongation immediately after the DJ grounding and increases the RSI. These results suggest that the increase in tendon tissue elongation during the initial phase is one of the factors to increase explosive power exertion.

1905 Board #61 May 30 2:00 PM - 3:30 PM
Reliability Of Isokinetic Eccentric Hamstring To Concentric Quadriceps Torque Ratio Between Velocities, Sexes, And Limbs

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 (No relevant relationships reported)

The ratio of eccentric hamstring strength to concentric quadriceps strength has recently been suggested to potentially have utility for prospectively identifying risk for injury. However, there has been little research on the reliability of these ratios and furthermore, the differences and reliability of this ratio between different velocities, sex, and limbs. **Purpose:** To establish the reliability of eccentric hamstring to concentric quadriceps ratios, and determine any differences between ratios at different angular velocities, sex, and limbs in healthy and physically active young adults.

Methods: Following a standardized warmup, 20 women (23.3±3.5 years) and 20 men (25.3±3.0 years) performed concentric (e60 and e240 degrees·s⁻¹) and eccentric (e30 and e120 degrees·s⁻¹) knee flexion and extension protocols using both the dominant (D) and non-dominant (ND) limbs. Average peak torque from each set was used to create two ratios of eccentric hamstring to concentric quadriceps strength: e30/c240 and e120/c240. **Results:** For both sexes, the intraclass correlation coefficient (2,1) for the e30/c240 ratios (\bar{r}^2 : .66 -.68, \bar{r}^2 : .62 -.71) were slightly higher than the e120/c240 ratios (\bar{r}^2 : .45 -.59, \bar{r}^2 : .46 -.51). The Standard Error of Measurement (SEM) was similar across the two ratios within each sex; however, the SEM was smaller for men (4.5-5.0%) compared to women (5.2-7.3%). The D ($P = .001$, 95% CI_{diff}: .03 to .10) and ND ($P = .035$, 95% CI_{diff}: .003 to .09) e30/c240 ratios for the women demonstrated a significant systematic decrease across the two sessions. There were no limb differences for either of the ratios ($P > .05$); however, the e30/c240 ratio for the women was significantly higher ($P = .046$) than the men (95% CI_{diff}: .01 to .72).

Conclusion: No potent reliability differences appeared between the two ratios, which may be attributable to using average peak torque across repetitions without considering

location of peak torque or sustained torque throughout range of motion (angular work). Partially explaining sex differences in absolute reliability and session changes could be experience with maximal effort muscular activation (e.g. resistance training).

1906 Board #62 May 30 2:00 PM - 3:30 PM
Regional Activation of Supraspinatus, Infraspinatus and Periscapular Musculature during Strengthening Exercises with Elastic Bands

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PURPOSE: Strengthening of the rotator cuff and periscapular muscles is crucial for appropriate neuromuscular control of the mobile glenohumeral and scapulothoracic joints. The aim of the current study was to quantify and compare the regional activation of supraspinatus (SUP), infraspinatus (INF) and some periscapular muscles during shoulder strengthening exercises with elastic bands.

METHODS: 27 right handed healthy volunteers (22.5 ± 2.7 years old) were recruited. Four fine wire electrodes were inserted into the anterior and posterior regions of SUP and the superior and middle regions of INF under ultrasound guidance. Four paired surface electrodes collected data from the upper, middle and lower trapezius and serratus anterior (UT, MT, LL, SERR respectively). Participants performed four resistance exercises (in Y, T, W and L postures) with elastic bands while maintaining good form and cadence. Kinematics were recorded synchronously by Vicon motion tracking system. Electromyography values were presented as % of maximal voluntary isometric contraction (MVIC) and compared across exercises using ANOVA.

RESULTS: Rotator cuff and periscapular muscles showed similar activation profiles throughout the Y, W and T exercises. The peak activation of SUP anterior occurred in 20% of L exercise cycle while for other regions it occurred in 40-60% of time cycle. Mean activations of all rotator cuff partitions were over 40% MVIC during four exercises, except middle INF during T exercise (29.3% MVIC). LT was activated >80% MVIC during all four exercises, with no significant differences across exercises while MT was significantly more active in T exercise. The activations of SERR and UT were significantly higher during Y exercise. **CONCLUSIONS:** YTWL exercises induced moderate to high activation in supraspinatus and infraspinatus partitions, and very high activation in lower trapezius. These exercises are appropriate for strengthening of some rotator cuff and periscapular muscles and can potentially be useful for rehabilitation of scapular dyskinesia and shoulder impingement. However, caution should be taken while prescribing Y exercise for these pathologic conditions as this exercise may induce high activation in UT. Providing additional strengthening exercises for SERR to this exercise package is recommended.

1907 Board #63 May 30 2:00 PM - 3:30 PM
The Effect Of Knee Joint Angle Difference On The Compartment Neuromuscular Activation In Rectus Femoris

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 (No relevant relationships reported)

Bi-articular muscles play an important role to smooth movement in human. However, the biomechanics and physiological function of those muscles is unclear. Thus, this study investigates the function of rectus femoris as a famous bi-articular muscle in lower limbs.

PURPOSE: The purpose of this study is to unravel the compartment neuromuscular activation of rectus femoris during isometric knee extension and hip flexion in different knee angles.

METHODS: Subjects were eight healthy men. Knee extension with hip flexion were performed in isometric contraction. Knee angle was set up at 90, 60, 30, and 0 degree. Also, there were three contractions as follow: Maximum voluntary contraction (MVC), 80%MVC and 60%MVC. Muscle activation of rectus femoris was measured by using multi-channel surface electromyography, and calculated the average rectified value (ARV). We evaluated the ARV of rectus femoris divided into proximal, medium and distal compartment. We evaluated the ARV of rectus femoris divided into proximal, medium and distal compartment.

RESULTS: In the proximal region at 30 degrees knee angle, averaged ARV value in the MVC (0.113 mV) was significantly higher than those of other two contraction groups (80%MVC: 0.071 mV, $p < 0.05$ vs MVC; 60%MVC: 0.047 mV, $p < 0.01$ vs MVC). There was no significant differences in ARV's both in medium and distal compartments.

CONCLUSIONS: Proximal region of rectus femoris has the role of knee extension and hip flexion in slightly flexed knee joint position. We conclude that the difference of knee angle affects the compartment neuromuscular activation in rectus femoris.

1908 Board #64 May 30 2:00 PM - 3:30 PM
Effect Of Neuromuscular Training On Rate Of Force Development And Joint Stability.

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Effect of neuromuscular training on rate of force development and joint stability. Williams, C.D. & Herring, B.
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Abstract

Neuromuscular adaptations to training are primarily responsible for explosive movements through increases in neural drive and efficiency, which increases recruitment of fast twitch muscle fiber and rate of force development (RFD). Increases in RFD allow an individual to produce more force in shorter time durations, and are expected to increase joint stability. The purpose of this study was to determine the effects of neuromuscular training on RFD and joint stability. A training group and a control group were used. Using a multi-joint isokinetic dynamometer, a 4-week training program was developed. Ten participants performed squat, leg drive, lateral squat, and deadlift exercises twice a week, for three sets of ten seconds each, at 50% of maximal velocity. Pre and post-tests measured RFD using a squat exercise at 50% of maximal velocity, and measured joint stability using the Landing Error Scoring System in Real Time (LESS-RT). Results indicated no significant differences between pretest measures of RFD or LESS-RT between the training and the control groups; nor were differences found between pre and post test measures of RFD and LESS-RT for the control group. Results indicated a significant increase in RFD ($t_{(9)} = -2.652$, $p = .026$) and a significant decrease in scores ($t_{(9)} = 3.648$, $p = .005$), indicating an increase in RFD and joint stability after training, and suggesting a decreased risk of injury.

1909 Board #65 May 30 2:00 PM - 3:30 PM
Shoulder Muscle Activity Changes in Patients After Injection and Physical Therapy

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INTRODUCTION

Shoulder pain is a common orthopedic ailment, with multiple potential sources of pain and dysfunction. A combination of treatments may be used. While treatment has generally shown to be effective, it does not resolve the syndrome for all patients.

PURPOSE: To determine the effect of a standardized treatment protocol on the neuromechanics of the shoulder. It is hypothesized that rotator cuff activation will increase with both pain relief and physical therapy.

METHODS

Seven subjects, who were diagnosed with subacromial impingement, and seven healthy controls were recruited. At the first testing session, the subject was instrumented with six surface electromyography sensors and two fine-wire sensors.

Subjects elevated their arm in the scapular plane, while kinematics and EMG were recorded. EMG data were normalized to a reference contraction.

Following a subacromial injection, the subject repeated elevation motion. Following the testing session, the subjects completed six weeks of physical therapy. The subjects returned for additional testing following the same protocol. For patients, the three testing periods were designated T1 (before injection), T2 (after injection), and T3 (after physical therapy). For healthy controls, only the original time point was analyzed.

RESULTS

Figure 1 shows the supraspinatus activity of seven patients during humeral elevation in the scapular plane. At baseline, it appears that muscle activation in the patients is lower than controls, but in most cases, increases over time. There also are potential differences in activity between patients and control subjects at the three time points, as well as changes associated with the subacromial injection or with physical therapy.

CONCLUSIONS

Immediately following the subacromial injection, activation levels appear to have remained relatively constant. However, after physical therapy, activation levels show a pattern of increase. Data collection and analysis are continuing.

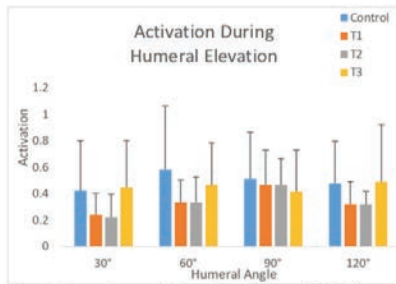


Figure 1: Supraspinatus activity at 30°, 60°, 90° and 120° of humeral elevation (n = 7, means \pm sd).

1910 Board #66 May 30 2:00 PM - 3:30 PM

Muscle Thickness And Strength Relationships In Patients With Patellofemoral Pain Before And After Rehabilitation

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(No relevant relationships reported)

The gluteus maximus (Gmax) and medius (Gmed) have shown altered strength and activation in patients with patellofemoral pain (PFP) and have been addressed commonly in rehabilitation programs. However, the relationship between strength and a visual method of quantifying muscle activation through ultrasound imaging has not been explored. **PURPOSE:** To determine relationships between muscle thickness (at rest and during contraction) and strength using hand-held dynamometry of the Gmax and Gmed in various positions (side-lying, bipedal stance, unipedal stance) before and after a 4-week impairment-based rehabilitation program. **METHODS:** 19 patients with PFP (23.7 \pm 4.8yrs, 168.7 \pm 6.8cm, 69.6 \pm 15.1kg, 14F) completed 12 sessions of supervised impairment-based rehabilitation focused on lower extremity range of motion, strength, functional movement, and core stability. Ultrasound imaging and strength of Gmax and Gmed was performed before and after rehabilitation. Ultrasound images were collected at rest while side-lying, during side-lying hip abduction, bipedal stance, and unipedal stance. Both strength and thickness measures were normalized to body mass (kg). **RESULTS:** There were no significant relationships found between strength and muscle thickness at the pre-rehabilitation session. Following rehabilitation, both Gmax and Gmed exhibited significant relationships between strength and muscle thickness during side-lying positions. For Gmax, side-lying at rest, there was a moderate relationship ($r=0.50$, $p=.03$) and during side-lying hip abduction ($r=0.46$, $p=.05$). Gmed revealed similar relationships following rehabilitation with side-lying at rest ($r=0.65$, $p=.003$) and during hip abduction ($r=0.46$, $p=.046$).

CONCLUSION: Muscle thickness, as captured with ultrasound imaging, increases as strength increases for both the Gmax and Gmed in individuals with PFP, while side-lying, and only following rehabilitation. The strongest relationship was found in the Gmed, which is supported by the positioning being the same for both thickness and strength measures. The concentric nature of the Gmed contraction during side-lying hip abduction could also be a major contributor to this relationship.

D-59 Free Communication/Poster - Upper Limb

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

1911 Board #67 May 30 2:00 PM - 3:30 PM

Classifying Upper Extremity Exercises Using Biomechanics Captured with an Inertial Measurement Unit-based Device

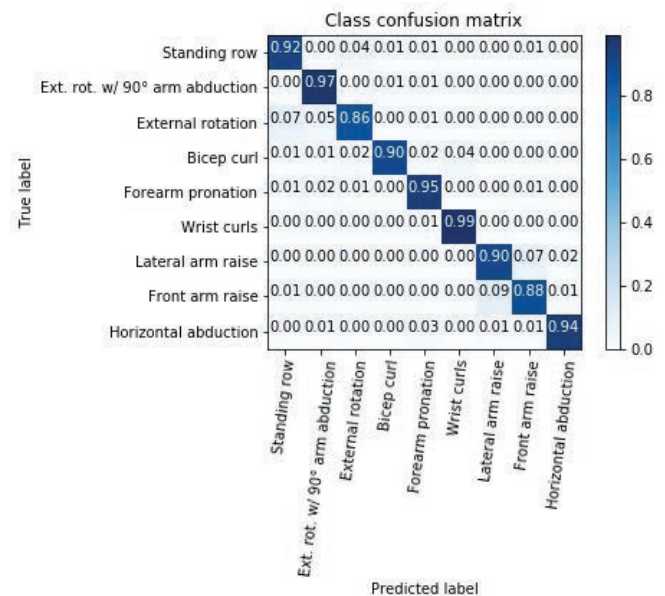
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(No relevant relationships reported)

Exercise adherence and physical activity can be difficult to measure. Current methods often rely upon self-report surveys which are susceptible to error. Machine learning methods can be applied to biomechanical data to classify and identify activity. Each

exercise has a unique “fingerprint” of biomechanical data in that there is a unique combination of motion in each joint. Inertial measurement units (IMU) can move biomechanical analysis from the lab to real world environments allowing for more ecologically valid measurements. **PURPOSE:** The purpose of this study is to develop a machine learning algorithm for classifying nine different upper extremity exercises, based upon biomechanics captured from an IMU-based device. **METHODS:** 50 participants (mean age = 21.9 years) were recruited. Participants performed one compound and eight isolation exercises with their right arm while wearing the device. Each exercise was performed ten times for a total of 4500 trials. The device consists of a small, self-contained computer and four 3-axis IMUs. IMUs were placed on the hand, forearm, upper arm, and torso. Joint angles were calculated using relative rotations between pairs of IMUs. A modified Hampel filter and Savitzky-Golay filter were applied to remove outliers and noise. Random Forests were trained on 50% of the data and tested on the remaining 50%. **RESULTS:** The model performed well with an overall classification accuracy of 92.4%. Figure 1 shows the class confusion matrix where the numbers represent the proportion of true cases that were predicted. **CONCLUSION:** The results suggest upper extremity exercises can be classified using biomechanics data captured with a novel IMU-based device. These findings set the basis for more objective activity logs which can be used for measuring exercise adherence, physical therapy, and physical activity levels. Ultimately, the device may be used to create activity profiles for health screening and health status.



1912 Board #68 May 30 2:00 PM - 3:30 PM

Effect of a Period of Cervical Flexion on Upper Extremity Muscle Strength

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(No relevant relationships reported)

As daily technology use increases, there is an increase in periodical cervical flexion, which can cause a strain on the neck and muscles of the upper extremity. It has been studied that on average people regularly experience cervical flexion of 45 degrees during handheld technology use. **Purpose:** Examine the effect that 30 minutes of cervical flexion has on upper extremity muscle strength, specifically the biceps brachii, triceps brachii, and middle deltoid. **Methods:** Twenty-four participants (12 male, 12 female) (n=24; height= 173.1 \pm 9.3 cm; weight=73.33 \pm 22.58 kg) were measured before and after 30 minutes of 45 degrees of cervical flexion in a seated position using a MicroFET2 Hand Held Digital Muscle Tester to isometrically test each muscle. Paired Samples T-test was used to determine overall strength changes and percent strength decreases. **Results:** Significant changes in muscle strength were evident in the left biceps brachii (254.1 \pm 101.5 vs 239.87 \pm 103 N, $p<0.05$), right biceps brachii (270.67 \pm 96.23 vs 254.53 \pm 102 N, $p<0.05$), left middle deltoid (140.82 \pm 54.27 vs 125.42 \pm 51.27 N, $p<0.05$), and right middle deltoid (129.2 \pm 46.1 vs 122.89 \pm 49.76 N, $p<0.05$). No significant strength changes were measured in either triceps muscle. Minimal changes were seen across contralateral arm muscles and across genders. When comparing dominant to non-dominant arms, significant changes in percent strength change were found in the dominant biceps brachii (272.8 \pm 100.77 vs

269.15±109 N, $p<0.05$), non dominant bicep brachii (251.94±96.59 vs 235.25±95.74 N, $p<0.05$), dominant triceps brachii (151.63±54.59 vs 141.34±51.32 N, $p<0.05$), dominant middle deltoid (132.6±47.92 vs 124±49.13 N, $p<0.05$), and non dominant middle deltoid (137.44±53.21 vs 124.27±51.92 N, $p<0.05$). **Conclusion:** A normal daily degree of cervical flexion will decrease some upper extremity strength over the course of 30 minutes.

1913 Board #69 May 30 2:00 PM - 3:30 PM
Effects Of An Exercise And Kinesiotape Intervention
On Forward Head/Rounded Shoulder And Scapular
Dyskinesia

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 (No relevant relationships reported)

Improper posture including forward head, rounded shoulder and scapular dyskinesis have been linked to neck and shoulder pain. Treatment for forward head posture (FHP), rounded shoulder posture (RSP), and scapular dyskinesis has consisted of an exercise protocol. Kinesiotape (KT) has recently emerged as a treatment method but there is a lack of research on the effectiveness, or whether exercise or KT is better than the other. **PURPOSE:** To compare a KT intervention to a strengthening and stretching program for correction of FHP, RSP, and scapular dyskinesis in a healthy, non-athletic, college age population. **METHODS:** Twenty healthy college-aged subjects with forward head, rounded shoulder posture and scapular dyskinesis completed the study. There were 10 subjects (7 females, 3 males, 20.30±8.2 yr, ht=171.07±11.82 cm, wt=79.47±13.79 kg) in the exercise group and 10 subjects (7 females, 3 males, 20.40±1.43 yr, ht=166.61±11.99 cm, wt=69.40±11.48 kg) in the KT group. Subjects were randomized into two intervention groups undergoing a four-week program. One group participated in a strengthening and stretching exercise protocol (EG) based on the current literature, while the other group had KT applied to the upper back and shoulders for a duration of five days with two days of no tape in a seven-day period. Pre-and post-test measurements included the craniocervical angle (CVA) in degrees, forward shoulder angle (FSA) in degrees, and scapular dyskinesis as assessed using scapular dyskinesis scoring (0-3, maximum combined score = 6) for each scapula.

RESULTS: There was a significant time main effect for the scapular dyskinesis score (SDS) as both groups improved pre-to-post intervention ($F=12.5$, $P<0.01$; $EG=4.8\pm1.14$ vs 5.3 ± 0.949 , $KT=4.10\pm1.59$ vs 4.9 ± 1.01). Time effect sizes were small to moderate for CVA ($KT=.13$ to $EG=.53$), RSA ($EG=.15$ to $KT=-.46$) and SDS ($EG=.44$ to $KT=.50$) in both groups. Group effect sizes were small for CVA (0.24), RSA (0.25) and SDS (0.36). Minimal-detectable-change-scores were achieved for the CVA ($EG=3.90$, $KT=.80$) and SDS ($EG=.50$, $KT=.80$) for both groups, indicating clinical improvement. No other results were significant. **CONCLUSIONS:** Both groups improved pre-to-post intervention for the three measurements, even though only SDS was significant. Thus, either treatment could be used.

1914 Board #70 May 30 2:00 PM - 3:30 PM
Stimulation Techniques used to Assess Corticospinal
Excitability Alters an Attentional Focus Maximal
Voluntary Contraction of the Elbow Flexors.

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(No relevant relationships reported)

PURPOSE: To investigate the role of attentional focus on force output by assessing 1) force output during maximal voluntary elbow flexion contractions, 2) corticospinal excitability and 3) motor unit activation patterns

METHODS: 7 resistance-trained males completed two experimental sessions. Each session consisted of 12 maximum voluntary contractions (MVC) with 180s rest of recovery between MVC. Participants were given counter-balanced external and internal attentional focus conditions prior to each MVC to direct attention. Force output and electromyography (EMG) of the biceps brachii, triceps brachii, and brachioradialis were recorded for both sessions. Transcranial magnetic stimulation, transmastoid electrical stimulation, and brachial plexus electrical stimulation were used to produce motor evoked potentials (MEPs), cervicomedullary motor evoked potentials (CMEPs) and maximal M-waves (M_{max}) in the biceps brachii during each MVC in one of the two sessions. All MEPs and CMEPs were normalized to M_{max} .

RESULTS: Forces produced during the stimulation session were not significantly different between external and internal focus conditions ($p = 0.20$). However, forces produced during the non-stimulation session were 19.9% higher with an external cue compared to internal cues ($p < 0.05$). As well, forces produced with external cues were 13.2% greater during the non-stimulation session compared to the stimulation session. ($p < 0.05$). EMG activity was not found to be significantly different between attention focus cues ($p \geq 0.1$).

CONCLUSIONS: The usage of stimulation techniques likely distracted participants from the attentional focus cues provided during the stimulation session. Therefore,

we were unable to successfully assess changes in corticospinal excitability between focus cues. However, we were still able to show that external cues direct greater force production of the elbow flexors compared to internal cues.

D-60 Free Communication/Poster - New Insights in
Children and Youth

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

1915 Board #71 May 30 3:30 PM - 5:00 PM
The Comparison of Children Active Travel Mode Time
Under the Different Air Quality

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(No relevant relationships reported)

There are sufficient evidence to confirm the adverse effects of air pollution and the positive effects of active travel mode on the health. However, few studies have research on the impact of different air quality on children active travel mode time, especially in Asia country like China. **PURPOSE:** By comparing the active travel mode time of children under the different air quality areas to show the impact on air quality of children active travel mode time. **METHOD:** Through Beijing Municipal Environmental Protection Bureau to record the past year daily AQI (air quality index) data of different areas in Beijing, and according to the data to select two schools in good air quality (the AQI is 91 and 96) and two schools in poor air quality (the AQI is 102 and 120), all totals of 407 students (boys = 217, age = 10.78 ± 0.93 yrs). Using the questionnaire to record the children active travel mode time, including the time of children to go to school or other places on foot during the weekdays and weekend, and the time of children to go to school or other places by bike during the weekdays and weekend. The data were analyzed by using one-way ANOVA. **RESULT:** By comparing the active travel mode time of children in two schools with AQI of 91 and 96 (68.67±111.38 vs. 117.30±137.68mins, $P<0.05$); By comparing the active travel time of children in two schools with AQI of 91 and 102 (68.67±111.38 vs. 154.66±249.61mins, $P<0.05$). **CONCLUSION:** Air quality may have an impact on children active travel mode time, the children in the best air quality areas have relatively less active travel mode time. Future studies should consider the more factors that may impact the children active travel mode time.

1916 Board #72 May 30 3:30 PM - 5:00 PM
Physical Activity, Sedentary Time, Body Composition
and Cardiorespiratory Fitness In 4th Grade Hispanic
Children

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(No relevant relationships reported)

Physical activity (PA) positively influences health parameters such as cardiorespiratory fitness (CRF) and body composition in children and adolescents. However, evidence of these associations, including sedentary time (ST), among Hispanic children is insufficient. **PURPOSE:** To determine associations between PA, ST, body composition, and CRF in 4th grade Hispanic children in Puerto Rico. **METHODS:** A group of 70 boys (n=33) and girls (n=37), 9.4±0.5 years of age completed a CRF test (PACER) and body composition evaluation (height, weight, calf and triceps skinfolds) using the FITNESSGRAM protocol, and wore an accelerometer for 7 consecutive days. T-tests and Wilcoxon rank-sum tests were conducted to test for sex differences when appropriate, and correlation analyses by sex to test for associations between variables.

RESULTS: Compared with boys, girls were less active (238.7±48.1 vs. 199.4±72.4 min/day of moderate to vigorous PA, $P=0.01$; 18528±4539 vs. 15003±5883 steps/day, $P=0.01$) and more sedentary (6.8±1.2 vs. 7.8±1.8 hrs/day, $P=0.01$). Boys and girls were not different in their mean BMI (18.0±5.0 vs. 18.5±3.6 kg/m², $P=0.63$), %fat (22.6±11.0 vs. 25.2±8.1 %, $P=0.26$), max steps/min (133±14.4 vs. 131±18 steps, $P=0.57$), and CRF test (34.2±21.2 vs. 26.5±17.1 laps, $P=0.11$). CRF in boys was inversely correlated with BMI and %fat ($\rho=-0.39$ ($P=0.04$), -0.42 ($P=0.02$); respectively), and directly correlated with vigorous PA ($\rho=0.40$, $P=0.03$); while in girls, CRF was directly correlated with maximal steps/min ($\rho=0.34$, $P=0.04$). **CONCLUSION:** Although boys and girls appear sufficiently active, lower PA and higher ST among girls should be addressed to promote healthier lifestyles. Also, the

influence of PA intensity and body composition on CRF appear to differ by sex, a consideration for future PA interventions in this population. Supported in part by FIPI/DEGI/UPRRP.

1917 Board #73 May 30 3:30 PM - 5:00 PM
Effects of Exergaming on Motor Skill Competence, Perceived Competence, and Physical Activity in Preschool Children

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(No relevant relationships reported)

PURPOSE: Few school settings offer structured physical activity (PA) opportunities for preschool children, with little study conducted examining exergaming's effectiveness on health outcomes in this age group. This study's purpose, therefore, was to examine a school-based exergaming intervention's effect on preschool children's perceived competence, motor skill competence and PA versus usual care (recess), as well as examine gender differences for these outcomes.

METHODS: Sixty-five preschoolers (33 girls; $M_{age} = 4.45 \pm 0.46$; $M_{BMI_{percentile}} = 59.05 \pm 32.04$) from 2 underserved urban elementary schools in a Midwestern U.S. state were enrolled and then assigned to 1 of 2 conditions, with school as experimental unit: (1) usual care recess group (8 weeks of 100 minutes [5 days x 20 minutes] recess/week); and (2) exergaming intervention group (8 weeks of 100 minutes [5 days x 20 minutes] school-based exergaming/week). All children underwent identical perceived competence, motor skill competence and moderate-to-vigorous PA (MVPA) assessments at baseline and at the end of the 8th week. A multivariate analysis of variance with repeated measures was employed to examine preschool children's changes in perceived competence, motor skill competence and MVPA over time.

RESULTS: A significant Group by Time effect was observed for MVPA ($F(1, 52) = 4.37, p = 0.04, \eta^2 = 0.04$), but not perceived competence ($F(1, 52) = 0.83, p = 0.37, \eta^2 = 0.02$) or motor skill competence ($F(1, 52) = 0.02, p = 0.88, \eta^2 = 0.00$). Specifically, intervention children displayed significantly greater increased MVPA at 8 weeks than the comparison children (4.05 vs. -1.99 minute). Additionally, there was a significant Time effect for motor skill competence ($F(1, 52) = 15.61, p < 0.01, \eta^2 = .23$) and Gender effect for MVPA ($F(1, 52) = 5.06, p = 0.02, \eta^2 = 0.09$). In detail, while all preschoolers' motor skill competence improved over time, boys demonstrated higher MVPA than girls at both time points.

DISCUSSION: Exergaming showed a positive effect in promoting preschool children's MVPA at school and has the potential to enhance perceived competence and motor skill competence. More research with larger sample sizes and longer study durations is warranted.

1918 Board #74 May 30 3:30 PM - 5:00 PM
The Effect of Extracurricular Coordinated Physical Education on the Development of Basic Motor Skills of Children aged 7-9 Years Old

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to analyze the effect of the extracurricular physical education program through a 12-week-coordination on the development of basic motor movements for children of 7-9 years.

METHODS: A sample of 120 children of the elementary school period, 58 of whom were in the experimental group and 62 of whom were in the control group, were incorporated into the study in line with their own consent after their guardian had also informed. The program lasted for 12 weeks in the form of 2 days and 2 hours a day. The control group was not involved in any extracurricular physical education program. A research model of "pretest-posttest" was used. The "independent t" and the "paired samples t" statistical package program were used to analyze the data.

RESULTS: The study results indicated that transfer coordination ($t=2.89, p<0.05$), click-to-click ($t=2.76, p<0.05$), climbing obstacles ($t=4.47, p<0.05$), and rolling skills ($t=3.81, p<0.05$) that four indicators were significantly higher in the experimental group. The rolling skill was a significant change pre-and post-experiment in the control group ($t=2.13, p<0.05$), no significant differences in other variables.

CONCLUSIONS: As the results of this study, it follows that apart from clearly mentioning the importance of physical pricing practices. The extracurricular physical education program through long-term proper practices will enable children to develop their basic motor skill. (This study was supported by NPOSS Grant 15CTY011.)

1919 Board #75 May 30 3:30 PM - 5:00 PM
Comparisons Of In-school And Out-of-school Physical Activity Among Chinese Elementary School Children

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(No relevant relationships reported)

PURPOSE: Relatively little is known regarding children's physical activity (PA) during school and outside of school. Therefore, the objective of this study was to compare in-school and out-of-school PA among Chinese elementary school children.

METHODS: A cross-sectional study was conducted among 360 (4th grade) children recruited from 3 elementary schools in Shanghai, China. PA was measured in 5 consecutive school days by accelerometers. Minutes per hour (min/h) of moderate-to-vigorous PA (MVPA) and total PA (TPA) were calculated using established cut points. Children's in-school and out-of-school MVPA and TPA were compared using paired *t* test. Gender differences in MVPA and TPA across the two study settings were also examined using independent *t* test.

RESULTS: 242 participants (boys: 45.5%, mean age: 9.6 ± 0.3 years, weight: 35.0 ± 7.6 kg, height: 139.8 ± 6.1 cm, body mass index: 17.8 ± 2.9 kg/m²) provided valid accelerometer data (defined as ≥ 2 days, ≥ 10 h/day) and were included in the study. Results showed a higher level of in-school MVPA compared to out-of-school MVPA (3.1 min/h vs 2.3 min/h, $P<0.001$) and of in-school TPA compared to out-of-school TPA (17.3 min/h vs 15.1 min/h, $P<0.001$). There were no difference in out-of-school MVPA and TPA across gender but boys showed a higher level of in-school MVPA (3.1 min/h vs 2.3 min/h, $P<0.001$) and TPA (18.3 min/h vs 16.6 min/h, $P<0.001$) compared to girls.

CONCLUSION: Chinese elementary school children spent more time engaging in in-school PA compared to out-of-school PA with boys showing a higher level of in-school PA compared to their counterpart girls. Findings suggest that PA promotion strategies should focus on developing out of school, community-based programs and that maximizing in-school PA among girls.

1920 Board #76 May 30 3:30 PM - 5:00 PM
Predictors of Return to a Childhood Healthy Eating and Active Living Obesity Clinic

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(No relevant relationships reported)

PURPOSE: To identify predictors of program retention among children enrolled in a multifactorial obesity treatment clinic designed to support behavior change in physical activity and healthy eating to combat unhealthy weight levels. **METHODS:** Children age 2-18 years old ($n = 285$) attended a baseline visit at a childhood healthy eating and active living (CHEAL) clinic. Parents completed a behavioral survey and height, weight, blood cholesterol and blood glucose were objectively measured. Weight status was reflected as the Percent Over the 50th Percentile for age and sex based on CDC reference values (BMI50). Survey items included questions about prenatal and infancy history, family medical history, and eating and activity behaviors as well as desire to make changes and discuss nutrition behaviors with a dietician. All survey and objective measures were first evaluated with univariate analysis (Chi-Square and t-test) to identify differences between Returners and Non-Returners. Variables identified as having a significant relationship with returning for a second clinic visit were then entered into logistic regression models using forward selection. Four different models were constructed, with Model 4 containing all variables that were significant in univariate analyses.

RESULTS: Significant variables in univariate analyses included BMI50, sex, age, baseline cholesterol, sugar sweetened beverage (SSB) consumption, willingness to meet with a dietician, and the mother gaining more than 35 pounds during pregnancy. In logistic regression, children who consumed SSB once per week were more likely to return for a second clinic visit than those consuming SSB every day (OR 4.5 (95% CI: 1.9 - 10.5)) and older children were less likely to return than younger children (OR 0.9 (95% CI: 0.8 - 0.99)).

CONCLUSIONS: The predictors identified support theories associated with the importance of readiness for change (SSB consumption, willingness to meet with a dietician) and suggest that engaging families when children are young may improve retention rates for clinic-based interventions targeting healthy weight or energy-balance behaviors.

- 1921** Board #77 May 30 3:30 PM - 5:00 PM
Evidence for Compensation or Synergy of Children's Activity During Outdoor and Indoor Preschool Time
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(No relevant relationships reported)

INTRODUCTION: Evidence for physical activity (PA) compensation (e.g., high PA leads to low PA in another part of the day) and synergy (e.g., building on times of high PA with additional high PA) in school-aged youth has been reported, but has not been studied in preschoolers. **PURPOSE:** To determine if preschoolers exhibit evidence of compensation or synergy in indoor and outdoor PA during child care. **METHODS:** Children (N=44; 3-4 y) in three preschools wore an accelerometer on their right hip for two school days. PA intensity was determined using Pate cut-points (counts/15sec). A proximity tagging beacon was placed in each classroom, and children's accelerometers acted as receivers. Lack of communication between beacons and receivers indicated that children were outdoors. Outdoor and indoor time (min/hr) in light, moderate, vigorous, or total PA was determined. Paired t-tests were used to identify if time in each intensity (for indoor/outdoor time) significantly differed between days ($p < 0.05$). Difference in time in each intensity between days was calculated and Pearson correlations were performed to compare between-day changes in outdoor and indoor light, moderate, vigorous, and total PA (e.g., correlation between change in outdoor total PA vs. change in indoor total PA). Positive associations support synergy, while inverse associations support compensation. **RESULTS:** No differences in time in each intensity between days were found. Change in outdoor light ($r = 0.02$, $p = 0.883$), moderate ($r = -0.17$, $p = 0.279$), and total ($r = -0.14$, $p = 0.369$) PA were not significantly related to change in indoor light, moderate, and total PA, respectively. Change in outdoor vigorous PA was positively related to change in indoor vigorous PA ($r = -0.40$, $p = 0.007$). For total PA, 59% of children exhibited evidence of compensation and 41% exhibited evidence of synergy. For vigorous PA, 45% of children exhibited evidence of compensation, and 55% exhibited evidence of synergy. **CONCLUSION:** Results suggest that vigorous intensity exercise may be more synergistic in nature. The weak-to-moderate, negative correlations among light, moderate and total PA warrant evidence for PA compensation at these intensities; however, results should be further examined in future studies using a larger sample size. **Funding:** ACSM Foundation, MWACSM, NASPEM, SHAPE

- 1922** Board #78 May 30 3:30 PM - 5:00 PM
The Effectiveness Of High-intensity Interval Training Versus Moderate-intensity Continuous Training On Cardiometabolic Risk Factors In Childhood Obesity: A Meta-analysis
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(No relevant relationships reported)

Exercise training is mainly prescribed for obese children to decreased cardiometabolic risks, however, studies examining the difference between high-intensity interval training (HIIT) and moderate-intensity continuous training (MICT) are limited. **PURPOSE:** The purpose of this study was to determine if HIIT differentially impacted on cardiovascular risk factors compared with MICT in obese children. **METHODS:** The relevant literature was searched from the databases of PubMed, Web of Science, Embase, the Cochrane library, and CNKI, which was completed in September 2018. Only randomized controlled trials involving both HIIT and MICT on obese children were included, and studies involving only one intervention would be excluded. Two researchers independently performed literature screening, literature quality evaluation, and data extraction according to inclusion and exclusion criteria. **RESULTS:** A total of 9 study with 309 obese children were included. Compared with baseline, both HIIT and MICT can significantly reduce body weight (BW), body mass index, systolic blood pressure, diastolic blood pressure, and increase VO2peak. Similar results were also found with respect to fasting glucose (FG) and fasting insulin in HIIT, while MICT is not significant. HIIT showed a small but significant effect on BW (mean difference (MD): -0.797 kg, 95%CI -1.018 to -0.575, $p = 0.0001$), total cholesterol (standardized mean difference (SMD) = -0.877, 95%CI -1.733 to -0.022, 0.044), HOMA-IR (MD = -0.620 mmol/L, 95%CI -1.234 to -0.006, 0.048), FG (MD = -0.391 mmol/L, 95%CI -0.608 to -0.173, 0.001) compared than MICT did. The main difference between HIIT and MICT is that HIIT is more effective for VO2peak (MD: 3.364 ml/kg/min, 95%CI 1.902 to 4.826, $p = 0.0001$). **CONCLUSIONS:** Our meta-analysis of randomized controlled trails indicates that both HIIT and MICT can significantly reduce cardiovascular risk factors in obese children, while HIIT with greater improvement observed in cardiorespiratory fitness.

- 1923** Board #79 May 30 3:30 PM - 5:00 PM
The Effects Of Active Video Games And SPARK PE On Children's In-school Physical Activity
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(No relevant relationships reported)

PURPOSE: Active video games (AVGs) is a technology tool that allows participants to engage in physical activity (PA) while playing video games. Research has shown that AVGs may serve as a "gateway" to increase individuals' PA. A physical education (PE) curriculum, Sport, Play, And Recreation for Kids (SPARK), is also designed to promote students' fitness and PA. The purpose of the study is to compare the effects of the two interventions (AVGs vs. SPARK PE) in increasing participants' in-school moderate to vigorous PA (MVPA).

METHODS: Both third (n=29, 34.5% for boys, 65.5% for girls, mean age = 9.1; SD = .6) and fourth grade (n=36, 41.7% for boys, 58.3% for girls, mean age = 10.2; SD = .5) students from a public school located in the South Georgia region participated in the study. Participants from third grade were enrolled in AVGs group while fourth graders were engaged in SPARK PE class. Both interventions lasted for six weeks with three 40-min sessions each week. A total of six Kinect AVG stations were set up with six participants practicing dance games at each station. Students in the SPARK PE group were taught by a student teacher who is familiar with SPARK K-5 curriculum. All participants were pre- and post-tested on their in-school PA for three days prior to and after the intervention using ActiGraph GT3X+. Everson's cut points were applied to generate the percentage of time engaged in MVPA. A two-way mixed ANOVA was conducted to examine the effects of interventions (between-subjects) and time (within-subjects) on participants' in-school MVPA percentage.

RESULTS: There was no significant main effect of time ($F(1, 63) = .72$, $p > .05$, partial $\eta^2 = .01$) on participants' in-school MVPA percentage. There was, however, significant main effect of interventions ($F(1, 63) = 23.5$, $p < .001$, partial $\eta^2 = .27$) on students' in-school MVPA percentage, with SPARK PE group (mean = 3.9) had higher percentage than did the Kinect AVG group (mean = 2.7). In addition, there was no significant interaction between time and intervention groups ($F(1, 63) = 1.60$, $p > .05$, partial $\eta^2 = .03$).

CONCLUSIONS: Neither Kinect AVG nor SPARK PE changed participants' in-school MVPA percentage. The effect of PA interventions on children's in-school MVPA need to be explored in future studies.

- 1924** Board #80 May 30 3:30 PM - 5:00 PM
Predictors and Acceptability of Shared Physical Activity in Parent-Child Dyads
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PURPOSE: To identify significant predictors and assess the acceptability of shared physical activity (PA) in young children and their parents.

METHODS: Twenty-eight parent-child dyads (mean±SD; age, parents: 38.0±6.6, children: 6.0±1.7) completed sessions in a fitness center that included five different shared PAs (brisk walking, dancing, tag games, body-weight exercises, and jumping games) and were instructed to try to complete at least one PA per day in the following week at home. One week later, parents reported their dyad's participation in the shared PAs. Parents reported demographic characteristics, family chaos, parent PA self-efficacy, parental PA self-efficacy for their child, and average min/week of shared PA. A forward stepwise regression was used to determine the optimal model to predict the total number of minutes parent-child dyads spent completing each PA together at home. McNemar's test was used to determine differences between perceived acceptability and completion of the five PAs as a dyad during shared time.

RESULTS: Lower family chaos ($B = -19.41$, $p = 0.034$), higher parent body mass index (BMI) ($B = 7.65$, $p = 0.003$), and higher annual household income ($B = 11.85$, $p = 0.023$) significantly predicted minutes of shared PA at home. The proportion of parents who perceived brisk walking as an acceptable PA was not different ($p = 0.125$) than those who briskly walked with their child. The proportion of parents who perceived jumping games, body-weight exercises, dancing, and tag games as acceptable PAs was greater than those who completed these PAs with their child (all, $p < 0.05$).

CONCLUSIONS: Shared PA participation may be higher when participants have lower family chaos, higher parental BMI, and higher annual household income. Brisk walking could be considered in future family-based PA programs since it was perceived as acceptable and was completed in the home environment, whereas the other shared PAs were perceived as acceptable but not completed at home.

- 1925** Board #81 May 30 3:30 PM - 5:00 PM
The Effects of Playground Zoning on Physical Activity During Recess in Elementary-Aged Children.
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(No relevant relationships reported)

While many factors contribute to the development of obesity, a sedentary lifestyle plays a significant role in this epidemic. Epidemiological data indicates that 50% of children aged 6-11 years old and approximately 92% of adolescents aged 12-18 years old are not meeting the recommended health guideline of 60 minutes of moderate-to-vigorous physical activity (MVPA) per day. Therefore, the most effective interventions for combating inactivity and childhood obesity should target children before inactivity develops in their adolescent years. Due to the increasing youth obesity rates, schools have been identified as ideal environments to promote physical activity (PA). **PURPOSE:** The purpose of this study was to compare changes in physical activity in youth, measured by accelerometry, during recess with a playground zoning intervention. **METHODS:** The sample included 433 third-, fourth-, and fifth-grade boys and girls from two elementary institutions. PA was observed during recess using systematic observation of play and leisure activity in youth (SOPLAY) and measured using Actigraph-GT3X accelerometers on a subset of students ($n = 78$). Baseline data were collected for one week prior to playground zoning. Afterwards, the playgrounds were zoned into six various activities for two weeks and PA data was observed and measured. **RESULTS:** A repeated measures ANOVA detected a significant main effect with the zoning and decreased time spent in sedentary activity ($p = .013$) and moderate activity ($p = .027$). A significant cross-over interaction was detected with zoning and an increase in time spent in vigorous activity ($p = .017$) and MVPA ($p = .006$) for third graders, whereas fifth graders significantly decreased the time spent in MVPA ($p < .001$). Furthermore, third grade boys accumulated 204 more steps on the zoned playground compared to baseline measurements ($p = .001$). A McNemar test revealed a 5% increase in observational PA on zoned playgrounds ($p < .001$). **CONCLUSION:** Zoned playgrounds are an applicable, manageable, and effective program that can help improve PA during recess for young children. However, a different intervention may be needed to improve PA in older children.

- 1926** Board #82 May 30 3:30 PM - 5:00 PM
Influence of Parents' Physical Activity on Children's Physical Activity And Cardiopulmonary Endurance
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(No relevant relationships reported)

It is reported that parents have important influences on the children's physical activity (PA) and health fitness, but such research has hardly been found in China nowadays. **PURPOSE:** To investigate PA level, health fitness and economic status among the children of 7-9 yrs and their parents; to assess the influence of parents' PA level, economic, educational condition and so on. **METHODS:** The subjects were selected from Huilongguan Centre Primary School in Beijing. The children are 7-9 yrs and their parent who brought up them with age of 30-39 yrs. Through self-designed questionnaire, the study made investigation of economics and educational status on the subject families, and the other main contents including medical history, family history, PA and sports. It was obtained the PA data of the children by the revised PAQ-A, and the parents' PA level were measured by accelerometer (ActiGraph GT3X+). Health fitness examination adopted the national standard for pupil's fitness measurements. **RESULTS:** 36 families completed the examination totally. According to daily average time of MVPA, whether one person or two of the couple, less than 30 mins was regarded as PA insufficient family (iPAf), and more than 30 mins was PA sufficient family (sPAf). (1) The data proved 20 sPAf and 16 iPAf in the study. (2) There were different in the children's scores between sPAf (3.02±0.53) and insufficient ones (2.61±0.58) ($P < 0.05$), and the BMI of the two groups (15.63±1.95 vs 17.77±3.67) showed great difference ($P < 0.01$). (3) The time of 50m*4 shuttle-run between the two children groups were different (119.35±29.42 vs 127.56±21.14s, $P < 0.05$); (4) The sedentary time everyday of the husband and wife in a family were moderately correlated ($r = 0.516$, $P = 0.023$), and the light PA time displayed low positive correlation ($r = 0.362$, $P = 0.046$), while the correlation was not found between the time of their moderate and more intensity PA ($r = 0.145$, $P = 0.093$). **CONCLUSIONS:** (1) The findings indicated that the higher PA level the parent had, the higher PA level their children did; and the children's cardiopulmonary endurance are higher similarly, whereas with the lower obesity extent. (2) The PA level of the husband and wife were interdependent and interactive. Supported by Central Universities and Colleges Basic Scientific Research Funds Special Funding (2016ZX016).

- 1927** Board #83 May 30 3:30 PM - 5:00 PM
Preschool Children's Cognition is Associated With Motor Skill Competence and Cardiovascular Fitness
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(No relevant relationships reported)

PURPOSE: While the early years are a critical window for the development of a healthy lifestyle, it is the period of growth for which we know the least about evidence linking physical activity with health outcomes in this population. This cross-sectional study examined the associations among physical activity (PA), motor skill competence (MSC), perceived physical competence (PPC), cardiovascular fitness (CF), and cognition in preschool children.

METHODS: Sixty-five preschool children (33 girls; 27 White, 21 Black, 10 Hispanic, 7 other; $\bar{x}_{age} = 4.45 \pm 0.46$; $\bar{x}_{BMI\text{percentile}} = 59.05 \pm 32.04$) were recruited from two local elementary schools in Minneapolis, Minnesota. Children's 3 days PA during school time included moderate-to-vigorous PA (MVPA) and steps were assessed via Actigraph Link; MSC was measured via the Test of Gross Motor Development-Second Edition; PPC was assessed via the Pictorial Scale of Perceived Competence and Social Acceptance; CF was assessed via a modified YMCA 3-Minute Step Test; and cognition was assessed via the computer-administered NIH Toolbox. Multiple linear regression was performed to determine the associations among outcome measures.

RESULTS: Preschool children's MVPA was not significantly related to MSC ($r = 0.182$, $p > 0.05$), PPC ($r = 0.121$, $p > 0.05$), CF ($r = -0.141$, $p > 0.05$), cognition ($r = -0.095$, $p > 0.05$), but step counts were significantly positively related to MSC ($r = 0.282$, $p < 0.05$), and preschool children's MSC was a significant predictor of step counts [$F(4, 63) = 4.65$, $\beta = 0.12$, $p < 0.05$, $R^2 = 0.24$] after age, gender, and BMI were adjusted. In addition, PPC was significantly positively correlated with MSC ($r = 0.366$, $p < 0.01$), and was a significant predictor of MSC [$F(4, 63) = 2.66$, $\beta = 0.26$, $p = 0.04$, $R^2 = 0.15$]. Preschool children's cognition was significantly positively correlated with MSC ($r = 0.266$, $p < 0.01$) and CF ($r = 0.372$, $p < 0.01$), respectively, but only CF seemed to be a significant predictor of cognition [$F(2, 62) = 4.52$, $\beta = 0.35$, $t = 2.73$, $p = 0.01$, $R^2 = 0.14$].

CONCLUSIONS: The findings support the need for effective strategies that simultaneously promote motor skill competence, cardiovascular fitness, cognition, and physical activity behaviors in early childhood. Future research with larger and more diverse samples is warranted.

- 1928** Board #84 May 30 3:30 PM - 5:00 PM
Physical Literacy Competency Among Elementary and Middle School Children
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Physical literacy addresses the ability, confidence and desire needed to optimize physical activity participation. Ability to perform, or competency in, fundamental movement skills, has not been recently evaluated among children in the United States, which is essential for identifying needs for intervention.

PURPOSE: To compare physical literacy competency between sexes and age groups in children. **METHODS:** 288 children (134 males, 153 females; age 9±2 years; height 132±36 cm; mass 41±14 kg) from 6 schools volunteered to participate. Participants completed tasks in a randomized order to assess five domains of physical literacy competency: locomotor, running, balance, upper extremity (UE) and lower extremity (LE) object control. Trained raters evaluated competency using a standardized, valid and reliable assessment (PLAYfun; Canadian Sport for Life). Participants were divided into age groups (Elementary: grades K-4; Middle: grades 5-8). Competency on all tasks was measured using a 0-100 continuous scale. Total average score and domain average scores were compared between sexes and age groups using a multivariate analysis of variance ($\alpha < .05$). **RESULTS:** There were no significant interactions between sexes and age groups ($p > .05$). Regardless of age, males demonstrated greater competency than females for overall score (mean±SE points: males=71.5±1.0, females=63.7±1.0; $p < .001$), running (males=75.4±1.8, females=63.72±1.80; $p < .001$), UE object control (males=73.32±1.71, females=56.4±1.7; $p < .001$), and LE object control (males=66.9±2.0, females=52.3±2.0; $p < .001$). Regardless of sex, Middle had greater competency than Elementary for overall score (Middle=62.2±1.0, Elementary=73.0±0.9; $p < .001$), locomotor (Middle=75.3±1.17, Elementary=65.0±1.3; $p < .001$), balance (Middle=77.4±1.3, Elementary=62.1±1.3; $p < .001$), UE object control (Middle=70.0±1.6, Elementary=59.8±1.8; $p < .001$), and LE object control (Middle=67.9±1.9, Elementary=51.2±1.8; $p < .001$). **CONCLUSIONS:** Sex differences in physical literacy are present among children in the United States, especially in

tasks involving object control. Similarly, over 20% of children in middle school lack competency in object control tasks. These areas need to be addressed in order to optimize long-term physical activity.

- 1929** Board #85 May 30 3:30 PM - 5:00 PM
Classroom-based Strategies to Reduce Disparities in Physical Activity Among Children with Asthma
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 (Sponsor: Rebecca Hasson, FACSM)
 (No relevant relationships reported)

PURPOSE: Children with asthma often experience physical activity (PA) induced symptoms 5-10 minutes following the start of exercise, with symptoms peaking 5-10 minutes post-activity. Classroom PA breaks provide shorter bouts of PA (4 minutes), and may represent a novel strategy to promote PA participation in this clinical population. Using a classroom-based PA intervention, we tested the feasibility of 5, 4-minute PA breaks to promote PA participation in children with asthma. **METHODS:** Nine, 3-6th grade classrooms at an elementary school in Detroit, MI (79% Hispanic; 80% on free/reduced lunch; 31% prevalence of asthma and asthma-like symptoms) participated in the 20-week intervention. Asthma status was self-reported via the International Study of Asthma and Allergies in Childhood (ISAAC) questionnaire in conjunction with nurse documentation. PA participation, exercise intensity (sedentary (SED), low-intensity physical activity (LPA), moderate-to-vigorous intensity physical activity (MVPA)), and asthmatic symptom occurrence were assessed via direct observation. **RESULTS:** All students accumulated approximately 19 total minutes (4.5±0.8 PA breaks x 246±8.0 seconds) of activity per day during PA breaks. Throughout the intervention, a greater percentage of children with asthma participated in MVPA during the PA breaks compared to children without asthma (asthma: 52.9±1.5% vs. non-asthma: 46.1±1.3%; $p=0.001$). In contrast, a greater percentage of students without asthma participated in LPA during PA breaks (non-asthma: 30.2±1.1% vs. asthma: 25.8±1.2%; $p=0.006$). There were no differences in the percentage of students who were SED during PA breaks (asthma: 21.3±1.7% vs. non-asthma: 23.7±1.8%; $p=0.155$). Out of 294 observations, six instances of asthmatic symptoms (coughing) were observed post PA break. **CONCLUSIONS:** Classroom-based interventions that incorporate short bouts of PA, represent safe exercises for children with asthma. Given the higher participation in MVPA among children with asthma, classroom interventions may be effective in reducing PA disparities in school settings.

- 1930** Board #86 May 30 3:30 PM - 5:00 PM
Wearable Activity Monitors as Part of a Childhood Obesity Treatment Program
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 (No relevant relationships reported)

PURPOSE: It is well known that childhood obesity has become a common issue in the United States (1), and that obesity contributes to a multitude of chronic diseases and negative health conditions (2). One of the biggest challenges in the treatment and prevention of childhood obesity is that the goal of these programs is primarily to modify behaviors that occur outside of the program space. The purpose of this study was to summarize the findings from a 6-month program that used wearable activity monitors (WAM) as part of a clinical obesity treatment program for fifteen children in Arizona (USA) between December 2015 to November 2017. **METHODS:** Obese children were referred to participate in this program by their pediatrician. Participants were provided a WAM that was used to monitor their physical activity (PA) levels, heart rate, and sleep habits. For the first week, participants were instructed not to change their behaviors so that baseline PA data could be collected. Subsequently, appropriate step and heart rate zone goals were set and progressively increased each week that a participant met their previous goal. **RESULTS:** Adherence to wearing the WAM was high, with only about 1.3% of activity data and 3% of sleep data missing throughout the entire program. Three children dropped out of the study before the program was completed. For the children who completed the program, modest improvements were noted for step count, and healthy sleep habits were found to be positively correlated with PA. In baseline data collection, the children walked on average 8,900 steps per day. In the final week, the children recorded 9,784 daily steps on average, representing approximately a 10% increase in the average number of steps taken. **CONCLUSIONS:** Overall, childhood obesity treatment programs focus heavily on modifying behaviors that occur outside of the clinic setting. A WAM appears to be a feasible approach to continuously monitor and increase the PA of obese children. Including WAM and progressive goal setting in a clinical obesity treatment program

for children may be an effective method to increase PA levels outside of the clinical setting. Further exploration of the link between healthy sleep habits and PA could yield additional findings useful to childhood obesity treatment and prevention.

- 1931** Board #87 May 30 3:30 PM - 5:00 PM
Association of Sports Participation with Intake of Fast Food for Family Meals Among Rural Children
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 (No relevant relationships reported)

After-school sports participation is common among children, and the busy lives of families could lead to challenges to prepare healthful family meals. This often results in families seeking the convenience of fast food for their evening meal. However, there is a scarcity of research, particularly among families in rural areas, examining whether children's sports participation is associated with families' intake of fast food as their evening family meal. **PURPOSE:** To examine associations between sports participation and fast food intake of rural children. **METHODS:** Baseline data from the childhood obesity prevention, randomized controlled trial, NU-HOME, were analyzed. Children ($n=60$; age= 8.95 ± 0.89 years; 62% female; 60% normal weight) and their parents reported on sociodemographics, child's sports participation (activities in the last year and frequency after school and in evenings) and family's intake of fast food as the evening meal. Logistic regression analyses were performed. **RESULTS:** Mean sports participation in the past year was 2.36 ± 1.27 activities, with children reporting engaging in after-school and evening activities on 2.19 ± 1.66 and 2.61 ± 2.21 days, respectively, over the past week. Of their evening family meals in the past week, parents reported that 1.2 ± 1.01 meals were considered fast food. Although sports participation in the past year was correlated with socioeconomic status, there was no statistically significant association between sport participation and fast food as evening family meal ($p>0.05$). **CONCLUSIONS:** Although sports participation was not associated with fast food intake as evening family meal in this study, future research should explore this relationship in other populations, particularly in larger studies. Furthermore, the possibility of lower availability of fast food options in rural areas compared to more urban settings could be an important caveat.

- 1932** Board #88 May 30 3:30 PM - 5:00 PM
The Association Between Sex and Directly Observed Physical Activity in Preschool-Age Children
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Sex disparities in physical activity (PA) are evident in preschool-age children (2.9 – 5 years old). Preschool-age boys have been reported to participate in more PA during free play. However, it is unknown if this disparity is evident when participating in a structured PA intervention. **Purpose:** To examine the association between sex and directly observed PA levels in preschool-age children while participating in a PA intervention. **Methods:** This study utilized data from the Short bouts of Exercise for Preschoolers (STEP) study. STEP was a 6-month cluster randomized controlled study that examined the effects of short bouts of structured PA implemented within the classroom setting as part of designated gross motor playtime in ten preschool centers. STEP consisted of structured PA during the first 10 minutes of gross motor playtime followed by 20 minutes of free playtime. PA levels during the 10-minute intervention session were measured using a modified Observational System for Recording Physical Activity in Children-Preschool Version. PA intensity was classified as sedentary, light, or moderate-to-vigorous (MVPA). This secondary analysis focused on the baseline and 3-month data of participants randomized to the intervention group (preschool centers, $n=5$; participants, $n=75$; age = 3.9 ± 0.67 years). Spearman correlations were used to examine the association between sex and PA intensity during the intervention. Repeated measures ANOVAs were used to examine the effect of sex on PA intensity. **Results:** Participants spent similar percent of intervals in MVPA at baseline (boys, 41.77 ± 6.59 ; girls, 38.27 ± 5.16) and 3-months (boys, 46.61 ± 7.59 ; girls, 43.89 ± 7.55). There were no significant associations between sex and directly observed MVPA at baseline ($r=-0.035$, $P=0.37$) or 3-months ($r=-0.039$, $P=0.81$). Similarly, there were no significant effects of sex on any PA intensity (all $P>0.80$) during the intervention. **Conclusion:** In this sample, sex was not associated with or impacted the number of intervals that preschool-age children spent in MVPA during the structured PA intervention. Future studies are needed to determine if these trends remain the same in a larger sample size.

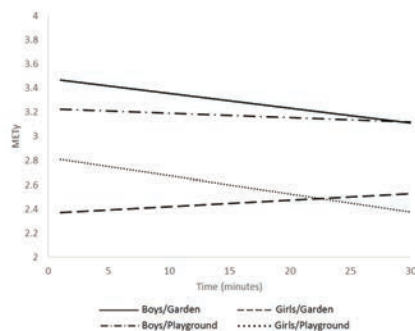
Funded by: Robert Wood Johnson Foundation, Active Living Research Grant 68509

1933 Board #89 May 30 3:30 PM - 5:00 PM
Patterns of Physical Activity Change during Playground and Gardening Activities in Young Children

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(No relevant relationships reported)

Previous research shows a decline in activity intensity during outdoor free play in young children, with the pattern of decline varying between boys and girls. However, this area has not been studied in other outdoor locations (i.e., garden) or during semi-structured play. **PURPOSE:** To determine if a time course change in intensity level, defined as a change in youth MET (MET_y), occurs during outdoor play on a natural playground and in a garden setting in preschool children. **METHODS:** Twenty-six children (4.5 ± 0.7 y; 13 boys) wore an ActiGraph GT3X+ accelerometer on the right hip during two 30 min free living conditions; free play on a natural playground and semi-structured play in a garden. The Pate et al. equation was used to calculate VO₂ from accelerometer data. MET_y values were calculated by dividing predicted VO₂ by predicted basal metabolic rate (Schofield equation). Hierarchical linear models were used to demonstrate the changes in MET_y over time (level one variable = time, level 2 variable = individual child, predictor variables = sex (boy or girl) and location (garden or playground)). There was a three-way interaction among time, location, and sex (F(1, 725.984) = 7.858, p<0.001), thus separate models were run for each sex. **RESULTS:** For boys, there was no time by location interaction (F(1, 387.174) = 1.038, p=0.309) and no main effects for time (F(1, 177.036) = 3.115, p=0.268) or location (F(1, 384.913) = 1.234, p=0.078). For girls, there was a significant time by location interaction (F(1, 313.624) = 9.925, p=0.002), yielding the following equation: MET_y = 2.81 - 0.44 (location; playground = 0, garden = 1) - 0.02 (time) + 0.02 (location*time). The figure represents the average change in MET_y for each location and by sex.



CONCLUSIONS: Boys' MET_y level was consistent across time in both locations. Girls' MET_y level declined in the playground but increased in the garden. For girls, semi-structured activity in a garden may result in sustained higher MET_y activity during play.

1934 Board #90 May 30 3:30 PM - 5:00 PM
Recess And Overweight And Obesity In Children 5-11 Years Of Age: 2013-2016 Nhanes

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 (Sponsor: James R. Churilla, FACSM)

(No relevant relationships reported)

There is limited evidence examining reported weekly volume of recess and odds of overweight and obesity using large nationally representative samples of U.S. children. **PURPOSE:** Examine the associations between reported weekly volume of recess, and overweight and obesity in a nationally representative sample of U.S. children. **METHODS:** The study sample included male (n=1,434) and female (n=1,409) children 5 to 11 years of age who participated in the 2013-2016 National Health and Nutrition Examination Survey. Overweight and obesity were defined using the 85th and 95th percentile of body mass index of the same age and sex. Proxy respondents answered interview questions regarding the number of days/week and minutes/day that the child participates in recess. **RESULTS:** Compared to a referent group participating in recess five days/week for > 30 minutes/day, analysis revealed significantly higher odds of obesity in females reporting no recess participation (Odds Ratio 1.81; 95% Confidence Interval, 1.03-3.16, P=0.0397). This relationship was independent of age and race/ethnicity. A similar relationship was not revealed for prediction of overweight in females or overweight and obesity in males. **CONCLUSION:** In a large nationally representative sample of U.S. children, reporting no recess was associated with significantly higher odds of obesity in females.

1935 Board #91 May 30 3:30 PM - 5:00 PM
Game-Play Characteristics by Field Size in Boys Youth Lacrosse

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(No relevant relationships reported)

US Lacrosse's Athlete Development Model (LADM) currently encourages small-sided game (SG) field dimensions to increase development and skill acquisition for youth athletes. No studies have evaluated changes in game-play subsequent to SG participation in boys' youth lacrosse (BYL). **PURPOSE:** To describe game-play characteristics during SG (35-45 yd) and full-field games (FG, 60-70 yd) in BYL. **METHODS:** Data was collected from 33 BYL players in Virginia (8.5±0.5 years, 138.3±5.7 cm, 35.9±6.5kg) on SG (n=15) and FG (n=18) teams. All games were filmed using a digital camera affixed to a camera lift system. Game-play characteristics were measured by reviewing the game video and coding for characteristics of unsuccessful passes, successful passes, shots on goal, goalie saves, changes of possession, loose balls, and intercepted passes. Descriptive statistics were reported (Frequency, Mean) for all observed game-play characteristics. **RESULTS:** Teams participated in 12 games total with 159 total athlete-exposures. Total gameplay characteristics were: unsuccessful passes (SG=587, FG=399), successful passes (SG=165, FG=347), shots on goal (SG=81, FG=143), goalie saves (SG=28, FG=79), changes of possession (SG=419, FG=335), loose balls (SG=799, FG=670), and intercepted passes (SG=31, FG=24). The average characteristic per game were: unsuccessful passes (SG=97.8, FG=66.5), successful passes (SG=27.5, FG=57.8), shots on goal (SG=13.5, FG=23.8), goalie saves (SG=4.7, FG=13.2), changes of possession (SG=69.8, FG=55.8), loose balls (SG=133.2, FG=111.7), and intercepted passes (SG=5.2, FG=4.0). Further characteristics included: percent successful passes (SG=22%, FG=47%) and percent of successful shots on goal (SG=60%, FG=41%). **CONCLUSION:** Generally, FG had a greater percentage of successful passes than SG with comparable attempts per game between the two groups. In addition, SG had a greater successful shot percentage on less shots but had fewer goalie saves per game. Lastly, the SG team had more unsuccessful passes, loose balls, and turnovers. Further research is required to understand the effects of all aspects of the LADM on player development in BYL.

1936 Board #92 May 30 3:30 PM - 5:00 PM
Increased Acute-chronic Training Load Ratio Is Associated With Time-loss Injury In Elite-youth Female Soccer Athletes

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(No relevant relationships reported)

Prior research demonstrates that elevated acute (1-week) relative to chronic (3-4 weeks) training load (TL) ratios are associated with increased injury risk. However, there is no existing research examining this relationship in youth female soccer athletes, who are at high risk for certain injuries during sport, such as anterior cruciate ligament injury. **PURPOSE:** To investigate the association between acute-to-chronic TL (A:C) ratio measures with time-loss injury in elite-youth female soccer athletes. **METHODS:** Forty-three elite-youth female soccer athletes participated in the study. Daily measures of training load, measured by self-reported (0-10 scale) rating of perceived exertion (RPE) multiplied by training duration (minutes), were recorded within 30-minutes of practices and games from pre-season (August 2017) until the end of the fall competitive season (December 2017) using a customized phone app. Following completion of the competitive season, the athletes completed a survey to determine their history of experiencing a time-loss injury during the season. A:C ratios were calculated at week-9 relative to weeks 5 through 8, as this was the most intensive TL period of the season. Binary logistic regression examined the association between A:C ratio and time-loss injury status. Receiver operator curve (ROC) analyses was performed to select a A:C TL cutpoint, followed by computation of sensitivity, specificity and area under the curve (AUC). Odds ratios (OR) were calculated and compared between those with and without time-loss injury. **RESULTS:** Nineteen athletes reported to miss ≥1 day of practice or game due to injury. Logistic regression demonstrated greater A:C ratio was associated with increased risk of time-loss injury (OR = 12.65 [95% CI=1.51, 105.27], Wald=5.49, P=0.019). ROC curve analysis identified an A:C ratio cutpoint of 1.62 to have optimal screening properties: sensitivity=73.3%, specificity=87.5%, AUC=0.76. The OR for an A:C ratio of 1.62 or higher compared to less than 1.62 was 19.25 (95% CI=3.64, 101.77). **CONCLUSIONS:** Elevated A:C ratios (>1.62) are associated with increased risk of suffering time-loss injury in elite-adolescent female soccer athletes. Monitoring and managing A:C TL may be an important injury prevention strategy in this population.

1937 Board #93 May 30 3:30 PM - 5:00 PM
Physical Education Enrollment Trends of Youth with Obesity in a Large Midwestern Metropolitan Area

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PURPOSE: To determine physical education (PE) enrollment trends of youth with obesity in primary and secondary schools in a large Midwestern metropolitan area.
METHODS: Data from 71 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Entries were refined to include only school-aged children, ages 6-18 years old. Multiple encounters per subject were included if the encounters occurred during separate school years. Information regarding frequency (days per week) and duration (length of school year) of PE class was used to determine what percent of total school days a subject was enrolled in PE. Data were analyzed to determine trends in PE enrollment by age, gender, race, ethnicity and socioeconomic status.
RESULTS: Data were obtained for 6221 patient encounters (3514 females, 2706 males). Of these, 31.4% of patients were not enrolled in PE during the school year of the encounter. The most common frequencies of PE enrollment overall were 20% (29.4%) and 40% (16.3%) of total school days. There was no significant difference in PE enrollment between the age groups of 6-11 years and 12-13 years (26.6% vs. 26.5%). Students ages 14-18 years old were enrolled in PE a lower percentage of school days (18.5%, $p<0.0001$). Of students ages 14-18 years, males were enrolled in PE significantly more than females (21.2% vs. 16.7%, $p=0.002$). Subjects with government-funded health insurance were enrolled in PE more than students with private health insurance (25.2% vs. 22.0%, $p<0.0001$). Differences between race and ethnicity were not significant.
CONCLUSION: PE enrollment in this population falls below previously reported national averages for elementary and middle school students and slightly above average for high school students. The majority of school-aged youth with obesity in this metropolitan area do not acquire enough physical activity through PE to meet recommended daily physical activity guidelines.

1938 Board #94 May 30 3:30 PM - 5:00 PM
BMI, Body Composition and Race are Associated with Decreased Bicycling Ability in Youth with Obesity.

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 (No relevant relationships reported)

PURPOSE: To evaluate which factors may decrease the ability to ride a bike in youth with obesity.
METHODS: Data from 71 months of clinical visits to a pediatric weight management program were extracted from electronic medical records. Demographics and anthropometric measures, along with patient response to the question, "Are you able to ride a bike?" were analyzed to determine which factors limit a patient's ability to ride a bike. Levels of continuous variables for riders vs non-riders were compared using Wilcoxon rank sums tests. Fisher's Exact tests were used to compare proportions. Stepwise logistic regression was used to determine independent predictors of ability to ride.
RESULTS: Data were obtained from 4276 patients (2409 females, 1876 males). Mean age was 12.2 ± 3.2 years. Mean BMI was 33.5 ± 9 kg/m². Overall, 78.9% of the subjects were able to ride a bike. Males were more able to ride than females (79.4% vs. 78.6%, $p=0.54$). Caucasians were more able to ride than African Americans (80.0% vs. 76.9%, $p=0.0491$). Older aged subjects were more able to ride than younger aged subjects (12.6 ± 3 vs. 11.9 ± 3.8 years, $p<0.0001$). Subjects with a higher BMI were less able to ride (34.8 ± 9.3 vs. 33 ± 8.8 kg/m², $p<0.0001$). Subjects with a higher percent body fat (PBF) were less able to ride (46.4 ± 6.1 vs. 43.4 ± 6.7 %, $p<0.0001$). Body fat mass was also significantly higher in the group that was unable to ride (41.1 ± 25.5 kg vs. 37.3 ± 15.1 kg, $p<0.0001$).
CONCLUSIONS: Many different factors contribute to the ability to ride a bike in youth with obesity. Gender, race, age, BMI and body composition were all associated with the ability to ride a bike. Youth with greater amounts of obesity and body fat may struggle more to ride a bike. Being unable to ride a bike limits options for active transportation and moderate-to-vigorous play in youth with obesity.

1939 Board #95 May 30 3:30 PM - 5:00 PM
Game-Play Characteristics by Field Size in Girls' Youth Lacrosse

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To facilitate player development, the Lacrosse Athlete Development Model (LADM) recommends the use of small-sided games (SG) and fewer players on the field. Yet, no studies have evaluated if SG change game-play in girls' youth lacrosse (GYL).
PURPOSE: To describe game-play characteristics during SG and full-field games (FG) in GYL. **METHODS:** Female athletes (N=28, 8.5 ± 0.5 years, 132.4 ± 3.6 cm, 31.4 ± 1.7 kg) participated on either a small-sided (SG, n=13) or a full-field (FG, n=15) 10U level team within a single GYL league in Virginia. Both SG and FG teams participated in 6 games during the season. All games were filmed using a digital camera affixed to a camera lift system. Game-play characteristics were measured by reviewing game video and coding the frequency of observed activities (e.g. successful passes, changes of possession, intercepted passes, shots on goal, and loose balls). Descriptive statistics (Frequency, Mean) for game-play characteristics were calculated.
RESULTS: A total of 137 athlete-exposures (AE) occurred across 12 games (SG=59AE, FG=78AE). Total characteristics for the season were: unsuccessful passes (SG=476, FG=378), successful passes (SG=59, FG=110), shots on goal (SG=183, FG=189), goalie saves (SG=58, FG=79), changes of possession (SG=333, FG=281), loose balls (SG=625, FG=575), and intercepted passes (SG=17, FG=10). Average characteristics per game were: unsuccessful passes (SG=79.3, FG=63.0), successful passes (SG=9.83, FG=18.3), shots on goal (SG=30.5, FG=31.5), goalie saves (SG=9.7, FG=13.2), changes of possession (SG=5.5, FG=4.68), loose balls (SG=104.2, FG=95.8), and intercepted passes (SG=2.8, FG=1.7). Further, the FG team had a larger proportion of successful passes (23%) than the SG team (11%). However, the SG team had a larger proportion of successful shots on goal (63%) than the FG team (54%).
CONCLUSION: A greater proportion of successful passes were observed in FG than SG with comparable attempts and slightly fewer intercepted passes per game. Further, SG was observed to have a greater proportion of successful shots on goal despite FG having slightly more attempted shots on goal and more goalie saves. Additional research is needed to better understand how all aspects of LADM guidelines affect player development and skill acquisition in GYL.

1940 Board #96 May 30 3:30 PM - 5:00 PM
Physical Activity Among Youth Lacrosse Players: Full vs. Modified Field Play

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PURPOSE: US Lacrosse developed the Lacrosse Athlete Development Model (LADM) to provide every athlete the opportunity to enter, enjoy and excel by learning and playing lacrosse in a way that's best for each stage of growth and development. Evaluation is essential to determine whether the LADM achieves the stated goals. The study aim was to assess whether players' physical activity (PA) was greater during games played on modified (Mod) fields than full-sized (Full) fields.
METHODS: This prospective cohort study involved two boys' and two girls' youth lacrosse teams who participated in six full or modified games. 61 youth players between the ages of 8-10 (U10) were selected via a convenience non-probability sample. Full field games were played on 60x110 yard fields; modified field games were played on 35x60 yard fields; games were 50-54 minutes long. Players wore the Actigraph Wgt3X-BT, a triaxial accelerometer that recorded PA over time in units of Metabolic Equivalents (1 MET = 3.5 ml O₂·kg⁻¹·min⁻¹). Data were categorized by PA level and analyzed using Chi-square tests to assess differences in PA by play (Full vs. Mod).
RESULTS: Boys' median PA was 3.0 METs (Full) and 2.8 METs (Mod). Girls' median PA was 2.9 METs (Full) and 3.2 METs (Mod). Among boys, vigorous physical activity was higher in full field games (13.9%) compared to modified field games (9.4%). ($p<0.001$) Among girls, moderate physical activity was higher in full field games (12.6%) compared to modified field games (10.3%) ($p<0.001$).
CONCLUSIONS: There were modest differences in activity level by game type among youth (U10) boys and girls lacrosse players when playing on the modified (smaller) field compared to the full field games. Although statistically significant, differences may be attributable to the following factors: • Higher player-field density on the modified fields (i.e., less open space on the modified fields); • More experienced and talented players participating in full field play; • Relatively more players on the

bench for more of the game on the modified fields than full size fields; • Coaches stopping the game on multiple occasions to provide instructions to inexperienced players in the modified field game; • Local (rather than US Lacrosse) rules were used, allowing more players on the field and longer game times.

1941 Board #97 May 30 3:30 PM - 5:00 PM
Serum Vitamin D, and Metabolic Risks In Obese Youth Involved In a Physical Activity Program

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Purpose: to investigate whether a physical activity (PA) promotion program in overweight/obese (OW/OB) youngsters is favorable to changes in PA levels, vitamin-D (VIT-D) and metabolic profile and the correlations between those changes. **Methods:** This was an intervention study performed twice a week, over a period of six months with 57 OW/OB youngsters (31 girls). PA promotion program aimed to increase children and adolescent's moderate-vigorous PA levels. It was performed evaluation of body composition, physical activity, maturational stage and biochemical variables (HDL, LDL and VLDL cholesterol, glucose, insulin and VIT-D). For statistical analysis, Paired sample t-tests and partial correlations were used. **Results:** Significant differences between baseline and post intervention were observed for body composition, lipid profile and PA levels. Furthermore, Δ VIT-D was positively correlated with the Δ HDL ($r=0.30$), while negative correlations were found with metabolic risk factors. Δ VPA showed significant correlations with Δ VIT-D ($r=0.37$) and Δ HDL ($r=0.34$). **Conclusions:** After a PA program, OW/OB youth presented positive changes in body composition, vitamin D, metabolic profile and PA levels, indicating that interventions involving physical exercise should be promoted as an important component of a healthy lifestyle. This study was supported by FCT :UID/DTP/00617/2013

1942 Board #98 May 30 3:30 PM - 5:00 PM
Investigating the Impact of Daily Physical Education on Fitness Levels of Underserved Minority Youth

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PURPOSE: To investigate the impact of a 45-minute daily physical education intervention on overall fitness among underserved, minority elementary school youth. **METHODS:** An analysis of variance (ANOVA) mixed effect linear model was used to evaluate the effectiveness of 45 minutes of daily physical education on the Progressive Aerobic Cardiovascular Endurance Run (PACER), push-ups, and curl-ups among elementary school youth attending Legacy Early College, a Title I school in the southeastern US. Gain scores (final post-test assessment in May 2018 - original pre-test assessment in September 2017) were calculated and analyzed for significance. The interaction between school and time was estimated for each outcome. Each analysis was stratified by gender and adjusted by age to control for baseline differences by school. A Title I control school that provided physical education only one day per week was used as a comparison. **Summary of RESULTS:** Legacy students had significantly greater increases in curl-ups (Gain Score=12.23, $F=31.323$, $p=.000$) and PACER laps (Gain Score=6.18, $F=9.502$, $p=.002$). Legacy males and females observed greater increases in their fitness levels than controls. Legacy male and female students performed significantly better than controls in curl-ups, push-ups and PACER laps (Gain Scores=11.46, 3.14, 5.22, $F=71.695$, 51.126, 9.51, $p=.000$, .000, .002 respectively). **CONCLUSION:** Implementing 45 minutes of daily physical education in underserved elementary schools could improve children's overall fitness levels. Supported by Campbell Young Leaders.

1943 Board #99 May 30 3:30 PM - 5:00 PM
Using Dance to Promote Physical Activity and Fitness Among Adolescent Girls with Intellectual Disabilities

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Girls with intellectual disabilities (ID) exhibit poor fitness and low physical activity (PA) levels, and are considered a vulnerable, at-risk population. Girls with ID have limited access to many PA opportunities, but dance is accessible, widely available, and perceived as enjoyable. **PURPOSE:** To evaluate the feasibility and preliminary efficacy of a 12-week dance intervention to promote engagement in moderate to vigorous PA (MVPA) and increase cardiorespiratory (CR) fitness among girls with ID ages 16-21. **METHODS:** The intervention was implemented in 3 urban communities and included two 75-minute weekly dance sessions. Dance styles included hip hop, jazz, and modern; the choreography and session structure were designed to promote MVPA. Continuous heart rate (HR) monitoring (Polar® E600) was used for motivation and to record time spent below/in/above each girl's target HR (THR) zone (60-80% HR_{max}). Pre- and post-test CR fitness was measured by the 6-minute walk test (6MWT). Survey items assessed enjoyment and satisfaction. **RESULTS:** 18 adolescent girls (17.3 ± 2.7 y) with ID completed the intervention. Attendance was high; girls attended an average of 87% of dance sessions (range 67% - 100%). Overall, girls spent 52% (± 23%) of each session engaged in MVPA; defined as in or above their individual THR zone. Engagement level was quite variable; one girl averaged 4% of the dance session in her THR zone and another averaged 94%. When queried weekly about their PA intensity during the sessions, 11 of 18 girls reported that they worked "really hard" at every session. We observed a mean increase of 74.6 feet in distance walked on the 6MWT baseline to post-test ($n=14$); however, this difference was not significant ($p=0.17$). Post-intervention surveys indicated that girls "liked" the dance program (14 of 17), perceived improved fitness (15 of 17), and wished to continue dancing (15 of 17). Most girls reported a preference for a girls-only dance program and a program exclusively for those with ID. **CONCLUSION:** Participants engaged in dance at an MVPA intensity level for over half of the 75-minute sessions, supporting that dance is viable for promoting PA for girls with ID. Girls expressed their enjoyment of the program and wanted to continue beyond the 12-week program. More frequent training is likely needed to increase CR fitness.

1944 Board #100 May 30 3:30 PM - 5:00 PM
Relationship Between Physical Activity, Sedentary Time, Cardiorespiratory Fitness And Academic Achievement In Norwegian Adolescents.

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 (No relevant relationships reported)

Background: There is increasing evidence of positive associations between physical activity (PA), cardiorespiratory fitness (CRF) and academic achievement. Some studies have found an inverse association between sedentary time and academic achievement, however, the findings are mixed and the literature is inconclusive. **Purpose:** To examine the associations between objectively assessed PA, sedentary time, CRF and academic achievement in a sample of Norwegian adolescents. **Methods:** This cross-sectional study included 1518 adolescents aged 13.9 years (53.8% girls) from 29 schools in Norway. We assessed PA and sedentary time by accelerometry (Actigraph GT3X+). Intensity thresholds for sedentary time and MVPA were <100 counts per minute (CPM) and >2000 CPM, respectively. CRF was measured with an intermittent shuttle run test. Academic achievement in reading and numeracy were assessed using standardized national academic tests. We used a multiple linear mixed model analysis including school as random effect to account for clustering, adjusted for covariates (age, sex, socio economic status (SES) and accelerometer wear time). Additionally, the analyses modelling sedentary time and MVPA as exposure variables were mutually adjusted.

Results: Mean achievement in reading and numeracy were 55.9 (Standard deviation (SD) 10.0) and 55.8 (SD 9.7) points, respectively. Achievement in reading was positively associated with sedentary time ($B=0.044$, 95% CI: 0.027; 0.062), time spent in MVPA ($B=0.050$, 95% CI: 0.018; 0.083) and CRF ($B=0.014$, 95% CI: 0.009; 0.019). Achievement in numeracy was positively associated with sedentary time ($B=0.033$, 95% CI: 0.016; 0.050), time spent in MVPA ($B=0.033$, 95% CI: 0.014; 0.065) and CRF ($B=0.013$, 95% CI: 0.009; 0.018). **Conclusion:** Achievement in reading and numeracy are positively and independently associated with sedentary time, time spent in

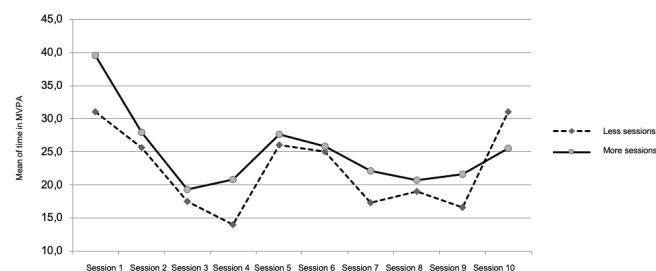
MVPA and CRF. The results suggest that accumulating 10 minutes more in MVPA or sedentary per day, is associated with improved achievement in reading and numeracy by approximately 0.5 and 0.3 points, respectively. However, due to the cross-sectional design and the small magnitude of the associations, the practical implications of these results should be interpreted with caution.

1945 Board #101 May 30 3:30 PM - 5:00 PM
Intervention With Exergames For Adolescents Promote Moderate To Vigorous Physical Activity

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Both the decline in moderate to vigorous physical activity intensities (MVPA) and the increase in sedentary behavior (SB) have different deleterious effects on the health of adolescents. **PURPOSE:** Verify a 10-week intervention using exergames with adolescents was able to promote levels of physical activity from moderate to vigorous intensities (MVPA) and compare the time in MVPA between the group with more or less participation in sessions. **METHODS:** Twenty adolescents (11 boys and nine girls) with an average age of 11.7 ± 0.9 years participated in an intervention with 10 sessions of exergames on the school, twice a week for about 40 to 60 minutes. XBOX 360 equipment was used with Kinect and the pair of adolescents practiced the games using an ActiGraph accelerometer. The analyzes included the total time and time of involvement in MVPA at each session. Descriptive statistics analyzes and the independent student T test were used. The level of significance was 5%. **RESULTS:** Of the 20 adolescents, three participated in all the sessions (10), six participated in nine sessions and seven participated in eight sessions, representing 80% of effective participation in the intervention. Only 20% of the students participated in only four to six sessions per week. Approximately half the time of each session was spent with MVPA (20.7min vs. 24.4min), in favor of the group with the largest participation in sessions with active video games. This same group presented up to the ninth session with longer mean time in MVPA compared to the group that participated in fewer sessions. **CONCLUSION:** It was possible to observe that a 10-week intervention using exergames with adolescents was able to promote levels of physical activity of moderate to vigorous intensities (MVPA), mainly in the group that have more participation in sessions.



1946 Board #102 May 30 3:30 PM - 5:00 PM
Twelve Years Follow Up - Prevalence Trends Of Physical Inactivity And Overweight In Brazilian Adolescents

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PURPOSE: Determine the physical inactivity and overweight prevalence in adolescents living at São Paulo State (Brazil) from 2005 to 2017. **METHODS:** We evaluated 3,845 adolescents as part of a cohort study that started in 2005 in São Paulo city. In this study we analyzed 2,012 both sex adolescents that were followed in 2005, 2009, 2013, 2015 and 2017. In 2005, adolescents were from 15 to 18 years of age. We assessed the habitual physical activity practice by International Physical Activity Questionnaire (IPAQ-short-8 version) considering active (AT) the adolescents that accumulated at least 300 minutes per week of moderate-vigorous PA and inactive (INA) if less than 300 min/week were reported. Body weight (kg) and height (m) were self-reported by questionnaire. BMI was calculated and the respective criteria for overweight classification were considered for Brazilian adolescents

(CONDE and MONTEIRO, 2006). The anthropometry tendency changed overtime, and a linear regression model was designed to express the annual physical inactivity prevalence average and the excess of body weight. The significance was $p < .05$.

RESULTS: In general, the prevalence of physical inactivity in 2005 was 50.4%, with significant increase to 53.2% (2009); 56.7% (2013); 59.2% (2015) and 60.2% (2017), with 0.91% annual increase. Higher variation was observed in girls than boys (1.32% \times 0.89% per year). The overweight prevalence followed similar trend: 2005 (16.7%); 21.2% (2009); 25.8% (2013); 28.2% (2015) and 29.3% (2017) with 1.29% increase per year ($p < .05$). Girls presented significantly and higher percentage change than boys (1.56 vs. 1.15% per year).

CONCLUSIONS: Data showed progressive trend of high physical inactivity and body fat increase, leading to an incidence of obesity in the next 10 years around 71.0% of all adolescents living in São Paulo State 37.2% of physically inactive behavior. These data suggests an early development of cardiovascular disease, with higher impact in girls than boys. Also data strongly suggest to effectiveness of public health policies towards the physical inactivity prevention and the excess of body mass among adolescents are related to unhealthy behaviors of eating, drinking and PA.

1947 Board #103 May 30 3:30 PM - 5:00 PM
Compliance With The 24-h Movement Guidelines In Hong Kong Adolescents: Associations With Body Mass Index

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(No relevant relationships reported)

The evidence-based 24-h Movement Guidelines (MG) for children and youth was launched in 2016, shifting the thinking from one single movement behavior to an integration of three behaviors under the 24-h circle: physical activity (PA), screen time (ST), and sleep. A low compliance rate of meeting these combined recommendations has been reported for children. However, few studies have focused on adolescents, and its association with health outcomes such as body weight status is largely unknown.

PURPOSE: To examine compliance with the 24-h MG among Hong Kong adolescents and their associations with body mass index (BMI).

METHODS: 1,039 adolescents (11-18 yrs) wore the waterproof activPALTM for 24-h over 7 consecutive days to assess PA and sleep duration. ST was measured using items from the validated Chinese version of the Children's Leisure Activities Study Survey. Participants were classified into 8 categories depending on the adherence to the 3 recommendations: none, single recommendation (PA, ST or sleep), two recommendations (PA & ST, PA & sleep, or ST & sleep) and all three recommendations. BMI was calculated as weight (kg) / height (m)². Linear mixed models were used to examine the associations of BMI with the 8 categories and the number of guidelines met (0-3), adjusted for age, sex and school clustering effects.

RESULTS: The analytic sample consisted of 656 adolescents (48% of girls) who provided valid activPALTM data for at least 4 days and completed questionnaire. Only 1.1 % of the adolescents met the overall 24-h MG, while 38.7% met none of them. The proportion of meeting one single recommendation of PA, ST and sleep was 9.9%, 30.3% and 39.2%, respectively. Adolescents who did not meet the PA recommendation ($b = 1.34$; 95% CI, 0.32 to 2.36; $p = 0.007$) and those who did not meet the combination of PA and sleep recommendations ($b = 2.15$; 95% CI, 0.49 to 3.82; $p = 0.011$) had higher BMI than those who met the respective recommendations. No significant association was found between number of recommendations met and BMI.

CONCLUSIONS: Compliance with the 24-h MG was alarmingly low among Hong Kong adolescents. Meeting PA recommendation and the combination of PA and sleep recommendations were more likely to have a healthier body weight.

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1948 Board #104 May 30 3:30 PM - 5:00 PM
The Effects Of HIIT And LIT On Weight Loss In Obesity Children/adolescents: A Systematic Review And Meta-analysis

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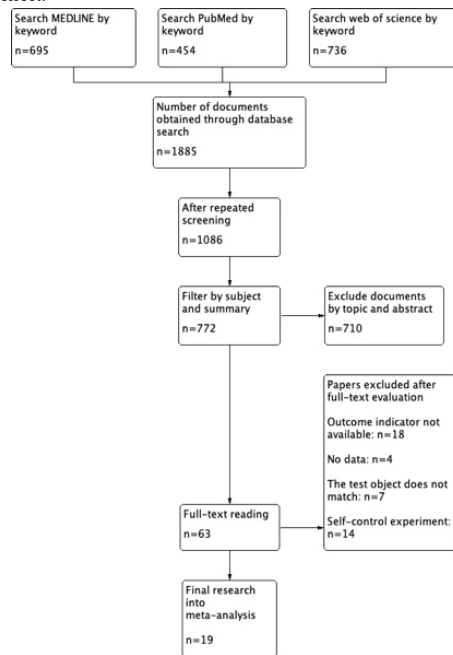
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(No relevant relationships reported)

PURPOSE: To explore the effect of high-intensity interval training and low-intensity training on weight loss in obese children and adolescents.

METHODS: Search database (MEDLINE, PubMed, websites of science core database), the deadline is May 20, 2018. The screening conditions were as follows: Randomized controlled trials; Writing in English; Participants in the study were obese children/adolescents between the ages of 6 and 18; The intervention model is HIIT or

LIT, and the training time is at least four weeks; The final results of the study should include weight (body weight), BMI, body fat ratio (% body fat), and body fat (fat weight). The risk assessment was assessed using the Jadad scale (total score of 7). **RESULTS:** Compared with LIT, HIIT can significantly reduce % body fat [-1.27(95%CI=-1.87,-0.67), $Z=4.14$ ($p<0.0001$)] ,BMI[-0.42(95%CI=-0.83,-0.01), $Z=2.00$ ($p=0.05$)] and body weight. [-0.40(95%CI=-0.73,-0.06), $Z=2.33$ ($p=0.02$)]; Comparing the EG and the CG of HIIT and LIT respectively which is found that for the body weight index, the combined statistical effect values of the two training methods were significantly different. However, LIT is better than HIIT [HIIT=-0.27(95%CI=-0.49,-0.04)] [LIT=-0.94(95%CI=-1.12,-0.75)]; % body fat, HIIT is better than LIT [HIIT=-0.56(95%CI=-0.84,-0.29)] [LIT=-0.45(95%CI=-0.70,-0.21)] **CONCLUSIONS:** HIIT is more effective for obese children/adolescents than LIT. LIT is better for whole body weight loss, but HIIT is better for body fat reduction. For aerobic training, the training period and the number of times are not proportional to the weight loss effect.



The subgroup analysis of low intensity training

Variables	Subgroup	Potential influencing factors	Number of study	Std. Mean Difference IV,Fixed,95% CI	P	P
Body weight	Age	< 14	4	-0.49 [-1.20, 0.23]	P = 68%	Z = 3.27 (P = 0.001)
		≥ 14:18	6	-0.69 [-1.15, -0.22]	P = 76%	
	Training cycle	< 12 weeks	2	-0.87 [-2.76, 1.01]	P = 89%	Z = 2.32 (P = 0.02)
		≥ 12 weeks	6	-0.48 [-1.00, 0.04]	P = 72%	
		frequency	5	-0.65 [-1.00, -0.30]	P = 85%	
		> 36	4	-0.80 [-1.07, -0.53]	P = 20%	
%body fat	Age	< 14	3	0.10 [-0.41, 0.63]	P = 0%	Z = 3.63 (P = 0.0003)
		≥ 14:18	3	-0.64 [-0.92, -0.35]	P = 70%	
	Training cycle	< 12 weeks	2	-0.80 [-1.39, -0.22]	P = 87%	Z = 4.63 (P < 0.00001)
		≥ 12 weeks	5	-0.51 [-0.76, -0.25]	P = 67%	
		frequency	2	-0.44 [-1.07, 0.20]	P = 87%	
		> 36	4	-0.37 [-0.64, -0.10]	P = 75%	

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Board #105

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Comparing a Body Image Assessment Scale with Anthropometric Measures in Chilean Adolescents

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Body image is an important marker of health and well-being among young people. Instruments to assess body image use contour images that participants use to describe their body image self-perception. These images must be culturally sensitive and adequate for different age groups. Although the Contour Drawing Rating Scale (CDRS) has been validated among adolescents in Spain, no previous studies have compared the body image CDRS with anthropometric measures among Chilean adolescents.

PURPOSE: To assess body image using the CDRS among Chilean adolescents, and compare with anthropometric measures including body mass index (BMI) and waist circumference (WC).

METHODS: A group of 156 Chilean adolescents (87 males, 69 females) aged 13-14 years old participated in the study. They completed the body image CDRS consisting of 9 images from which they selected the one representing their body image self-perception. Values for selected images ranged from 1 (underweight) to 9 (obese). Subsequently, body weight was measured with a Tanita-HD313® scale, height with a SECA-206® stadiometer, and waist circumference with a Lufkin W606PM® tape, while participants were barefoot, and wore short-sleeve t-shirts and shorts. BMI was then calculated (kg/m²). To determine sex differences, Chi-Square and t-test were used, and correlation analyses were performed to detect association between variables.

RESULTS: Body image CDRS values ranged from 2 to 8 in males, and 1 to 9 in females ($Z=4.237$, $p<0.001$). Mean (\pm standard deviation) BMI in males and females was 21.3 ± 3.5 , and 22.3 ± 3.3 kg/m², respectively ($Z=2.168$, $p<0.03$). Mean (\pm standard deviation) waist circumference in males and females was 75.9 ± 9.1 , and 74.1 ± 8.3 cm, respectively ($Z=1.012$, $p>0.05$). Spearman correlation coefficients showed a moderate but significant association between the CDRS score and BMI (males, $\rho=0.68$; females, $\rho=0.49$, $p<0.01$ for both) and waist circumference (males, $\rho=0.66$; females, $\rho=0.52$, $p<0.01$ for both).

CONCLUSIONS: The significant correlation between anthropometric measures and the CDRS in our group of Chilean adolescent males and females suggest that body image self-perception closely represent objective measures of body image assessment; thus, providing an adequate body image assessment tool in this population.

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Board #106

May 30 3:30 PM - 5:00 PM

Heavy TV Viewers Are The Heaviest Regardless Of Physical Activity: A Study Of 10,000 Preadolescents

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PURPOSE: To examine 1) whether recreational sedentary TV viewing and computer use are associated with body mass index (BMI), 2) whether the associations of TV viewing and computer use with BMI are modified by physical activity (PA), and 3) whether the associations of TV viewing and computer use are similar with BMI and waist-to-height ratio (WHtR).

METHODS: We assessed time spent on TV viewing, computer use and PA with an online questionnaire in 10,228 preadolescents with a mean age of 11.1 (SD 0.8) years from the Finnish Health in Teens (Fin-HIT) study. We categorized the preadolescents into Light, Medium and Heavy TV viewers and computer users, and into groups with Low, Medium or High PA levels. BMI categories and WHtR tertiles were established based on measured weight, height and waist circumference. We used multinomial logistic regression in order to calculate odds ratios (OR) with 95% confidence intervals (CI).

RESULTS: The percentages of Heavy TV viewers and Heavy computer users were higher in the overweight/obese group (46% and 43%, respectively) than in the normal weight (35% and 34%) or underweight groups (31% and 29%) (both $p<0.001$). Compared with Light TV viewers, Medium and Heavy TV viewers had a lower risk of being underweight (OR: 0.8, 95% CI: 0.7 - 1.0 and OR: 0.8, 95% CI: 0.6 - 0.9, respectively, when adjusted for age, sex, language, sleep duration and PA level) and a higher risk of being overweight/obese (adjusted OR: 1.3, 95% CI: 1.1 - 1.5 and OR: 1.6, 95% CI: 1.3 - 1.8, respectively). Compared with Light computer users, Heavy computer users had a higher risk of being overweight/obese (adjusted OR: 1.4, 95% CI: 1.2 - 1.7). We observed interactions between PA level and the amount of TV

viewed ($p=0.012$) or computer used ($p=0.010$). However, Heavy TV viewers had a higher risk of being overweight/obese regardless of PA level. The associations of TV viewing and computer use were similar with BMI categories and WHtR tertiles.

CONCLUSIONS: Heavy TV viewing and computer use are associated with higher BMI and central adiposity in preadolescents. Heavy TV viewing seems to increase the risk for overweightness and central adiposity, regardless of PA level. Strategies to reduce high sedentary screen times could potentially help in preventing overweightness and adiposity among children and adolescents.

1951 Board #107 May 30 3:30 PM - 5:00 PM
Body Composition Changes Associated With A Structured Exercise Program Among Children And Adolescents
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Children and adolescents in the U.S. fail to meet physical activity guidelines and health consequences associated with inactivity, such as high body fat composition, continue to impact children. Targeting children for physical activity and fitness interventions have the potential to improve body composition; however, little is known on body composition changes during a fitness-based intervention.

PURPOSE: To determine changes in body composition for children participating in a fitness-based intervention.

METHODS: 21 children (age = 9.38 ± 3.82 , BMI = 21.0, body fat percentage = 30.90) participated in an 8-week, structured fitness intervention consisting of 1-hour weekly sessions. Weekly sessions provided fitness opportunities in a fun, non-competitive environment with the purpose to elicit moderate-to-vigorous physical activity. Pre- and Post-testing using the iDXA was conducted to detail changes in body composition.

RESULTS: Results from a paired samples *t*-test showed significant increases in the following body composition measures: Left Leg Lean Mass ($t = -2.366$, $p = .028$), Right Leg Lean Mass ($t = -3.914$, $p = .001$), Lean Mass Trunk ($t = -2.766$, $p = .012$), Lean Mass Total ($t = -4.575$, $p < .001$), Right Leg Bone Mass ($t = -2.500$, $p = .021$) and Bone Mass Total ($t = -3.826$, $p = .004$). **CONCLUSIONS:** Participation in an 8-week fitness intervention showed positive body composition changes for children. These changes occurred with minimal intervention (1 hour per week). Future studies should determine the duration of the effect.

1952 Board #108 May 30 3:30 PM - 5:00 PM
Multi-Component School-Based Weight-Management Program Improve Physical Fitness and Vascular Reactivity in Obese Adolescent
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The prevalence of childhood obesity has increased markedly in both eastern and western countries. Development of obesity in early life could lead to serious health problems including a premature cardiovascular disease. Therefore, a primary prevention such as an effective weight management program would be needed in order to minimize the adverse effects of childhood obesity. **PURPOSE:** This study aimed to determine the effects of multi-component school-based weight-management program on body composition, physical fitness and vascular function and structure in obese adolescents. **METHODS:** Twenty-eight obese adolescents (21 males, 75%) between the ages of 13 and 15 (14.1 ± 0.8) at or above the sex-specific 90th percentile on BMI-for-age growth charts were recruited. Participants were randomly assigned into control (CON; $n=12$) and intervention (INT, $n=16$) groups. The INT group participated in a multi-component school-based intervention for 10 weeks which included supervised after-school physical activities, dietary and daily physical activities related advices. Moreover, school-health promotion environment and health education lectures for school staffs, students and parents were included in the program. Non-curricular physical activities (i.e., running, playing games and resistance training) were performed moderate to vigorous aerobic activities for 50 minutes/day, three days a week on alternate days. Body composition, physical fitness, vascular function (brachial-FMD) and structure (IMT and baPWV) were measured before and after intervention. **RESULTS:** After 10-week of multi-component school-based weight-management program, body mass (89.7 ± 8.6 vs. 88.0 ± 10.5 , $p < 0.05$) and body fat percentage (44.13 ± 5.27 vs. 41.22 ± 6.74 , $p < 0.05$) significantly decreased only in an INT group. Peak oxygen consumption (29.25 ± 2.41 vs. 31.56 ± 3.05 , $p < 0.05$) and health related physical fitness increased only in an INT group ($p < 0.05$). Moreover,

vascular reactivity of an INT group was improved after 10-week program compared with a CON group (6.81 ± 2.25 vs. 3.62 ± 1.48 , $p < 0.05$). There was no change in artery wall thickness and stiffness in any group. **CONCLUSIONS:** Multi-component school-based weight-management program may be an effective primary prevention for reducing cardiovascular disease risk factors.

1953 Board #109 May 30 3:30 PM - 5:00 PM
Weekly Frequency Of Meeting The Physical Activity Guidelines And Cardiometabolic Risk In Youth: Nhanes 2003-2006
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 (No relevant relationships reported)

The current physical activity (PA) guidelines for children and adolescents recommend accumulating 60 minutes of moderate-to-vigorous intensity physical activity (MVPA), 7 days per week. Although the time and intensity components of the PA guidelines have been rigorously studied, the days per week (frequency) component is less researched. **PURPOSE:** To examine the influence of frequency of meeting the MVPA guidelines on cardiometabolic risk in children and adolescents. **METHODS:** Accelerometer data from children and adolescents (age 6-18 years; $n=673$) with at least 4 valid days, 10 hours of wear time, and an average of ≥ 60 minutes per day of MVPA participating in the National Health and Nutrition Examination Survey 2003-2006 were used. The Evenson cut points for MVPA were applied. The proportion of valid days meeting the ≥ 60 minutes of MVPA guidelines (DMG) were calculated and used to assign subjects to quartiles. General linear modeling was used to compare associations of quartiles to individual cardiometabolic risk factors. Covariates included age, sedentary time, MVPA, sex, race/ethnicity, asthma, physical disability, assessment period, quartiles of the Healthy Eating Index, and poverty-income ratio.

RESULTS: DMG by quartile are as follows: Quartile 1 ($n=158$; DMG=43.6%; 95% CI 41.8-45.5); Quartile 2 ($n=171$; DMG 62.3%; 95% CI 61.4-63.2); Quartile 3 ($n=154$; DMG=75.3%; 95% CI 74.6-76.0); Quartile 4 ($n=194$; DMG=91.6%; 95% CI 89.2-94.1). Diastolic blood pressure was higher in Quartile 1 and Quartile 2 compared to Quartile 3 ($Q1=56.8$ mmHg, 95% CI 51.2-62.3; $Q2=56.9$ mmHg, 95% CI 50.4-63.4, $Q3=50.2$ mmHg; 95% CI 43.2-57.1; $p < 0.01$ and $p < 0.05$ respectively). There were no other differences between quartiles for BMI percentile, waist circumference, waist-to-height ratio, systolic blood pressure, cholesterol, triglycerides, glucose, or insulin. **CONCLUSION:** This cross-sectional analysis found no association between proportion of DMG and cardiometabolic risk factors in children and adolescents. Achieving an overall weekly average of 60 minutes per day of MVPA appears to be sufficient for cardiometabolic health regardless of meeting the frequency component of the PA guidelines. Future studies are needed to understand optimal weekly patterns and volume of PA as well as their associations with health outcomes in youth.

1954 Board #110 May 30 3:30 PM - 5:00 PM
Fitness In Pediatrics: Is It Adequately Carried Out?
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 (No relevant relationships reported)

INTRODUCTION: The physical fitness in the pediatric area is mandatory, prior to the realization of physical activity, whether recreational, school or competition. Regarding the increasing demand we find that each pediatrician performs them by requesting complementary studies according to their own criteria and in a routine manner.

OBJECTIVE: Show the lack of consensus when requesting studies to perform the physical aptitude in the area of pediatrics. **MATERIAL AND METHODS:** A personalized type survey was conducted; to specialists of the pediatric area in the city of Buenos Aires during the month of May of the year 2018, in which they questioned about physical fit in pediatric age in healthy children and for all kind of physical activity. The data obtained was analyzed to know what evaluations and complementary studies request to give the physical aptitude. **RESULTS:** A total of 105 pediatricians were interviewed, of which 99 of them made physical aptitudes in their daily practice, this being the total number of surveys selected, 94% were clinical pediatricians and 6% had another subspecialty (cardiology, infectology, other ones). 68% had more than 10 years in the profession, only 12% had less than 5 years of activity in the specialty: this data did not make a significant difference when deciding on the request for studies. The 60% of professionals performed daily physical fitness, being 96% for school physical activity and of these only 45% were competitive schools and sport, none of them was for high performance. In relation to studies requested, 73% asked for an electrocardiogram, 25% Rx. of chest, 21% blood count, 10% echocardiogram and 3% ergometry annually, considering for this the type of physical activity to be carried out, as well as the weekly work load of the activity. The request for studies was not greater in the cases of competitive sports nor was it influenced by the number of weekly hours of sports practice. In relation to the age to request different studies, the majority

of doctors performed it after 5 years old and it was striking that in 72% of them do it annually, despite being the whole population healthy children. **CONCLUSIONS:** Facing this result, we believe it is necessary to unify the medical criteria to request studies in relation to the needs of patients

- 1955** Board #111 May 30 3:30 PM - 5:00 PM
Contribution Of In-school And Out-of-school Physical Activity Towards Meeting The Daily Recommendations.
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PURPOSE: The purpose of the study was to examine in-school and out-of-school activity in children as related to achieving daily activity recommendations for moderate-to-vigorous physical activity (MVPA) and steps. **METHODS:** Activity patterns of 346, 10-12 year old fifth-grade students in three Midwestern elementary schools were assessed during a two week period, one week during school hours only and the other week for continuous 24 hour periods. Data were collected using wrist worn activity trackers (Polar Active). Teachers distributed the devices at the start of each school day and collected at the end of each school day for the first week and provided to the students for the next week for continuous monitoring. Monitors measured MVPA, steps, and calories expended per day. Demographic and anthropometric data were also recorded (age, height, weight). All data were uploaded to the monitor's manufacturer website and then collected by the researchers. A prior study was used to determine that four days of monitoring could accurately estimate physical activity. A final sample of 186 (N=186) students who attained a 500 step minimum for the same four consecutive school days between both weeks (M-R or T-F), were identified. These data were used to determine averages for steps, minutes of daily activity, and calories expended. **RESULTS:** Results indicate students attained an average of 15319.38 steps/day. In-school activity and out-of-school activity accounted for an average of 6362.79 steps/day (41.53% of total), 8956.59 (58.47% of total) respectively. Activity minutes averaged 77.43 minutes/day. In-school and out-of-school activity accounted for an average of 33.58 minutes (43.37% of total), and 43.85 minutes (56.63% of total) respectively. Calories expended averaged 2044.66 Kcal/day. In-school and out-of-school activity accounted for an average of 1560.56 Kcal (76.32% of total), and 484.10 Kcal (23.68% of total) respectively. **CONCLUSIONS:** These results indicate that out of school activities account for most of daily steps taken and activity minutes in the fifth grades students studied during an average school day. A similar distribution of caloric expenditure was not observed between in school and out of school monitoring.

- 1956** Board #112 May 30 3:30 PM - 5:00 PM
The Effect of Increased Extracurricular Physical Activity on the Mathematics Achievements of Children aged 7-9 Years Old
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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to assess the impact of an increased extracurricular physical activity on mathematics academic performance for children aged 7-9 years. **METHODS:** A sample of 120 children aged 7-9 participated in the MQ101 Program. The experimental samples were randomly divided into the experimental group (58 children) and the control group (62 children). The experimental group involved in the extracurricular exercise with games as the main activity content, intervention. The activity lasted for 12 weeks, twice a week for 60 minutes each time, exercise intensity: MVPA = (220-age) × (60-69%); the control group did not participate in any intervention project. The body shape, physical fitness, and mathematics testing scores of the subjects were tested before and after the experiment. The main finding is the change in numerical scores, measured by a standardized mathematical test of 10 minutes. The secondary outcome is a change in body shape and physical fitness. **RESULTS:** The results showed that the experimental group was better than the control group in the problem solving ($t=2.87, p<0.01$), calculation speed ($t=-3.39, p<0.01$) and accuracy rate ($t=2.21, p<0.05$). The math scores of the experimental group were significantly higher than the control group ($t=4.14, p<0.01$). In addition, the changes in physical fitness of the experimental group were significantly better than the control group ($t=2.34, p<0.01$), however, the difference in body shape index was not statistically significant ($t=1.91, p>0.05$).

CONCLUSIONS: The results of this randomized trial are expected to provide schools and policy-makers with significant new insights into the potential of extracurricular PA to improve physical fitness and academic achievement in children. (This study was supported by NPOPSS Grant 15CTY011.)

- 1957** Board #113 May 30 3:30 PM - 5:00 PM
Influence Of Menarche On Perception, Dimension And Body Image Of Active And Insufficiently Active Girls
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Menarche causes body changes such as increased body fat and classic changes occur in secondary sexual characteristics. In this way due to body changes, the body perception also needs to be adjusted. The regular practice of physical activity has been considered a key element to improve the perception of size and body image in different populations, however, to our knowledge, the association between menarche and the level of physical activity in perception of the dimension and of the body image still unexplored. **PURPOSE:** Verify the influence of menarche in the perception of the dimension and the body image of active and inactive girls. **METHODS:** After the approval of the São Judas Tadeu University Research Ethics Committee, thirty-eight girls were distributed into two groups active and insufficiently active subjects and analyzed semiannually by 2,5 years by identification before and after menarche. Anthropometric parameters (height, body weight and body mass index), perceptions of body size (using the Image Marking Procedure) and body image (silhouettes scale) were used as evaluation parameters. **RESULTS:** After menarche, all the girls in both groups presented alteration ($p<0.05$) only in the anthropometric parameters and in the body perception index of the hip after the menarche. No significant changes were identified ($p>0.05$) between groups. **CONCLUSION:** menarche induced anthropometric alterations and perception of the hip dimension, but without promoting changes in the general perception of the body, as well as in the indication of the silhouettes and in the corporal satisfaction regardless of the level of activity physical.

- 1958** Board #114 May 30 3:30 PM - 5:00 PM
Habitual Physical Activity And Academic Achievements Among Undergraduate Adult Students
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 (No relevant relationships reported)

Physical activity is associated with many physical and mental health benefits. The activity improves mood, reduces stress and anxiety and as shown previously increases academic performance with higher grades among youth and young undergraduate students. **PURPOSE:** To examine the relationship between physical activity habits and academic achievement among undergraduate adult male and female students. **METHODS:** Two hundred and thirty two male students (34.5 ± 10.2 yrs) and seventy two female students (36.5 ± 7.6 yrs) from the Faculty of Health Sciences at Ariel University volunteered to participate in this study. The cross-sectional study was conducted using a quantitative method and data was collected by a closed questionnaire, which included questions about physical activity in view of intensity, type of activity, time duration and frequency per week and was analyzed vis-à-vis academic achievements. **RESULTS:** A significant positive correlation ($p<0.03$) was found between physical activity habits and higher grades only among the male students. For the younger male students and the adult male students - the higher the physical activity time duration and frequency the higher the grades were. No correlation between adult female students' physical activity and academic grades were found ($p>0.05$). **CONCLUSIONS:** Older male students' academic grades were correlated to their physical activity habits. The awareness of the importance of physical activity habits among undergraduate male students is not limited to the younger age students but is also true for all age groups.

- 1959** Board #115 May 30 3:30 PM - 5:00 PM
Assessing Hispanic College Students Knowledge Related to Metabolic Syndrome Conditions
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 (No relevant relationships reported)

PURPOSE: To investigate Hispanic college students' awareness and knowledge related to metabolic syndrome (MetS) conditions. **METHODS:** Hundred and thirty-nine Hispanic college students (age= 22.43 ± 4.07) volunteered to participate in the study. Each participant read and signed the consent form prior to any data collection to take place. Demographic data including age,

race, gender, and major were collected. Participants then answered 89 questions and completed MetS knowledge questionnaire (Yahia et al., 2014; Becker et al., 2008). The questionnaire was designed to assess MetS related knowledge and awareness and has seven categories: diabetes, adiposity, hypertension, high serum cholesterol, arteriosclerosis, stroke, and myocardial infarction. Students' responses were scored and interpreted as poor knowledge ($\leq 50\%$ correct), fair knowledge (51-80% correct), and good knowledge (81-100%).

RESULTS: The results showed that majority of the students had fair level of knowledge (71.80% correct) related to MetS conditions. The participants were more knowledgeable on stroke and adiposity, and least knowledgeable on cholesterol, myocardial infarction, and diabetes components. There was no significant difference between genders for the level of knowledge for adiposity, cholesterol, myocardial infarction, and diabetes component of the questionnaire. However, there was a significant difference in knowledge level for stroke component between genders ($p < 0.01$). Males had more knowledge on stroke component than females.

CONCLUSIONS: Majority of Hispanic college students have fair level of knowledge about MetS and MetS related conditions. Findings suggest that students MetS related knowledge and awareness can be improved. MetS is highly prevalent among Hispanic population. Therefore, increasing Hispanic students' awareness and knowledge related to MetS is essential to improve students' overall health. Previous studies identified colleges and universities as potential settings for health prevention and early intervention. Future studies should investigate the effects of various intervention methods on Hispanic students' MetS related knowledge and long-term health conditions.

1960 Board #116 May 30 3:30 PM - 5:00 PM
Comparison of School Meal Patterns in High School Athletes and Non-Athletes

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(No relevant relationships reported)

PURPOSE: To compare differences in school meal patterns and total (both interscholastic organized sports and leisure-time) physical activity among high school athletes and non-athletes. **METHODS:** A total of 308 high school students (16.04 ± 1.35 years old, 56.5% female, 59.4% Caucasian) completed a series of questionnaires regarding their consumption of meals provided at school (both breakfast and lunch), participation in their school's free/reduced price meal program, and reasons for not consuming school meals. Additionally, questions regarding weekly duration and frequency of organized interscholastic sports practices and leisure-time physical activity were included. Due to skewed distributions, both non-parametric and parametric analyses were conducted to compare differences among male and female athletes and non-athletes. All analyses were conducted in SAS software version 9.4 with a significance level set at $\alpha < 0.05$ software.

RESULTS: Out of the 308 participants, 56% of the sample ($n=168$, 51% female) participated in interscholastic sports, and 44% ($n=136$; 65% female) were classified as non-athletes. Student athletes participated in more overall weekly physical activity ($p=0.00$) compared to non-athletes. No differences existed between athletes and non-athletes regarding their consumption of either school breakfast (24.4% athletes vs. 18.4% non-athletes, $p=0.2$) or lunch (52.3% athletes vs 45.6% non-athletes, $p=0.24$). Additionally, there were no differences between athletes (29%) and non-athletes (34.5%) regarding participation in the school free/reduced meal program ($p=.023$). Qualitative feedback provided for avoiding consumption of school meals included students arriving to school without enough time to purchase breakfast before class, eating breakfast or lunch from home, and that school meals are not appetizing or healthy. **CONCLUSIONS:** School meals are consumed by student athletes; therefore the nutritional value of school meals should provide for the energy needs of student athletes as well as the general student population of non-athletes.

1961 Board #117 May 30 3:30 PM - 5:00 PM
Effects of Peer-Led Aerobic Training on the Physical and Psychological Health of Urban College Students

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PURPOSE: Mental health concerns, like anxiety and depression, are prevalent among college students (Blanco et al., 2008). Chronic moderate-intensity exercise has been shown to improve these difficulties (Morres et al., 2018). This study evaluated changes in physical and psychological health in ethnically-diverse urban undergraduate students after a 10-week peer-led aerobic training intervention. **METHODS:** Twenty-three sedentary undergraduate students (mean age = 21 ± 2.24 yrs) participated in a 10-week training program composed of one weekly peer-led aerobic exercise session and completed 2 additional sessions per week independently. One week prior to and following the training program, assessments of cardiovascular fitness, using

the Rockport 1-mile walk test, anthropometric measures, and psychological health, using self-report measures from the NIH Toolbox and the Patient-Reported Outcomes Measurement Information System scales, were conducted. Paired-samples t tests were used to assess pre-post program changes in these measures. **RESULTS:** Participants attended 8.3 ± 1.26 moderate-vigorous exercise sessions under the supervision of their peer-trainer and exercised independently 2.39 ± 1.95 d-wk⁻¹ for an average of 34.85 ± 19.62 min-session⁻¹. Despite a significant progressive increase in intensity from the first 3 to the last 3 sessions (mean HR = 135.98 ± 16.98 and 150.15 ± 15.16 , respectively; $p < .001$), no effect of aerobic training on cardiovascular fitness or other anthropometric measures were detected (all $p > .10$). Nevertheless, there were significant pre-post-program improvements on multiple measures of psychological functioning including perceived stress, positive affect, sadness, and emotional support (all $p < .05$). There were marginally significant trends towards improvement in measures of perceived rejection ($p = 0.055$), general life satisfaction ($p = 0.062$), and perceived hostility ($p = 0.069$).

CONCLUSIONS: These preliminary findings are consistent with the literature indicating that moderate-intensity aerobic exercise improves psychological functioning. They support the further assessment of peer-mediated aerobic exercise to alleviate stress and improve quality of life in undergraduate students representing a diverse inner-city demographic.

1962 Board #118 May 30 3:30 PM - 5:00 PM
Relationship Between Duration and Quality of Sleep on College Student Health Behaviors and Outcomes

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(No relevant relationships reported)

Lack of sleep among college students is currently a massive epidemic affecting millions. Sleep duration and quality is an important determinant of overall health, and is related to health behaviors (physical activity (PA) & diet) and outcomes (mental health). But little is known about these relationships among college students.

Purpose: Examine how PA, depression, body mass index (BMI), fruit and vegetable consumption (FVC), and academic performance differed based on sleep quality and duration. **Methods:** Students completed an online survey, self-reporting their sex, height, weight, grade-point average (GPA), PA levels, FVC, and also responded to questions regarding mental health and sleep. Participants were grouped into those who reported less <4 or ≥ 4 nights of restful sleep/week. Paired samples t-tests examined differences in the aforementioned PA, FVC, BMI, and GPA between groups. Chi-square tests for independence examined differences in mental health (depression and stress) based between groups. **Results:** 4380 participants responded to the sleep question, the majority of whom were women (59.2%) and non-Hispanic white (76.1%). For all participants, those who reported better sleep reported significantly higher moderate PA ($p = .045$), vigorous PA ($p < .001$), weekly MET-min ($p < .001$), and GPA ($p < .001$), whereas BMI ($p = .627$) and FVC ($p = .107$) did not differ between groups. When split by sex, the same results were revealed for women, but among men the only significant differences were in GPA ($p = .042$) and vigorous PA ($p = .019$). Those who reported better sleep also reported significantly less symptoms of depression regardless of sex ($p < .001$). **Conclusion:** A positive relationship between sleep and PA was found for women. In men, only vigorous PA was found to have a positive relationship with sleep. Though, a positive relationship between sleep and academic performance was evident for both sexes. In addition, better sleep was associated with better mental health regardless of sex. In summary, findings highlight the importance of more education on the importance in the relationship of sleep and better academic performance and mental health. Further research is required to examine the relationship, in particular directionality, between the amount PA and the duration of sleep in college students.

1963 Board #119 May 30 3:30 PM - 5:00 PM
Student Experiences in a Mandatory Health and Wellness Course, A Qualitative Investigation

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Research suggests that many undergraduates do not achieve the minimum recommended amounts of physical activity (PA). Furthermore, the link between college students' attitudes toward PA and participation are unclear. **PURPOSE:** The purpose of this investigation was to qualitatively examine student experiences and attitudes about PA while enrolled in a conceptually-based, mandatory, health and fitness course. **METHODS:** Semi-structured interviews were performed individually

with a subset of 10 (6 female, age 18-21 years, 70% Caucasian) students who were enrolled in a larger study (n=135) investigating learning and behavioral outcomes from participation in a health and fitness course. Interviews were audio recorded and transcribed verbatim. Thematic analysis was used to identify predominant themes. **RESULTS:** Interviewees described their experiences and learning outcomes from the course. In regards to PA attitudes and practices, three themes emerged: (1) Self-Consciousness. Participants reported feeling embarrassed and awkward in the fitness center when using equipment that was unfamiliar to them. (2) Friend/Family Influences. The majority of interviewees reported exercising with friends as a strategy to improve motivation. Additionally, many identified family members as either having a positive or negative influence on PA behaviors. (3) Motivational Factors. The primary factors participants cited as influencing PA motivation were health, and maintenance of body weight. **CONCLUSIONS:** Results show that several factors influence college students' motivations, attitudes, and adherence to PA participation. It is recommended that health educators consider implementing practices to ensure that physical activity courses meet the specific needs of college students. This study was funded by a Fitchburg State University Special Projects Grant.

1964 Board #120 May 30 3:30 PM - 5:00 PM

Effects Of A 13-week Yoga Class On College Aged Student's Flexibility, Body Image, And Mood

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PURPOSE: Yoga has been practiced as a low to moderate intensity physical activity in recent years and evidence suggests that yoga practices can bring beneficial effects on physical and mental health. The present study examined whether a 13-week yoga practice of postures, breathing, and relaxation techniques can improve the flexibility, body image and mood of college aged students. **METHODS:** A sample of 60 students was recruited from university to participate in a 13-week yoga class. A pre-post test design was used for this study. Measurement on the physical aspects included the flexibility test and whereas the mental aspects included body image questionnaire (Body Appreciation Scale-2) and mood questionnaire (The Positive and Negative Affect Scale). Data were analyzed at the significance level of $p < .05$ for one group pre- and post-test of two data sets. **RESULTS:** The Mann-Whitney showed significance at the $p < .01$ for the sit and reach flexibility test and significance at the $p < .05$ for the body image and mood questionnaire. Sixty students (19 ± 2 years; 1.60 ± 0.15 m; 52 ± 8.4 kg) reported improved flexibility (ranged from 3% to 9%), increased body appreciation (mean value from 3.8 to 4.2) and positive mood (mean value from 3.9 to 4.3) after the 13-weeks class. The majority students desired to participate in more yoga classes in the future. **CONCLUSIONS:** This study suggests that a 13-week yoga class showed improvements of flexibility, increasing positive body image and enhancing mood who are novice yoga practitioners. Since the participants in this study were all girls and future study can examine the gender difference on the topic.

1965 Board #121 May 30 3:30 PM - 5:00 PM
Associations between Parents' Physical Activity and Young Children's Health Outcomes

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PURPOSE: While parents play an important role in child development, little is known about the influence of parents' physical activity (PA) on young children. This study examined the associations between parents' PA and their preschoolers' body mass index (BMI), PA, and fundamental movement skills (FMS). **METHODS:** Of 257 parent-child dyads recruited across 3 cohorts from 4 Colorado Head Start/preschool centers from 2010-2012, 109 children (57 girls, 36 Hispanic, $\bar{X}_{age} = 4.69 \pm 0.34$, $\bar{X}_{BMIz} = 0.49 \pm 1.14$) and parents had complete data were included in the analysis. Parents' and children's PA on 4 weekdays and 2 weekends were assessed by pedometers and calculated as steps per hour. Children's BMI and sex- and age-adjusted BMIz scores were calculated using 2000 CDC Growth Charts for the United States. Children's FMS was assessed via the Bruininks-Oseretsky Test of Motor Proficiency—2nd Edition (BOT-2), including 1) Balance, 2) Running Speed and Agility (locomotor skills), 3) Upper-Limb Coordination (object control skills), and 4) Strength. Bivariate correlation and linear regression were used to examine the associations between parents' PA and children's BMI, PA, and FMS.

RESULTS: Bivariate correlation indicated that parents' PA was positively associated with children's locomotor skills ($r = 0.19$, $p < 0.05$), strength ($r = 0.21$, $p < 0.05$), PA ($r = 0.34$, $p < 0.01$), and inversely related to children's BMI ($r = -0.23$, $p < 0.05$). Linear regression further suggested that parents' PA was a significant predictor of children's locomotor skills [$F(5, 108) = 2.45$, $\beta = 0.13$, $p < 0.05$, $R^2 = 0.11$], PA [$F(5, 108) = 2.95$, $\beta = 0.32$, $p < 0.05$, $R^2 = 0.13$], and BMI [$F(5, 108) = 2.97$, $\beta = -0.16$, $p < 0.05$, $R^2 = 0.13$], but not a significant predictor of strength [$F(5, 108) = 1.35$, $\beta = 0.18$, p

$= 0.25$, $R^2 = 0.06$], after children's age, sex, ethnicity, and school site were adjusted. **CONCLUSIONS:** The findings suggest that parents' physical activity behavior is directly associated with their children's BMI, PA, and FMS—setting the stage for the development of experimental trials seeking to promote improvements in preschool children's FMS and overall health. Future research with larger and more diverse samples investigating the influence of parents' PA intensity (i.e., light, moderate, and vigorous) on preschool children's other health outcomes is warranted.

1966 Board #122 May 30 3:30 PM - 5:00 PM
Effects Of A Peer-led Aerobic Training Program On Physical Activity Behavior Of Urban College Students

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PURPOSE: Peer-based education is commonly used on college campuses to provide health information. Using it to introduce physical activity to ethnically-diverse sedentary students attending an urban commuter college has not been explored. We examined the impact of a 10-week peer-based aerobic-exercise (AE) training program on urban college students' leisure physical activity behavior. **METHODS:** Inactive students ($N = 23$, mean age: 21 ± 2.24 yrs) participated in a 10-week training program consisting of approximately 3 weekly AE sessions. Once-per-week sessions led by a peer-student trainer included a short lecture on exercise's health benefits followed by 30 mins of AE (55%-65% HRR); participants were instructed to complete 2 other AE sessions independently per week and completed weekly online journals to assess adherence. Pre- and post-training evaluations of AE behavior patterns [International Physical Activity Questionnaire (IPAQ)] were conducted in the weeks prior to and following the exercise program and one month (30-IPAQ) and 90 days (90-IPAQ) after the conclusion of training. Descriptive statistics describing program participation and adherence are presented. Paired-samples t-tests were conducted comparing pre- and post-training cardiovascular fitness. **RESULTS:** Each week 19.1 ± 1.66 participants attended a peer-led session, training at THR of 142.61 ± 22.88 . Participants completed a mean of 8.3 ± 1.26 sessions out of the expected 10. They completed a mean of 2.39 ± 1.95 d-wk⁻¹; 34.85 ± 19.62 min-session⁻¹ independently. Twenty (86.96%) participants completed the 90-IPAQ thus, students' leisure physical activity analysis included only these 20 participants. Pre-IPAQ data demonstrated that 25% of participants engaged in leisure physical activity at a mean of 164 ± 120 MET-min-wk⁻¹. One month following the training period 60% of participants exercised at a mean of 434.38 ± 395.76 MET-min-wk⁻¹; 90-IPAQ data demonstrated 55% of participants continued to engage in leisure physical activity at 488.73 ± 381.33 MET-min-wk⁻¹ on average. There was no significant effect of aerobic training on participants' cardiovascular fitness level. **CONCLUSION:** Participation in a peer-led aerobic training program may serve as a gateway to adopting a low level of leisure physical activity by urban college students.

1967 Board #123 May 30 3:30 PM - 5:00 PM
Association of Sleep Quality and Physical Activity among Chinese College Students

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Sleep plays a critical role in the growth of youth. However, increasing studies suggest that the sleep quality (SQ) in Chinese youth is in a worrying situation. Meanwhile, SQ is associated with lifestyle factors, such as physical activity (PA). Therefore, this study will particularly focus on the association between PA level and SQ in Chinese college students, a special youth group who are under academic pressure.

PURPOSE: The present study is aimed to determine the correlation between SQ and PA level in Chinese college students.

METHODS: In 2017, 4330 college students (male: 60.1%; female: 39.9%) aged 17-24 years were randomly sampled from Shanghai Jiao Tong University, China. SQ, PA level, academic pressure and lifestyles of students were collected via a questionnaire. SQ and PA level were evaluated by Pittsburgh Sleep Quality Index (PSQI) and International Physical Activity questionnaire, respectively. SQ dichotomizes two levels: good SQ (PSQI score ≤ 5) and poor SQ (PSQI score > 5). PA was also divided into two levels: sufficient PA and insufficient PA according to World Health Organization moderate-to-vigorous physical activity (MVPA) recommendations.

RESULTS: Average MVPA time was 43.5 ± 37.5 min/day (males: 47.0 ± 39.6 min/day; females: 38.1 ± 33.2 min/day). About 25.5% of participants met MVPA recommendations (males: 29.0%; females: 20.1%). Average SQ score was 7.81 ± 1.89 (males: 7.67 ± 1.86 ; females: 8.06 ± 1.91). About 89.5% of participants had poor SQ (males: 87.9%; females: 91.8%). Males with sufficient PA had better SQ (7.42 ± 1.87) than those with insufficient PA (7.74 ± 1.85 , $p < 0.05$). But no significant correlation was found in females. The linear regression results showed that insufficient PA was

associated with higher SQ score ($B=0.24, P<0.01$) among males. Other health-related factors such as dietary habits and academic pressure also showed significant correlation with SQ. However, regarding the females, no significant correlation between PA and SQ was observed. Furthermore, after adjustment for the demographic variables and health-related factors, the results of binary logistic regression showed that males with insufficient PA had higher odds of poor SQ ($aOR=1.44, 95\%CI=1.12-1.86, P<0.01$) compared with the others.

CONCLUSION: Better SQ was related to higher PA level in male college students.

1968 Board #124 May 30 3:30 PM - 5:00 PM

Associations Between Physical Activity, Diet, And Substance Use With Academic Performance

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Physical inactivity, poor diet, and alcohol/substance abuse are common health behaviors among college students. However, little is known about the relationship between these health behaviors and academic performance. **Purpose:** To examine differences in grade point average (GPA) based on physical activity (PA) levels, fruit and vegetable consumption (FVC), and use of alcohol and substances. **Methods:** Students completed an online survey self-reporting demographics (age, sex, race/ethnicity), PA (min/week of moderate and vigorous PA), FVC (servings/day), use of alcohol and substances (yes/no), as well as GPA. Independent samples t-tests were used to examine differences in GPA between those who did/not meet PA and FVC recommendations, and those who did/not use alcohol and substances. **Results:** Data was collected from 3738 participants (women, 57.8%, non-Hispanic white, 77.2%). For all participants, GPA differed significantly between those who did ($3.40\pm.40$) and did not ($3.36\pm.48$) accumulate 500 weekly MET-min ($p=.034$), and those who did ($3.42\pm.40$) and did not ($3.34\pm.46$) meet FVC recommendations ($p<.001$). GPA also differed significantly between tobacco users ($3.26\pm.41$) and non-users ($3.40\pm.42, p<.001$), as well as cigarette users ($3.30\pm.40$) and non-users ($3.41\pm.42, p<.001$), but not based on alcohol use, for all participants. **Conclusion:** Findings indicate that those who utilize substances, are less physically active and display unhealthy eating habits, tend to have poor academic performance. This provides insight to students and campus health professionals regarding how their health behaviors may be affecting their GPA.

1969 Board #125 May 30 3:30 PM - 5:00 PM

Pilates Connect: A Program To Support The Transition Of Student-athletes To Lifetime Activity

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Student-athletes face challenges maintaining physical activity when they transition beyond college athletics, including loss of team support, few specific goals and strong athletic identities with weaker exercise identities (Fuller, 2014; Reifsteck, Gill, & Labban, 2016). Resources that prepare final-year student-athletes for meaningful lifetime physical activity support physical and psychological wellness. **Purpose:** To implement the *PILATES Connect* program for final-year student-athletes and evaluate their experiences and program support in the transition to lifetime physical activity. **Methods:** Twelve final-year student-athletes participated in *PILATES Connect*, once each week for six weeks. The sessions included 35 minutes of Pilates training, 15 minutes of reflection and discussion, and 10 minutes of evaluation. Measures included attendance, session and program evaluations, and focus groups. **Results:** Final-year student-athletes strongly adhered to the program, with an overall attendance rate of 94.4%. In session evaluations (1=not at all true, 7=very true), participants agreed that they were pretty good at Pilates ($M=4.8$), did the activity because they wanted to ($M=6.6$), and felt like they could trust the other participants ($M=6.4$). Participants agreed that *PILATES Connect* supported their confidence in the transition to lifetime activity ($M=5.5$), greater control over activity choices ($M=5.9$), and connection to other participants ($M=6$). They would recommend *PILATES Connect* to other student-athletes ($M=6.8$) and consider participating in Pilates or other group exercise in the future ($M=6.8$). Focus group responses highlighted increased confidence through progression in a new form of activity and recognition of different options for activity after graduation. Student-athletes enjoyed discussing the transition with peers and felt less alone. They recommended more sessions and promoting the program through word of mouth and feedback from past participants. **Conclusion:** The six-week *PILATES Connect* program was feasible, as evidenced by strong adherence rates and positive feedback from participants. Final-year student-athletes agreed that the program supported their competence, autonomy, and relatedness in physical activity as they approached the transition to alumni.

1970 Board #126

May 30 3:30 PM - 5:00 PM

Gunter Submission

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PURPOSE: To learn if different physical activity (PA) promotion approaches for boys compared to girls are needed in rural elementary school settings, we evaluated sex differences in total physical activity (TPA) and moderate-to-vigorous physical activity (MVPA) among 1st - 5th graders attending six rural schools in Oregon.

METHODS: We assessed the PA levels of 1739 students (835 girls and 901 boys) over four consecutive school days using Walk4Life MVP pedometers in fall 2015. Devices were worn above the right hip for the duration of the school day (6.5 hours/day) and programmed to measure PA time at any intensity (i.e. no minimum requirement for step rates/min). Time spent in MVPA was evaluated using a pre-specified step rate (≥ 120 steps/min). Teachers distributed and collected devices daily, recorded wear time, and reported daily classroom schedules (e.g. time for recess, lunch, etc.). At the end of day 4, data were downloaded, screened for outliers (daily step counts <500 or >15000 , incorrect MVPA settings) and adjusted for transport time. Linear mixed effects models were used to assess relationships between TPA and MVPA, and child sex and grade level. To examine the school and teacher influence, we utilized teachers nested within schools as a random effect in the model. All analyses were run in R.

RESULTS: Analyses were done on data from 577 boys and 552 girls. There were significant sex and grade-level differences in the volume of TPA and MVPA accrued throughout the school day ($p<0.001$). Boys accrued more TPA and MVPA than girls, and younger children accrued more TPA and MVPA than older children ($p<0.001$). There was a significant grade by sex interaction. Specifically, for both MVPA and TPA, girls in 2nd through 4th grades accumulated fewer minutes than similarly aged boys, and this difference was attenuated as children got older. By grade 5, boys and girls were accruing similar levels of TPA and MVPA during school hours.

CONCLUSIONS: Physical activity levels at school declined for all students from 1st through 5th grade. Girls in 2nd through 4th grades exhibited lower TPA and MVPA levels than boys. Preliminary findings suggest different approaches to increase PA among elementary school girls may be warranted. More data are needed to learn where to target those approaches.

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1971 Board #127

May 30 3:30 PM - 5:00 PM

Effect Of 10-week Flag Football Intervention On Physical Activity Of Overweight And Obesity Children

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PURPOSE: To investigate the effect of 10-week flag football exercise and regular physical education class on daily physical activity (PA) levels in elementary school students.

METHODS: A total of 48 9-10yr students (mean age in yr: 9.73 ± 0.55 ; 24 males, 24 female) was divided into either a flag football intervention group or a conventional physical education group. The intervention group received a 35-minute flag football exercise session, twice a week, for 10 weeks. The physical education group received a 35-minute/day routine session, including gymnastics and sports games. Daily PA was measured before and after 10 weeks for both groups using ActiGraph GT3X+ (wore on right hip) for seven consecutive days. The cut-points established by Evenson et al. were used to convert ActiGraph counts data into PA in minutes in different intensity levels (sedentary: 0-25 counts/15 seconds, light: 26-573 counts/15 seconds, moderate-to-vigorous: ≥ 574 counts/15 seconds). Differences in PA between intervention and control groups before and after the 10-week intervention period were compared by a series of mixed model repeated measures ANOVAs. Data were expressed as mean \pm standard deviation; Significant level was set at 0.05. **RESULTS:** The intervention group spent less sedentary time than the control group after the 10-week intervention (Table 1). **CONCLUSIONS:**

Flag football exercise could help reduce overweight and obesity elementary school students' daily sedentary time. Meanwhile, it was noticed that daily MVPA levels of most of these students were significantly below 60 min/d. This study was supported by National Social Science Fund of China (No. 18BTY095)

Table 1 Group differences in weekday PA levels (min/d)

PA		Intervention (n=24)	Control (n=24)	F	p	η^2
ST	Pre	565.47±79.85	556.49±68.70	1.80	0.04	0.19
	Post	497.05±59.81*	529.21±104.51			
LPA	Pre	199.51±28.91	181.58±48.38	0.82	0.07	0.37
	Post	182.22±36.35	177.15±44.34			
MPA	Pre	30.48±9.57	26.98±9.19	0.85	0.07	0.36
	Post	27.65±8.79	27.12±9.84			
VPA	Pre	16.23±5.10	15.56±6.74	1.353	0.07	0.251
	Post	14.74±7.85	15.66±7.30			
MVPA	Pre	46.72±11.84	42.54±13.73	1.419	0.07	0.239
	Post	42.39±14.69	42.78±15.35			

1972 Board #128 May 30 3:30 PM - 5:00 PM
The Effect Of Extracurricular Physical Activities In The Development Of Coordination Of Children Aged 7 To 9 Yearsold

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PURPOSE: The purpose of this study was to assess the effects of extracurricular physical activities on the physical coordination in children aged 7-9 years.

METHODS: A sample of 120 children aged 7-9 years (52% boys) was enrolled for a 12-week experimental intervention study. The sample was divided into an experimental group (58 children) and control group (62 children) by random number method. The experimental group participated in extracurricular intervention courses twice a week for 1 hour. The content of the course was mainly game, medium exercise intensity. The control group did not participate in the extracurricular exercise. The "Chinese Children Coordination Test" (CCCT) developed by the project team was used to conduct the coordination test before and after the experiment. The raw data was standardized and compared according to age and gender.

RESULTS: After 12 weeks of extracurricular intervention, the results showed that the scores of the experimental group in the transfer coordination ($t=2.89$, $p<0.05$), click-to-click ($t=2.76$, $p<0.05$), climbing obstacles ($t=4.47$, $p<0.05$), and rolling skills ($t=3.81$, $p<0.05$) were significantly higher than the control group. The experimental group was significantly higher than the control group ($t=2.90$, $p<0.05$) in the standardized comprehensive score. **CONCLUSION:** Extracurricular physical activity intervention could significantly improve the coordination ability of children, and the density of extracurricular physical activities should be strengthened in this age group.

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1973 Board #129 May 30 3:30 PM - 5:00 PM
Effects of Eight-week Fundamental Motor Skills Intervention on Children's Physical and Cognitive Health Outcomes

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Globally, 80.3% of school-aged children do not engage in the recommended 60 minutes of daily moderate-to-vigorous physical activity (MVPA; Hallal et al., 2012). Motor skill competence is fundamental to a child's physical activity and cognitive development (Stodden et al., 2008), and thus may explain the lack of MVPA engagement among children.

Purpose: This study aimed to examine the effects of a fundamental motor skills (FMS) intervention program on physical and cognitive health outcomes among elementary children.

Methods: Participants were 31 K-2 students (19 girls, 12 boys; $M_{age} = 6.65$) from three public elementary schools in the southwestern U.S. They were randomly assigned to either the intervention (1 school, $n = 20$) or the control group (2 schools, $n = 11$). During two separate 8-week periods in 2017 and 2018, children in the intervention group (13 girls, 7 boys) joined the FMS intervention for three times per week (60

minutes each time), while children in the control group (6 girls, 5 boys) followed a traditional afterschool program (e.g., free play). Children's pre- and post-intervention data were collected using the Test of Gross Motor Development - 2nd edition (TGMD-2; Ulrich et al., 2000), accelerometers (Actical), and a cognitive function questionnaire (PedsQLTM; Varni et al., 2011). To examine the intervention effect, a 2×2 repeated measures MANOVA was used, with group as the between-subjects variable and time as the within-subjects variable.

Results: The MANOVA showed significant differences between the intervention and the control group over time, $F(4,26) = 16.83$, $p < .001$, partial $\eta^2 = .72$. Follow-up univariate tests for the group \times time effect indicated significant differences ($p < .05$) in locomotor skills (intervention: $M_{T1} = 25.4$ vs. $M_{T2} = 37.98$, $d = 8.31$; control: $M_{T1} = 29.73$ vs. $M_{T2} = 30.32$, $d = 0.25$), object-control skills (intervention: $M_{T1} = 24.68$ vs. $M_{T2} = 39.78$, $d = 7.07$; control: $M_{T1} = 27.05$ vs. $M_{T2} = 27.59$, $d = 0.19$), and MVPA (intervention: $M_{T1} = 143.62$ vs. $M_{T2} = 170.06$, $d = 2.54$; control: $M_{T1} = 166.24$ vs. $M_{T2} = 155.17$, $d = 0.79$), but not in cognitive function ($p > .05$).

Conclusion: The FMS intervention showed significant improvements in FMS and MVPA, compared to a traditional afterschool program. Findings highlight the importance of FMS for motor skill competence and MVPA promotion among school-aged children.

1974 Board #130 May 30 3:30 PM - 5:00 PM
Evaluation Of A Physical Activity Level And And Physical Fitness In Obese Children: Health Educational Program For Children (hepchild)

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(No relevant relationships reported)

PURPOSE: This study aimed to investigate the impact of a Health Educational Program for Children (HEPchild) being 5 days of Camp and 12weeks follow-up on the physical activity level (PAL) and physical fitness (PF) in obesity children.

METHODS: The HEPchild was designed for obese children and developed in two phases: The Phase 1 consisted of Pre assessments and five-day camp (CAMP); and Phase 2 corresponded to the 3 months follow-up. Twelve children attended to CAMP as well as PAL and PF tests

RESULTS: After 12 weeks, 25% of children became more active (> 1500 and < 3000 METs per week). In contrast the amount of sedentary children (< 600 METs per week) decreased by 15% and the insufficiently active (> 600 and < 1500 METs per week) increased by 15%. No child was classified as very active (> 3000 METs per week) in any time. The PAL leisure time during the week and during the weekend increased 26.06% and 14.1%, respectively, when comparing pre CAMP to the end of 12 weeks follow-up. SB during the week and the weekend showed a significant mean reduction of 177.14 and 41.43 minutes respectively. A significant improvement was observed in the subjects' sit and reach flexibility, upper limb strength, and lower limb strength.

CONCLUSIONS: The HEPchild contributed to increase PAL and reduction of sedentary behavior and improve physical fitness in obesity children.

1975 Board #131 May 30 3:30 PM - 5:00 PM
Introducing Physically Active Lessons in a UK Secondary School: A Pilot Cluster-Randomised Controlled Trial

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PURPOSE Assess the feasibility, acceptability & costs of delivering a physically active lessons (PAL) training program to secondary school teachers & explore preliminary effectiveness for reducing pupils' sedentary time. **METHODS** Two mixed-sex, non fee-paying schools were randomised as intervention ($n=1$; received PAL training) & control ($n=1$; no training) schools. Training was delivered to all subject teachers in two after school sessions & focused on integrating movement into lessons. Feasibility & acceptability of PAL training were assessed with quantitative & qualitative measures. Student outcomes (including accelerometer assessed activity) were assessed at baseline & 8 weeks post training for 107 & 98, 11-14 year olds at intervention & control schools, respectively. The study received ethical approval.

RESULTS 29 of 33 teachers attended both training sessions. Teachers' feedback indicated low acceptability of PAL training & a need to revise certain training components, e.g., outdoor PAL training & increasing the learning challenge of the PAL strategies. The assistant head teacher echoed teacher's concerns about the training but suggested the concept was acceptable for secondary schools. At follow up, teachers had increased PAL delivery & students received an average of 6.9 PAL/

week. Of the pupils who recalled being in a PAL (58%), >90% wanted teachers to continue teaching PAL. Delivering the training cost £901 (£451 staff time, £450 equipment). Change in student's sedentary time (95%CI) was +5.1(-1.3,11.5) & +1.3(-6.2,8.7) minutes at control & intervention schools, respectively. **CONCLUSION** As most PAL evaluations focus on primary schools, this study makes a valuable contribution to the literature. Delivering PAL training to teachers was feasible, and delivering & participating in PAL was acceptable for teachers & students. However, low acceptability of PAL training & no evidence of effectiveness on student outcomes indicate the need to review the training. Receiving 6-7, 60 minute PAL/week has the potential to reduce adolescent's sedentary time, although the amount of activity introduced by PAL requires review. Results do not support PAL implementation or progression to a full trial with the current program. Further research could explore if different PAL training elicits more promising results.

1976 Board #132 May 30 3:30 PM - 5:00 PM
SOFIT Studies of Physical Education in U.S. and International Schools

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(No relevant relationships reported)

There is growing interest in assessing physical education programs worldwide in order to improve program quality. To this end, SOFIT (System for Observing Fitness Instruction Time) is a valid and reliable tool for assessing physical education, and it has been used to evaluate physical education programs worldwide since 1991. **PURPOSE:** To compare and contrast the characteristics of SOFIT studies of PE conducted in U.S. schools and in other countries. **METHODS:** Following guidelines outlined by PRISMA, we searched 10 library databases for SOFIT studies conducted worldwide. We located a total of 800 distinct records (233 U.S.; 567 non-U.S.) and evaluated a total of 305 full-texts (137 U.S.; 168 non-U.S.) for eligibility. Studies were selected if they (a) were published in English in peer review journals; (b) used the standard SOFIT protocol; and (c) assessed physical education in preK-12 schools. **RESULTS:** Fifty-eight studies met the inclusion criterion, including 29 in the U.S. and 29 in other countries. U.S. studies included nearly five times more lessons as non-U.S. studies (12,256 vs 2,703 lessons). All 58 studies described physical activity, 83% described physical activity and lesson context, and 53% included physical activity, lesson context, and teacher behavior. Interobserver reliabilities consistently exceeded 85% agreement for all main variables. The most common analyses in U.S. studies were for teacher preparation (48%), lesson location (38%), and student gender (31%). In contrast, in non-U.S. studies the most common analyses were for student gender (59%), teacher preparation (34%), and lesson location (21%). Mean lesson MVPA% was below the 50% public health objective in most studies worldwide. There was substantial diversity both within and among studies in the allocation of time to different contexts. Less than 30% of studies assessed MVPA% within lesson contexts. **CONCLUSIONS:** SOFIT has been reliably used to assess physical education internationally since 1991. There was substantial diversity in study characteristics and how data were analyzed and reported. Increased consistency in implementing the SOFIT protocol and the reporting of data could improve the generalizability of results and provide a clearer worldwide picture of the conduct of physical education.

D-61 Free Communication/Poster - Physical Activity and Health II

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

1977 Board #133 May 30 3:30 PM - 5:00 PM
Accumulating 10,000 Steps/Day Using a Wristband Activity Monitor May Not Meet Step Guidelines.

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Physical activity (PA) guidelines aimed at accumulating 10,000 steps/day through exercise (EX) and activities of daily living (ADL) has become increasingly common with the advent of wristband PA monitors. Yet, accumulated "steps" with wristband PA monitors may not equal validated pedometers. Consequently, there is a need for evaluating and developing guidelines for step counts using wristband PA monitors for the general population. **PURPOSE:** To compare pedometer and wristband PA monitor steps accumulated through EX and ADL designed to mimic real-world behavior using a diverse participant population. **METHODS:** 24 males and 35 females, age: 18-65 yrs., BMI: 19-45 kg/m², including exercisers and non-exercisers, were recruited for this

two-day study. On Day 1 participants completed 30 minutes of EX on a treadmill at 64-74% of their age-predicted HRmax wearing a pedometer and wristband PA monitor. Pedometer and wristband PA monitor steps were recorded after EX and pedometer steps were subtracted from 10,000 to determine the remainder of steps participants needed to accumulate 10,000 steps through ADL on Day 2 (ADL pedometer steps = 10,000 steps - exercise pedometer steps). Next, participants were sent home with a pedometer and wristband PA monitor. On Day 2, participants were instructed to accumulate the remainder of steps needed to reach 10,000 steps through ADL. Once participants accumulated their ADL pedometer steps, step counts on both devices (i.e., wristband PA monitor and pedometer) were recorded. Total step counts were calculated as: EX steps on Day 1 plus ADL steps on Day 2 for devices. **RESULTS:** Significantly fewer wristband PA monitor steps were accumulated than pedometer steps during treadmill EX (3864±68 vs. 3573±81 steps; P<0.01) on Day 1 by 7.5%. Conversely, on Day 2, accumulated wristband PA monitor steps were significantly greater than pedometer steps during ADL (7973±275 vs. 6255±72 steps; P<0.01) by 27.5%. Consequently, total steps were significantly higher for wristband PA monitor steps than pedometer steps (11546±281 vs. 10119±57 steps; P<0.01). **CONCLUSION:** In order to achieve to the equivalent of 10,000 pedometer steps using a wristband activity monitor through treadmill exercise and activities of daily living, wristband activity monitor users should strive for closer to ~11,500 "steps" per day.

1978 Board #134 May 30 3:30 PM - 5:00 PM
Effects of Three Regular Activity Breaks on Postprandial Triglyceride Response in Healthy Young Adults

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PURPOSE: To determine whether interrupting prolonged sitting with three kinds of regular walking activity breaks has an immediate or delayed effect on postprandial triglyceride response.

METHODS: In a randomized crossover trial, 16 inactive healthy adults (7 men, aged 21-30 years) completed four 26-h (from 8:00 AM on day 1 to 10:00 AM on day 2) laboratory conditions. Except for the 9-h intervention phase, the same procedure was used in the following four trials: (1) 9-h prolonged sitting (SIT); (2), (3), and (4) sitting with 3, 5, and 8 minutes of brisk walking (60% VO_{2max}) every 35, 50, and 70 minutes, respectively (WALK3, WALK5, and WALK8). Postprandial serum triglyceride (TG) and nonesterified fatty acid (NEFA) were measured for 2-h dinner immediately on day 1 and for 2-h breakfast on day 2. Meals and meal times were standardized across the conditions for all the participants.

RESULTS: Compared with SIT, only WALK8 significantly attenuated 2-h breakfast postprandial triglyceride total area under the curve (tAUC; SIT: median [Q1, Q2], 2.12 mmol·h·L⁻¹ [1.46, 3.67] vs WALK8: 2.01 [1.25, 3.34], p = 0.041). The tAUC for 2-h dinner postprandial triglyceride and for both 2-h dinner and breakfast postprandial NEFA were not significantly changed in the three-activity break conditions. However, compared with SIT, the three-activity break conditions significantly increased the pre-dinner NEFA concentrations on day 1 (WALK3 52%, WALK5 36%, and WALK8 75%; all p < 0.05), but only WALK8 increased the fasting NEFA concentration on day 2 (25%; p < 0.05). No significant differences in all the above-mentioned indicators were found among the three-activity break conditions.

CONCLUSIONS: The 8-min brief bouts every 70 min attenuated the postprandial triglyceride response measured about 24 h after, not immediately after, the intervention phase. Supported by the Shanghai Science and Technology Committee (No. 16080503300).

1979 Board #135 May 30 3:30 PM - 5:00 PM
Physical Activity Level And Prescription Pattern Of Physical Activity Among Physicians In Santiago De Chile.

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(No relevant relationships reported)

PURPOSE: The aim of this research was to determine the level of physical activity (PA) and prescription pattern (PP) of physical activity among physicians in their private practices. **METHODS:** An analytical cross-sectional study analyzed 341 physicians (182 males, 159 females; mean age 39.7 years) of 13 different private health care centers in Santiago de Chile, South America. Data of PA was collected using the short form of the International Physical Activity Questionnaire (IPAQ-SV) and the data of the PP was collected using the Exercise Is Medicine (EIM) questionnaire developed in Latin America. **RESULTS:** 30% of the participants reported low level of physical activity (≤600-MET min/week). Higher physical activity levels were found among male physicians compared to female physicians (9% versus 6%). 80% of the physicians reported prescribing PA to their patients (always 37%; almost always

43%), but only 8% fully knew the international PA recommendations for health. When asked why they do not prescribe PA, among those who do not do it regularly, the main cause was because they do not know the PA current guidelines (12%), and among those who knew the guidelines, the "lack of time within the consultation" was the most common cause (39%), followed by the doctor's preconceived notion that "the patient will not comply with the prescription given" (19%). Although both national and international guidelines establish PA as the first line of treatment of chronic non-communicable diseases, 92% of physicians do not prescribe PA in accordance with these recommendations. Among these, 46% of them refer not to know these recommendations and something that in our opinion is even more worrisome is that 21% of the doctors surveyed, had knowledge of the guidelines, but do not apply them. **CONCLUSION:** data suggested a relationship between the level of knowledge of PA recommendation, the prescription pattern in clinical practice, and the practice of PA itself among doctors.

1980 Board #136 May 30 3:30 PM - 5:00 PM
Large vs Small Skeletal Muscle Mass Training: a Pilot Study on Solid Organ Transplanted Recipients

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Kidney (KTR) and liver (LTR) transplanted recipients suffer from a reduced exercise capacity ($\dot{V}O_{2peak}$) and performance. Several studies pointed out the skeletal muscle as the main responsible for the low peak work rate (WR_{peak}) and reduced $\dot{V}O_{2peak}$ in KTR and LTR, rather than the central factors (e.g. maximal O_2 delivery) (Williams & McKenna, 2012). Indeed, skeletal muscle dysfunctions and atrophy seem to be a common scenario in the post-transplant period (Kempeneers et al., 1990; Kallwitz, 2015).

PURPOSE: The aim of the present study is to determine if endurance training (ET) involving a small muscle mass, e.g. single leg cycling (SLC), might induce the development of higher $\dot{V}O_{2peak}$ and WR_{peak} than ET with large muscle masses, e.g. double leg cycling (DLC), in KTR and LTR.

METHODS: 9 sedentary patients were enrolled (KTR=6; LTR=3) and divided into SLC (n=5; age 50±10.3 yrs; time post transplant 11±14.8 yrs; BMI 25±3.0) and DLC (n=4; age 58.5±0.7 yrs; time post transplant 4.3±1.5 yrs; BMI 26.3±2.9) groups. Subjects completed DLC incremental test to determine $\dot{V}O_{2peak}$ and WR_{peak} on an electronically braked ergometer. Pulmonary gas exchange was measured using breath-by-breath analyses. All subjects were asked to attend 24 ET sessions: the DLC group trained both leg at the same time and the SLC group performed the first half of the session with one leg and the second half with the other limb.

RESULTS: 2 subject in the DLC group did not complete the ET regimen due to health-related issues, thus were excluded from the analysis. SLC (n=5) and DLC (n=2) groups completed 20±2.5 and 23±1.4 ET sessions, respectively. SLC and DLC groups increased significantly (p: 0.025) the $\dot{V}O_{2peak}$ of 2.5±2.0 and 3.0±2.3 mL·min⁻¹·kg⁻¹, respectively. SLC and DLC groups improved (p: 0.053) the WR_{peak} of 18.0±14.4 and 10.0±7.1 W, respectively.

CONCLUSION: These preliminary results suggest that SLC training elicited a similar change in $\dot{V}O_{2peak}$, but slightly higher improvement in WR_{peak} with respect to the DLC training. This might suggest the key role of skeletal muscles in limiting peak exercise performance. The results are promising, but the low sample sizes prevent us from drawing firm conclusions.

1981 Board #137 May 30 3:30 PM - 5:00 PM
Recalled Age at Menarche from The Michigan State University Motor Performance Study

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Background: Many growth studies have assessed age at menarche to quantify biological maturation, as it is related to several physiological and performance variables. Begun in 1967, the Michigan State University Motor Performance Study (MPS) tested youth on a battery of physical growth, maturation, and motor performance tasks twice yearly for 32 years. One maturation marker, age at menarche, was collected for female participants and their mothers. In a follow-up study to investigate participants' adult health outcomes, females again reported age

at menarche. **Purposes:** 1- Determine whether recalled age at menarche (up to 20 years after the fact) was related to a more timely assessment of age at menarche, and 2-Determine whether daughters' and mothers' ages at menarche were related to each other. **Methods:** During the MPS, a letter was sent to participants' mothers asking for age at menarche for themselves (n = 118) and their daughters (n = 99). At the follow-up, 127 females provided their recalled age at menarche; 25 of these respondents were matched with their earlier recall data. Descriptive statistics and correlations were calculated. **Results:** Age at menarche assessed during the MPS for the daughters was (mean ± sd) 13.13 ± 1.1 years (minimum-maximum = 11.2-16.7 years). At the follow-up, the recalled age at menarche was 13.11 ± 1.4 years (minimum-maximum = 10.2-18.0 years). For the 25 participants who had both MPS and follow-up data for age at menarche, the correlation was positive and strong: $r = 0.75$, $p < 0.001$. A moderate positive relationship between mothers' and daughters' ages at menarche was also found, $r = 0.39$, $p < 0.001$. Mothers of the MPS participants reported a slightly younger mean age at menarche than their daughters (12.83 ± 1.4 years). **Discussion:** Many studies have examined the accuracy of recalled age at menarche, with the relationship between actual and recalled age at menarche ranging from $r = 0.70$ -0.81. Results from this small sample showed that MPS participants remembered their ages at menarche with similar reliability. Given that the original results were based on the recall from their mothers, the agreement between the two recalls is particularly noteworthy. The current sample is consistent with previous work which found a significant correlation of $r = 0.25$ between mothers' and daughters' ages at menarche.

1982 Board #138 May 30 3:30 PM - 5:00 PM
Time Spent In Moderate- to Vigorous-intensity Physical Activity Is Associated With Intramuscular Adipose Tissue Content In Young Men

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Physical inactivity induces decreases of skeletal muscle mass and increases content of the adipose tissue in humans. However, it is not well known that the relationships between daily physical activity and various types of adipose tissues such as intramuscular adipose tissue (IntraMAT), intermuscular adipose tissue (InterMAT) or subcutaneous adipose tissue (SAT). **PURPOSE:** To investigate relationship between daily physical activity and contents of IntraMAT, InterMAT and SAT in the thigh for young men.

METHODS: Twenty healthy young men (24.5±4.8 years) participated in this study. Axial images of the mid-thigh were taken using magnetic resonance imaging. The cross-sectional area (CSA) of IntraMAT, InterMAT, SAT and skeletal muscle were measured. Daytime physical activity time was measured using an accelerometer on 14 consecutive days and summarized the activity time of two intensities; light-intensity (1.1-2.9 METs), and moderate- to vigorous-intensity (3.0-7.0 METs).

RESULTS: In the accelerometer data, time spent in light-intensity physical activity was 672.4±74.6 min/day, and time spent in moderate- to vigorous-intensity physical activity was 96.6±30.5 min/day. Light-intensity physical activity time was not significantly correlated with contents of all adipose tissues in the thigh. The moderate- to vigorous-intensity physical activity time was correlated with IntraMAT content ($r = -0.739$, $P < 0.01$). On the other hand, moderate- to vigorous-intensity physical activity time was not significantly correlated with contents of InterMAT and SAT. Stepwise regression analysis was performed, with IntraMAT content as a dependent variable and age, body mass index, SAT CSA/body weight, skeletal muscle CSA/body weight, light-intensity physical activity time, moderate- to vigorous-intensity physical activity time as independent variables. As a result, skeletal muscle CSA/body weight and moderate- to vigorous-intensity physical activity time were independent variables ($R^2 = 0.655$).

CONCLUSIONS: These results suggest that moderate- to vigorous-intensity physical activity time was related to IntraMAT content only, skeletal muscle size and moderate- to vigorous-intensity physical activity time could be a major determinant of IntraMAT content in young men.

1983 Board #139 May 30 3:30 PM - 5:00 PM
Association Between BMI And Health Perceptions In Preservice Teachers

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Schools play an important role in shaping the dietary and physical activity behaviors of children, and teachers are increasingly called to deliver health-related information in the school setting. No study has examined the association between body mass index (BMI) and health perceptions in preservice teachers in elementary education programs. **PURPOSE:** To determine the association between perceptions of physical activity, healthy weight, and healthy eating in a sample of preservice teachers in elementary

education programs. **METHODS:** Participants included 341 preservice teachers enrolled in elementary education programs in the state of Florida. Individuals ranged in age from 18 to over 50, with 93% of the participants in the age range of 18 to 29. Females accounted for 91% of the participants. All participants provided self-report height and weight information and responded to statements regarding perceptions of physical activity, healthy weight, and healthy eating. Participants also provided the number of days per week they engaged in at least 30 minutes of moderate to vigorous physical activity. **RESULTS:** Bivariate correlations showed lower BMI was associated with the perceptions of a more physically active lifestyle ($r = -0.25, p < .01$), healthier weight ($r = -0.66, p < .01$), and healthier eating choices ($r = -0.26, p < .01$). In terms of exercise, higher BMI was associated with fewer days per week of at least 30 minutes of moderate to vigorous physical activity ($r = 0.16, p < .01$). **CONCLUSION:** The current findings indicate that BMI is associated with perceptions of health in preservice teachers in elementary education programs. Should they be replicated, such findings encourage researchers to examine the ways in which health promotion programs should be delivered to preservice teachers to improve their health and enhance their ability to promote healthy eating and physical activity to their future students.

1984 Board #140 May 30 3:30 PM - 5:00 PM

Physical Activity and Body Composition in Adults

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(No relevant relationships reported)

Rates of overweight and obesity have risen significantly since the 1980's, while levels of physical activity have declined. Reductions in physical activity may explain much of the increased body fatness realized over the past several decades, and increases in physical activity may contribute to improved body composition and weight management.

PURPOSE: To examine the relationships among markers of energy expenditure and body composition in adults. **METHODS:** Participants arrived at the laboratory between 6:00 and 9:00 a.m., having fasted for at least 10 hours. Height and body mass (BM) were measured, and 4-compartment body composition (percent body fat [%BF], fat mass [FM] and fat-free mass [FFM]) was determined using data derived from bioelectric impedance analysis and dual energy x-ray absorptiometry. Resting metabolic rate (RMR) was determined via indirect calorimetry. Participants were then provided with accelerometers to allow for measurement of various markers of physical activity (PA), including physical activity energy expenditure (PAEE), sedentary time (SED), time spent in moderate- to vigorous-physical activity (MVPA), and step counts (STEPS). Accelerometers were worn for 21-28 days, and associations between markers of PA and body composition were analyzed. **RESULTS:** Absolute expressions of PA (e.g., PAEE, STEPS) were not associated with body composition. However, expressions of PA relative to various fractions of BM were significantly correlated with %BF in both men and women. The strongest predictor of %BF was STEPS·kgFM⁻¹·day⁻¹. Power regression analysis yielded the model, $2907.1(\text{STEPS} \cdot \text{kgFM}^{-1} \cdot \text{day}^{-1})^{0.778}$ in men ($R^2 = 0.91$), and $820.25(\text{STEPS} \cdot \text{kgFM}^{-1} \cdot \text{day}^{-1})^{0.546}$ in women ($R^2 = 0.82$). **CONCLUSIONS:** Physical activity expressed per unit of FM strongly predicted %BF. These findings suggest relative expressions of PA (e.g., STEPS·kgBM⁻¹·day⁻¹ or STEPS·kgFM⁻¹·day⁻¹) may be more efficacious than absolute expressions of PA in developing PA prescriptions for weight management.

1985 Board #141 May 30 3:30 PM - 5:00 PM

What is the Effectiveness of HIIT Body Work on Energy Expenditure in Active Male Adults

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INTRODUCTION: The High Intensity Interval Training (HIIT) has been identified as an important strategy in fitness by improving the cardiometabolic function in adults. However, different models of HIIT performed with body weight, known as HIIT body work (HBW) in blocks with maximum intensity, still lack information namely the energy demand imposed in training. **PURPOSE:** Assessment the energy expenditure in a single session of HBW in healthy male adults. **METHODS:** 12 male adults (33.3 ± 12 years old) performed an all-out protocol with 30 seconds effort x 30 seconds recovery, amounting 20 minutes in the total session. The session exercises were Jumping Jack (JJ), Burpee (BP), Mountain climber (MC) and Squat Jump (SJ), performing 5 sets for each set. The energy expenditure was determined by indirect calorimetry with K5, gas analyser throughout the entire session. Heart rate was also measured as well as the rating of perceived exertion (0-10 Borg scale). Repeated measures ANOVA, followed by Tukey (0.05) post hoc test, were performed to compare the differences between exercises. All analysis were performed using SPSS

software. **RESULTS:** The session mean VO_2 was $35.31 \pm 5.21 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, total energy expenditure was $250.78 \pm 27.41 \text{ kcal}$; mean heart rate was $164 \pm 8 \text{ bpm}$ and mean RPE was 8.92 ± 0.68 . The mean and standard deviation for the blocks of the different exercises are described in the table below, values followed by the same letter do not differ significantly from each other. Table – Mean VO_2 and energy expenditure per exercise and per minute of exercise.

	JJ	BP	MC	SJ
EE (kcal)	50.27 + 8.23 ^a	73.66 + 8.84 ^b	62.60 + 8.2 ^c	64.24 + 6.55
EE (kcal·min ⁻¹)	10.5 + 1.65 ^a	14.73 + 1.77 ^b	12.52 + 1.64 ^c	12.85 + 1.31

Note: a and b = significantly different from every other exercise ($p < 0.05$); c = significantly different from JJ and BP ($p < 0.05$). **CONCLUSION:** The burpee exercise is the most demanding exercise in terms of aerobic energy expenditure. Contrarily, the jumping jack exercise was the least demanding. Aerobic energy expenditure seems consistent with the use of this type of workout to promote weight loss and / or fat loss.

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Mechanical Efficiency After High Intensity Interval Training In HIV+ Hispanic Women

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High intensity interval training (HIIT) is known to improve cardiorespiratory fitness ($\text{VO}_{2\text{peak}}$) and exercise capacity in healthy and living with chronic disease adults. Mechanical efficiency (energy demand at a given workload) also helps improve exercise capacity; however, few studies have evaluated mechanical efficiency resulting from HIIT; and none with HIV+ adults. **PURPOSE:** To compare mechanical efficiency in HIV+ and HIV- women after a low volume HIIT intervention. **METHODS:** A group of 20 HIV+ and 11 HIV- Hispanic women completed a graded exercise test (GXT) on a bicycle ergometer with increments of 25W until volitional fatigue, during which measures of VO_2 and HR were obtained. GXT were conducted before and after a low volume-HIIT intervention (1:1 intervals) 3 days/wk. for 6 weeks (2 wks. (16 min total) at 80%, and 4 wks. (20 min total) at 90% of HR reserve). Percent $\text{VO}_{2\text{peak}}$ and %HRpeak were determined at 25, 50, 75, and 100W. T-tests and Wilcoxon Rank Sum tests were used to detect pre to post-test differences within each group. **RESULTS:** Compared with HIV-, HIV+ had lower VO_2 at 100W workload during pre-test (20.4 ± 1.9 vs. $17.5 \pm 1.9 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $P = 0.01$), and also at 75W and 100W during post-test (16.9 ± 1.7 vs. 14.8 ± 2.4 , $P = 0.02$; 21.0 ± 2.8 vs. $17.3 \pm 3.4 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $P = 0.01$; respectively). Reduced metabolic demand (% $\text{VO}_{2\text{peak}}$) was observed at 25W in HIV- (46.4 ± 15.4 vs. 37.9 ± 10.5 %, $P = 0.01$), at 50W in both HIV- and HIV+ groups (60.8 ± 16.5 vs. 53.6 ± 13.4 , $P = 0.02$; 62.8 ± 13.3 vs. 59.5 ± 11.2 %, $P = 0.04$; respectively), and at 75W in HIV+ (81.3 ± 13.8 vs. 75.9 ± 13.7 %, $P = 0.04$). **CONCLUSION:** Although VO_2 was lower at near maximal workloads in HIV+ compared with HIV-, both groups increased their mechanical efficiency at various submaximal workloads; thus, improving exercise capacity with HIIT. Supported by NIMHD S21MD001830, R21MH095524, U54MD007587-04, and R25MD007607.

1987 Board #143 May 30 3:30 PM - 5:00 PM

Weight Loss Decreases Dyspnea on Exertion and Unpleasantness in Obese Adults

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(No relevant relationships reported)

PURPOSE: We have previously shown that weight loss improved dyspnea on exertion in obese, otherwise healthy, women. Dyspnea is a multidimensional symptom comprised of at least two distinct domains: sensory-perceptual (i.e., dyspnea intensity) and affective distress (i.e., unpleasantness and emotional response). Both domains may lead individuals to avoid exercise. In this retrospective study, we investigated the effects of weight loss in obese women and men on these dyspnea domains. **METHODS:** Twenty-one participants (12 M/9 F, 33 ± 7 yrs, $169 \pm 12 \text{ cm}$, $102 \pm 18 \text{ kg}$, $35 \pm 4 \text{ kg/m}^2$, 41 ± 7 % body fat) underwent a 12-week weight loss program. Pre-

and post-intervention measurements included a submaximal cycling test at 60W for women and 105W for men. Participants rated their perceived breathlessness (RPB, 0-10 Borg scale) as well as unpleasantness, depression, anxiety, frustration, anger, and fear associated with their breathlessness (visual analog scales, 0-10 cm) at the end of the test. Paired t-tests were used to analyze difference between pre- and post-intervention. **RESULTS:** Significant decreases were achieved in body weight by 9 ± 4 kg ($9 \pm 4\%$), BMI by 3 ± 1 kg/m², and body fat by $5 \pm 10\%$ ($p < 0.05$). RPB dropped by 1.5 ± 1.8 ($p < 0.05$). Significant decreases in ratings of unpleasantness (-2.3 ± 2.2), anxiety (-1.2 ± 1.8), frustration (-0.8 ± 1.9), and fear (-0.4 ± 1.0) were observed, while ratings of depression and anger were unchanged. **CONCLUSIONS:** Moderate weight loss alleviated not only dyspnea on exertion, but also the unpleasantness and negative emotional response related to the dyspnea. Supported by NIH Grant R01 HL096782 and King Charitable Foundation Trust.

1988 Board #144 May 30 3:30 PM - 5:00 PM
Prior Baby Jumper Use Is Correlated With Children's Parent-Reported Physical Activity Level
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 (No relevant relationships reported)

PURPOSE: Baby jumpers are ubiquitous in the infant equipment selection. Anecdotal, while some parents link them to enhanced motor development, others link them with delayed walking onset. Baby jumper use involves successive vertical push-offs (rebounds) against the floor with the feet. The resulting raising and lowering of the body's center of mass is consistent with movements that require leg stiffness regulation. Leg stiffness has been shown to be positively related to maximum sprint velocity in adults and adolescents. Yet, no studies (to our knowledge) have investigated relationships between prior baby jumper use and current locomotor and physical activity (PA) behaviours in young typically developing children. This pilot study investigated these relationships.

METHODS: Parents of 45 children (age: 4 ± 2.3 years; height: 97.5 ± 25.6 cm; mass: 17.2 ± 9.4 kg) completed a 24-item survey administered through Qualtrics software. Questions included prior use of a baby jumper, age at walking onset, current fundamental locomotor behavior and PA level. Questions on the degree of a behavior level were on a 5-point Likert scale. Surveys were excluded, if a parent indicated that the child was born preterm or diagnosed with an intellectual or developmental disability. Bivariate correlations were used to evaluate the directionality of relationships between previous baby jumper use and locomotor and PA behaviors. A Mann-Whitney U test was used to compare age at walking onset between children who used and did not use a baby jumper.

RESULTS: Of the sample, 64% previously used a baby jumper. The proportions of the sample that were underweight, healthy weight, overweight, and obese, were 14%, 51%, 17%, and 17% respectively. Prior use of a baby jumper was moderately positively correlated with children's parent-reported PA level ($\rho = .545$, $p = .013$) and running pace (compared to peers their age and sex) ($\rho = .348$, $p = .019$). There was no significant difference in age at walking onset between the groups ($U = 231.0$, $p = .981$). **CONCLUSIONS:** Prior baby jumper use may be linked with running performance and PA level and may promote physical activity in young children. These relationships should be further investigated and modeled using objective measures of locomotor and PA behaviors. Prior baby jumper use did not delay walking onset in the sample.

1989 Board #145 May 30 3:30 PM - 5:00 PM
Overall Mortality, Survival, And Causes Of Death In Former US Olympians
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United States (US) send a greatest number of athletes to Olympic Games but their longevity and specific causes of deaths have not been examined.

PURPOSE: To quantify US Olympic athletes' longevity and to determine the impact of specific causes of deaths (CoD) on Olympians life duration in relation to the general population.

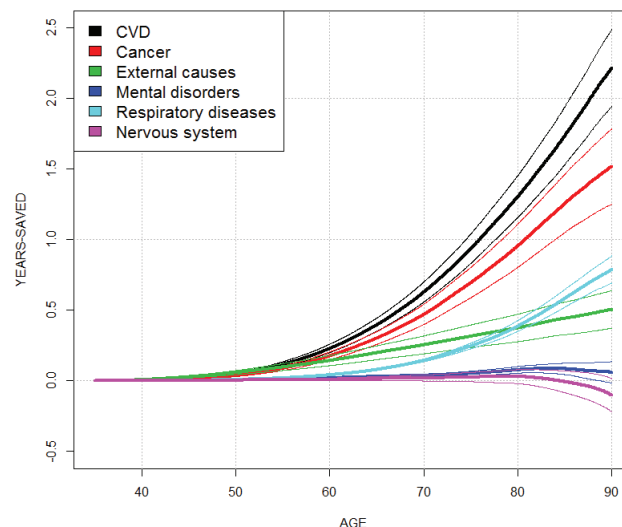
METHODS: Female ($n = 2,301$) and male ($n = 5,823$) US athletes who have participated at least once in the summer or winter Olympic Games between 1912 and 2012 were followed up to 2016. Their life status and CoD were certified by the National Death Index. The years-saved method was applied to quantify longevity gains/losses in former US Olympians in comparison to the general population.

RESULTS: Former US Olympians lived on average ~5 years longer (95% CI 4.3 to 6) than their referents in the general population, based on the 2,309 deaths observed out of 8,124 former athletes. The burden of each CoD was distributed according to

its impact on the total number of years of life saved: cardiovascular diseases (CVD), 2.2 years (1.9 to 2.5); cancer, 1.5 years (1.3 to 1.8); respiratory diseases, 0.8 years (0.7 to 0.9); and external causes, 0.5 (0.4 to 0.6). Nervous system diseases and mental disorders mortality rates were not significantly different from their peers in the general population.

CONCLUSION: US Olympians live ~5 years longer than their referents in the general population, advantage mainly driven by lower risks of CVD and cancer. Nervous system diseases and mental disorders do not appear to contribute to the extended longevity that Olympians display.

Years of life saved among US Olympic athletes per causes of death



1990 Board #146 May 30 3:30 PM - 5:00 PM
Elevated Serum Uric Acid And Heart Failure In U.S. Adults: 2007-2016 NHANES

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(No relevant relationships reported)

There is limited evidence examining the relationship between elevated serum uric acid (UA) concentration and heart failure (HF) in U.S. adults. **Purpose:** Examine the associations between elevated UA and HF using a nationally representative sample of U.S. adults. **Methods:** The final sample with complete data for this analysis ($N=17,412$) included men and women aged ≥ 40 years who participated in the 2007-2016 National Health and Nutrition Examination Survey. Self-reported diagnosis of HF was assessed via interview. Elevated UA was defined as values >6.0 mg/dL for women and >7.2 mg/dL for men. Multivariable gender-stratified logistic regression was utilized to examine the odds of HF. **Results:** The estimated prevalence of HF was 3.85% and 3.39% among men and women, respectively. Age adjusted analysis revealed significantly increased odds of HF in men (odds ratio [OR], 2.78; 95% confidence interval [CI] 2.09-3.71, $P<0.01$) and women (OR, 3.25; 95% CI 2.37-4.45, $P<0.01$) with elevated UA. Significance remained following adjustment for education, income, race, body mass index, alcohol consumption, hypertension, diabetes, physical activity, and creatinine in men (OR, 1.59; 95% CI 1.04-2.43 $P=0.03$) and women (OR, 2.03; 95% CI 1.33-3.08, $P<0.01$). **Conclusions:** In a representative sample of U.S. adults, having an elevated UA concentration was associated with significantly increased odds of HF when compared to adults with normal UA.

1991 Board #147 May 30 3:30 PM - 5:00 PM
Modernization of a Developing Country: Effect on Body Mass Index

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(No relevant relationships reported)

Modernization provides technology and resources that commonly displace physical activity (PA) from the daily routine; in time, body mass index (BMI) trends upward.

Given the host of deleterious consequences precipitated by poor body composition, it may be helpful to isolate specific factors that predict the largest elevations in BMI. Uganda is an appropriate location to evaluate this. Over 5 years, the percentage of women classified as overweight or obese increased from 19% to 24%; men increased from 4% to 9%. During this time, PA underwent considerable change while nutrition was relatively stable. **PURPOSE:** To evaluate the impact of modernization on BMI in Uganda. **METHODS:** We analyzed the 2016 Demographic and Health Surveys of Uganda, Household Members database. 11,577 subjects met inclusionary criteria. We conducted descriptive statistics to characterize this population, linear regression to examine the effect of modernization on BMI, and logistic regression to test these factors on the odds of overweight (BMI ≥ 25) or obesity (BMI ≥ 30). **RESULTS:** Mean age was 28.7 ± 10.2 yr; BMI was 22.0 ± 3.7 ; 16.0% of subjects were either overweight (n=1,405) or obese (n=440). More subjects owned a bicycle (40.6%) than a motorcycle (12.6%) or car (4.3%); more subjects owned mobile phones (79.7%) than computers (4.3%); 28.8% of households had electricity and 16.2% had television. Linear regression ($R^2=0.160$; $p<0.001$) found BMI to be increased when a household had a refrigerator ($\beta=0.483$; $p<0.004$), electricity ($\beta=0.409$; $p<0.001$) and television ($\beta=0.961$; $p<0.001$). Additionally, ownership of a car ($\beta=0.421$; $p<0.016$) and a mobile phone ($\beta=0.625$; $p<0.001$) predicted increases in BMI, while ownership of a bicycle ($\beta=-0.330$; $p<0.001$) and a land-line phone ($\beta=-0.657$; $p<0.034$) predicted decreases in BMI. Logistic regression (pseudo $R^2=0.21$; $p<0.001$) found the odds of being overweight or obese increased when a household had electricity (79%; $p<0.001$) and television (107%; $p<0.001$). Additionally, ownership of an automobile (41%; $p=0.002$) and a mobile phone (147%; $p<0.001$) increased the odds of being overweight or obese. **CONCLUSIONS:** Specific features of modernization associate with increases in BMI. As developing countries continue their development, public health interventions are warranted to promote the maintenance of PA.

1992 Board #148 May 30 3:30 PM - 5:00 PM
Effects of Division I Cross-Country Training on Iron Markers and Systemic Inflammation

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Inflammatory cytokine and immune cell production is modulated by iron status including storage measured by ferritin levels. Cross-country athletes have an elevated risk of iron depletion; the effects of long term cross country training on inflammatory cytokine profile and its relationship with iron storage markers have yet to be elucidated.

PURPOSE: To determine the influence of cross-country training on markers of inflammation and iron storage and to interpret potential mechanisms underlying these relationships.

METHODS: Twelve NCAA division 1 cross-country athletes, ages 18 to 25 years old, were followed for two years. Blood was collected at the beginning of the season and analyzed by complete blood count (CBC) and ferritin levels were assessed by enzymatic spectrophotometry. Cytokines IL-1 β , IL-2, IL-4 IL-5, IL-6, IL10, TNF- α and IFN- γ were measured with the Luminox® MAGPIX® system. Dependent samples t-test was used to compare ferritin cytokines and CBC mean difference between first and second year measurements. Pearson correlations were conducted to assess associations between ferritin and immune cells/inflammatory cytokines. IBM® SPSS Statistics 22 software was used to analyze the data.

RESULTS: TNF- α levels increased from the 1st to the 2nd year (98.60 ± 11.17 vs. 121.41 ± 11.93 pg/dL, $p=0.006$). Platelets (253.63 ± 12.28 vs 267 ± 13.43 K/ μ L, $p=0.041$), Neutrophils (44.46 ± 1.26 vs 50.46 ± 2.70 K/ μ L, $p=0.045$) and Monocytes (8.58 ± 1.90 vs 10.61 ± 2.70 K/ μ L, $p=0.003$) also significantly increased from the 1st to the 2nd year. Ferritin levels were positively correlated with TNF- α both years ($r=0.716$ $p=0.009$, $r=0.595$ $p=0.04$).

CONCLUSIONS: One year of cross-country training seems to influence increases in pro-inflammatory cytokines and immune cell concentrations in NCAA Division 1 Athletes. Although there were no significant changes on ferritin levels over the years of study, ferritin increases were linked to increases in pro-inflammatory cytokine TNF- α .

1993 Board #149 May 30 3:30 PM - 5:00 PM
Relationship Between Weight History and Depression in U.S. Adults

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 (No relevant relationships reported)

PURPOSE: Explore the relationship between changes in weight over time and subsequent depression status using a nationally representative sample of U.S. adults.

METHODS: The study sample (n=20,505) included male and female adults (≥ 36 years of age) who participated in the 2007-2016 National Health and Nutrition

Examination Survey. Weight history examined fluctuations of weight, mainly gain in weight, from self-reported current weight and self-reported weight 10 years ago. Depression status was assessed using the PHQ-9 utilizing a cut point of ≥ 10 to assign a depression score. Logistic regression analysis was utilized to examine odds of depression across ranges of weight gain. **RESULTS:** Overall prevalence of depression among U.S. adults aged 36 years and older was found to be at 7.5% (95% Confidence Interval [CI] 6.9-8.2). Following adjustment for gender, race, education, smoking, and physical activity, those who gained 20 or more lbs. had significantly greater odds of having depression (OR 1.45; 95% CI, 1.26-1.67) compared to those gaining <5 lbs. (referent). A similar relationship was not revealed for other weight gain ranges: 5-9lbs. (OR 0.84; 95% CI, 0.62-1.14), 10-14lbs. (OR 0.90; 95% CI, 0.70-1.15), 15-19lbs. (OR 0.93; 95% CI, 0.66-1.31). **CONCLUSION:** Findings revealed that weight gain of 20lbs. or more resulted in significantly greater odds of a PHQ-9 score indicative of depression.

1994 Board #150 May 30 3:30 PM - 5:00 PM
Cardiorespiratory Fitness, Serum 25-hydroxyvitamin D, and Risk of Metabolic Syndrome Among Men: The Cooper Center Longitudinal Study

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 (No relevant relationships reported)

PURPOSE: We examined the individual and joint associations among cardiorespiratory fitness (CRF), serum vitamin D [25(OH)D], and metabolic syndrome (MetSyn). **METHODS:** Between 2006 and 2018, 14,349 apparently healthy men completed a comprehensive health examination. Measures included CRF based on a maximal treadmill exercise test, components of MetSyn, and 25(OH)D. Participants were classified into categories of low (quintile 1), moderate (quintiles 2-3), and high (quintiles 4-5) CRF by age group, as well as by clinical cut points for MetSyn and 25(OH)D. We examined mean 25(OH)D levels in men with and without MetSyn. We calculated odds ratios (OR) of MetSyn across levels of CRF and 25(OH)D, and also examined joint associations among these three variables. **RESULTS:** The prevalence of 25(OH)D deficiency and MetSyn was 16.9% and 22.2%, respectively. Mean 25(OH)D levels were 30.9 ± 11.6 and 26.3 ± 10.7 ng/mL in men without and with MetSyn, respectively ($p<0.001$). Prevalence of MetSyn was inversely associated with ordered categories of CRF and 25(OH)D (p for trend <0.001 for both). Men with normal 25(OH)D had lower odds of MetSyn than men who were vitamin D deficient (OR=0.29, 95% CI=0.26-0.33). Men with moderate (OR=0.31, 0.27-0.35) or high CRF (OR=0.08, 0.07-0.09) had lower odds of MetSyn than men with low CRF. Joint associations between CRF, 25(OH)D, and MetSyn revealed significantly greater prevalence of MetSyn in unfit men when compared to fit men within each category of 25(OH)D ($p<0.001$). Each 5 ng/mL increment of 25(OH)D, and 1 MET increment of CRF was associated with a 16.0% and 31.3% lower prevalence of MetSyn, respectively. **CONCLUSION:** There are strong individual and joint associations between CRF, 25(OH)D, and MetSyn. Although these observed associations are cross-sectional, it seems prudent to recommend increased levels of physical activity and vitamin D intake in men with low CRF, vitamin D deficiency, and/or MetSyn.

1995 Board #151 May 30 3:30 PM - 5:00 PM
Effect Of Fitbit Alone Compare To Fitbit And Kinesiology-Dietitian Counseling In Sedentary Men: Preliminary Report

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 (No relevant relationships reported)

The scientific literature has shown increased data on the FitBit ambulatory self-monitoring device but little is known about its effects on sedentary adult men.

PURPOSE: The purpose of this pilot study was to evaluate the impact of FitBit-HR2 (G1) and FitBit-HR2 with kinesiology - Dietitian counseling (G2) on the number of steps taken per day. **METHODS:** 12 sedentary men aged between 18-35 yld were asked to wear a Fitbit watch for 60 days. Six men using FitBit (mean= 25.7 ± 3.2 years old, BMI 21.8 ± 3.7 kg/m²) were compared to 6 men using FitBit while also receiving kinesiology - Dietitian counseling (mean= 27.3 ± 5.0 years old, BMI 25.2 ± 8.3 kg/m²) in their respective ecological environments. The participants in G2 received four 60-minute individual counseling sessions. **RESULTS:** Both groups appear to have significantly increased the number of steps they take per day during the study. Participants in G1 took 5838.9 ± 1035.0 steps on average at week 1 and 9029.0 ± 2529.4 steps at week 7 (Cohen's $d = 1.65$; $p<0.001$). Participants in G2 took 3708.2 ± 1340.2 steps on average at week 1 and 8942.9 ± 4456.6 steps at week 7 (Cohen's $d = 1.59$; $p<0.01$). While G2 mean Steps difference (week 7-week 1) is bigger than that of G1, it is too early to suggest that counseling sessions combine with FitBit had an increased value. **CONCLUSION:** It appears that using a self-monitoring ambulatory device

by itself is likely to help sedentary men to increase the step per day number. Future research should involve more sedentary men and women of all ages to help conclude the impact of either FitBit alone and FitBit and counseling.

1996 Board #152 May 30 3:30 PM - 5:00 PM
Heart Rate Characteristics for Male Chinese College Students of Different PA-Level during 3000 Meters Running

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PURPOSE: To explore the Heart Rate load variation for male Chinese college students of different physical activity level during 3000 meters running, providing a reference for training load monitoring and security.

METHODS: Real-time heart rate of 475 Chinese undergraduate students in Tsinghua University were test with Team 2 Polar tester during 3000-meter-run test. The physical activity was investigated by an international questionnaire. All subjects were grouped three by PA levels. Data calculated by SPSS 20.0.

RESULTS: 1. There were significant difference in heart rate among students with different levels of physical activity during 3000-meter-run. The mean of maximum heart rate in group with lower PA level was the highest 202.4 ± 8.9 , while that of the group with good PA level was the lowest 198.7 ± 6.4 ($P < 0.05$). 2. The heart rate has relation to the time during 3000-meter-run. The average speed of first three laps has a significant linear relationship to the average heart rate ($R = 0.875$). The heart rate reached a plateau in the last four laps. The heart rate of all reached the maximum in the end of test. 3. The maximum heart rate of 20% individual students reached or exceeded the summit value of maximum heart rate (220-age), and continued for a several minutes within a relatively dangerous range.

CONCLUSIONS: Mean of maximum and average heart rate of Chinese male college students with good PA level group was lower than that of poor PA level group in 3000-meter-run test. There is a high risk factor for poor PA level Chinese male students when running continuously in the maximum heart rate level. Study was supported by The Chinese General Administration of sports (2015B075)

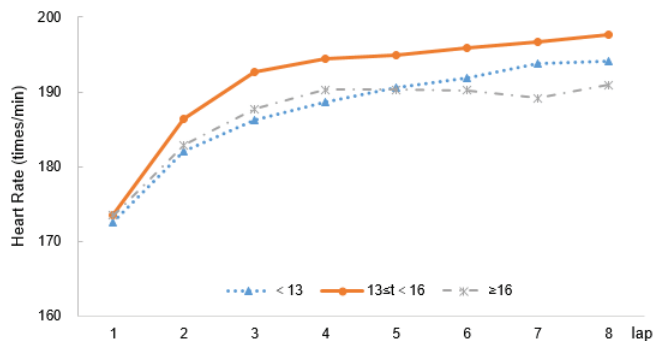


Fig. 1 Mean of heart rate for different PA levels during 3000 meter running

1997 Board #153 May 30 3:30 PM - 5:00 PM
Monitor Type: Participant Evaluations of Two Types of Activity Tracking Devices during a Walking Intervention

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Commercial physical activity tracking devices have gained popularity both in the lay population and in research settings, however, research examining the effectiveness of commercial physical activity monitors has been mixed. One potential factor to the mixed results may be participants' perceptions and preferences of the type of activity monitor. **PURPOSE:** The purpose of the study is to investigate usage and adoption issues as well as the perceived impact for two types of activity trackers. **METHODS:** A 2-arm randomized trial was used to compare the influence of type of data engagement on activity with two types of activity monitors: 1) a hip accelerometer (New Lifestyles 1000) ($n = 19$) requiring manual logging (MANUAL) and 2) a wrist accelerometer (Fitbit Charge 2) ($n = 19$) with digital logging (DIGITAL).

Participants wore the activity trackers for four weeks with instructions to attempt to meet daily step goals. At the end of the study they completed an online questionnaire evaluating their experiences with the activity trackers. The open-ended question responses for each participant were analyzed qualitatively by a content analysis. Meaning units ($n = 166$) from responses were coded and organized into categories and sub-categories. **RESULTS:** For both MANUAL and DIGITAL groups, the top identified categories regarding the perceived impact of the devices were 1) awareness of daily activity patterns ($n = 28$), 2) influenced motivation ($n = 15$), and 3) enhanced intuitive understanding of activity ($n = 14$). Differences between groups were found in prominent themes related to usage and adoption. The MANUAL users identified three themes equally: 1) concern about security of device while wearing ($n = 8$), 2) issues with ease of wearability ($n = 8$), and 3) positive experiences ($n = 8$). The DIGITAL users identified top themes: 1) no issues ($n = 8$) and usability problems ($n = 8$) equally, and 3) questioning accuracy ($n = 6$). **CONCLUSION:** Participants in both groups identified similar themes related to the impact of the devices indicating the both types of trackers were found to be perceived similarly impactful. Differences emerged in usage and adoption. Users of both types of trackers identified negatives and positives to tracker type indicating the importance of matching tracker type with personal preferences to maximize usage.

1998 Board #154 May 30 3:30 PM - 5:00 PM
The Downfall of Sitting: The Relationship between Sedentary Time and Blood Pressure

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 (No relevant relationships reported)

One third of the population is affected by hypertension, and previous research has shown that sitting for extended amounts of time can be detrimental to a person's health. **PURPOSE:** The purpose of this study was to evaluate the correlation between self-reported sitting time and blood pressure. It was hypothesized that sedentary time was significantly related to blood pressure. **METHODS:** The study included faculty or staff that were ambulatory and full-time equivalent. The participants were given a self-reported physical activity questionnaire (The International Physical Activity Questionnaire [IPAQ]) to determine sedentary time. Resting blood pressure (systolic and diastolic) was assessed using a stethoscope and sphygmomanometer, after sitting quietly in a chair for 5 minutes. Data was analyzed with a bivariate correlation test. **RESULTS:** There was a significant, positive, moderate relationship between sedentary time and systolic blood pressure ($n = 10$, $r = .705$, $p = .01$) and a significant, positive, strong relationship between sedentary time and diastolic blood pressure ($n = 12$, $r = .810$, $p = .001$). **CONCLUSION:** Self-reported sedentary time was positively related to blood pressure. In other words, the greater the individual's sitting time, the higher the systolic and diastolic blood pressure was found to be. Engaging in physical activity and reducing sedentary time may decrease the likelihood of developing hypertension. Future research should focus on the effects of programming to decrease sedentary time on measures of health.

1999 Board #155 May 30 3:30 PM - 5:00 PM
Self-Reported Sedentary Behavior Is Associated With Total, Visceral, And Segmental Body Fat In Adults

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Regional body fat deposition, particularly visceral fat, may be an important mechanistic link between sedentary behavior and cardiometabolic disease risk with advancing age. **PURPOSE:** To examine the associations of sedentary behavior and screen time with total, visceral, and segmental body fat in middle to older aged adults. **METHODS:** 47 adults (mean \pm SD: age 53.5 ± 11.2 y; body fat $30.5 \pm 10.6\%$; men 38.3%) self-reported sedentary behavior and moderate-to-vigorous physical activity (MVPA) using the Sedentary Behavior Questionnaire and International Physical Activity Questionnaire, respectively. Leisure screen time was defined as television viewing, video games and computer games. Total, visceral, and segmental body fat were estimated with the InBody770 bioelectrical impedance analyzer. Waist circumference was measured at the top of the iliac crest. Multiple regression assessed the associations of sedentary behavior and screen time with total and regional fat distribution, controlling for age, sex and MVPA. **RESULTS:** Average sedentary time was 7.5 ± 2.3 h \cdot d⁻¹ with 1.3 ± 0.9 h \cdot d⁻¹ reported as screen time. Sedentary time was associated with total fat mass ($R^2 = 0.19$, $\beta = 0.33$, $p = 0.02$), visceral fat ($R^2 = 0.20$, $\beta = 0.31$, $p = 0.03$), trunk fat ($R^2 = 0.17$, $\beta = 0.36$, $p = 0.01$), waist circumference ($R^2 = 0.23$, $\beta = 0.39$, $p < 0.01$) and leg fat ($R^2 = 0.24$, $\beta = 0.30$, $p = 0.03$) independent of age and sex. When MVPA was added to the model total fat mass ($R^2 = 0.20$, $\beta = 0.30$, $p = 0.04$), trunk fat ($R^2 = 0.17$, $\beta = 0.34$, $p = 0.03$) and waist circumference ($R^2 = 0.25$, $\beta = 0.36$, $p = 0.01$) remained significant. Screen time was associated with trunk fat ($R^2 = 0.13$, $\beta = 0.30$, $p = 0.04$) and waist circumference ($R^2 = 0.23$, $\beta = 0.38$, $p < 0.01$) independent

of age and sex, with the association of trunk fat attenuated after accounting for MVPA. **CONCLUSIONS:** Our findings suggest self-reported sedentary behavior is independently associated with the accumulation of excess total body fat, visceral fat, and fat within the trunk and legs in middle to older-aged adults. However, the association between sedentary behavior and visceral fat is attenuated by MVPA, indicating MVPA may be important for preventing the accumulation of visceral fat. Our findings also suggest total sedentary behavior is more strongly associated with regional fat deposition than screen time in this sample.

2000 Board #156 May 30 3:30 PM - 5:00 PM
Knowledge of Heart Disease and Indices of Physical Activity in Health and Non-Health Based Majors
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(No relevant relationships reported)

Cardiovascular disease (CVD) is the leading cause of mortality and is associated with modifiable lifestyle factors, such as physical activity (PA). Research has examined CVD knowledge (CVDK) and PA level in undergraduate students; however, no research has examined the relationship between CVDK and PA in this group. **PURPOSE:** To examine differences in CVDK and indices of PA between sex and major (health (HB) or non-health (NHB) based) and potential associations between CVDK and PA. **METHODS:** Students (N=241) completed an online survey including the 30-item Heart Disease Knowledge Questionnaire and 7-item International Physical Activity Questionnaire. Twenty-four outliers were removed prior to statistical analyses (n=217; 21.1±2.7 yrs; 145 females, 141 HB majors). Independent samples t-tests were conducted to test for differences in total (TK), dietary (DK), epidemiological (EK), medical (MK), risk factor (RFK), and symptom (SK) knowledge, as well as weekly frequency and duration of moderate PA (MPA), vigorous PA (VPA), and total MET-min/week of MVPA between sex and major. Alpha was adjusted for multiple comparisons. Pearson's r was used to test for linear associations between TK and PA indices. **RESULTS:** Sixty-seven percent of students met recommended PA guidelines with a minimum of 500 MET-min/week of MVPA. Females had greater RFK than males (4.6±1.6 vs. 4.0±1.6, p=0.006). HB majors had significantly higher TK (18.4±5.0 vs. 15.3±5.3, p<0.001), DK (3.7±1.7 vs. 3.1±1.9, p=0.007), EK (2.8±1.1 vs. 2.4±1.2, p=0.006), MK (4.4±1.5 vs. 3.3±1.4, p<0.001), and RFK (4.6±1.6 vs. 3.9±1.5, p=0.002) than NHB majors. There were no significant differences in SK between majors (p>0.05). Males reported significantly higher levels of MVPA than females (2300.7±2377.7 vs. 1441.9±1348.6 MET-min/week, p<0.01). There were no associations between TK and any PA index (p>0.05). **CONCLUSION:** HB majors had greater knowledge than NHB majors in all areas except SK; however, there were no differences in PA levels between majors. This suggests that CVDK may not translate to increased PA levels in undergraduates. Future research should investigate relationships between CVDK and risk reduction behaviors in this population.

2001 Board #157 May 30 3:30 PM - 5:00 PM
Association Between Objectively Measured Body Fat Percentage And Two Indirect Measures Of Adiposity
 Christopher M. Bopp, Oliver W.A. Wilson, Zack Papalia, Melissa J. Bopp, FACSM. *Pennsylvania State University, University Park, PA.* (Sponsor: Melissa Bopp, FACSM)
(No relevant relationships reported)

Body mass index (BMI), calculated using height and weight, is used clinically to diagnose obesity. The ability of BMI to estimate adiposity is limited in the general population and unknown in college aged individuals. Relative fat mass (RFM) has been proposed as an alternative technique to BMI for diagnosis of obesity. RFM accounts for mass stored in the lower portion of the torso by incorporating height and waist circumference into the equation. **PURPOSE:** The purpose of this study was to compare rates of obesity determined by BMI, RFM and objectively measured percent body fat (BF%) via bioelectrical impedance analysis (BIA) in a large cohort of college aged men and women. **METHODS:** 3804 college students completed an objective fitness assessment, where they self-reported their age and sex, and height, weight, waist circumference, and BF%, were assessed. Correlation and chi-square tests for independence analyses examined the relationships and differences in rates of obesity between each method. **RESULTS:** The mean age of the sample was 21.2±1.1, and the majority (n = 2406, 63%) identified as male. Significant correlations were found between BMI and BF% for men (r=0.79, p<0.001) and women (r=0.84, p<0.001); BMI and RFM for men (r=0.85, p<0.001) and women (r=0.83, p<0.001); and, BF% and RFM for men (r=0.74, p<0.001) and women (r=0.76, p<0.001). Differences were found between the observed and expected classification of normal adiposity or obesity by BMI, RFM and BF% for men and women (for all p<0.001). Among men, comparing BF% vs. BMI and RFM vs. BMI, more obese men via BF% or RFM were classified as normal via BMI (BF%; $\chi^2=665$, p<0.001; RFM; $\chi^2=1189$, p<0.001). For women, comparing BF% vs. BMI and RFM vs. BMI, more women who were obese via %BF and RFM were classified as normal via BMI (%BF $\chi^2=576$, p<0.001; RFM $\chi^2=108$, p<0.001). Comparing RFM and BF%, more men and women classified as

obese by RFM were considered normal by %BF ($\chi^2=626$, p<0.001; $\chi^2=246.5$, p<0.001). **CONCLUSION:** Strong associations are observed among BMI, RFM and objectively measured %BF in college students. Despite these strong relationships, discrepancies were observed between obesity classifications between BF%, BMI and RFM.

2002 Board #158 May 30 3:30 PM - 5:00 PM
Physical Activity and Health Habits Among Emergency Medical Technician Students
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Of the recognized emergency medical service professionals, the least is known about EMTs and EMT students. One known study suggests that EMT-B students have some level of predisposition to conditions such as high blood pressure, low exercise tolerance, obesity, and poor health-habit decision-making with regard to tobacco and alcohol use. **PURPOSE:** To determine the prevalence of health risk, physical activity and sedentary behaviors among students enrolled in an Emergency Medical Technician Certification Program. **METHODS:** Sixty EMT students (mean age 24.9 ± 8.3 years, 46.7% female, 98.4% Caucasian) completed risk behavior surveys including physical activity, health status, smoking, and alcohol use modeled after the Centers for Disease Control and Prevention (CDC) Behavioral Risk Factor Surveillance System (BRFSS) and a Modifiable Activity Questionnaire (MAQ) to assess leisure-time physical activity and sedentary behavior. **RESULTS:** The median (25th, 75th percentile) METmin/week of self-reported physical activity from the MAQ for all participants was 558 (228, 1074) and by gender 660 (246, 1074) males and 480 (375, 1098) females. When categorized as meeting or not meeting the current US Physical Activity Guidelines, 56.7% met or exceeded the ≥ 500 METmin/week guideline. Median BMI for all participants was 25.6 (22.9, 30.1) kg/m² with approximately 28.3% of the population considered overweight and 25% obese. Among reported health conditions, 41.7% rated their general health as very good or excellent; 20.0% percent reported being diagnosed with asthma and 16.7% reported being diagnosed with a depressive disorder. With regard to smoking and alcohol, 11.7% reported currently smoking, 15.0% reported current use of chewing tobacco or snuff and 43.3% reported ever vaping or using an e-cigarette. Additionally, participants reported a mean (standard deviation) of 4.4 (4.6) days per month of drinking at least one drink of alcohol and drinking 2.5 (2.4) drinks when they drank. **CONCLUSION:** Among EMT students, over half are meeting the current US Physical Activity Guidelines. Prevalence of overweight/obesity, smokeless tobacco use, and reported depression may put this population at risk for comorbid conditions as they transition from student to professional EMT.

2003 Board #159 May 30 3:30 PM - 5:00 PM
Accelerometer-determined Sedentary Time And Physical Activity Across Standard Occupational Categories In CARDIA
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PURPOSE High accumulated sedentary time with inadequate physical activity is a common behavioral profile in the United States. Examining differences in activity patterns across occupational categories can distinguish target populations for intervention.

METHODS This cross-sectional analysis of Year 20 CARDIA data (2005-6) included participants who had valid accelerometry data (≥4 days with ≥10 hours), reported job and job duties, and were not currently a student (n=2,050). Uniaxial accelerometry data (ActiGraph 7164), including leisure and occupational time, were expressed in 60 second epochs and summarized as: average counts per minute (CPM) and time spent (hours/day) in total sedentary behavior (SED), light physical activity (LPA), and moderate-to-vigorous physical activity (MVPA) using Freedson cutpoints. Self-reported job and job duties were categorized into the 23 major groups of 2010 Standard Occupational Classification (SOC) using Occuocoder v2.7 followed by adjudication by a trained researcher. Military and forestry categories were excluded because <5 participants reported jobs in those categories. Omnibus group differences were analyzed using ANCOVA adjusted for sex, race, age, education, wear time, center, and BMI.

RESULTS Table 1 shows the least and most favorable three SOC groups in each activity category with mean (standard error) reported. P-values represent overall group

difference across occupational categories. Building/grounds maintenance had the highest CPM while office and admin support had the lowest. Architecture/engineering had the highest SED while food preparation had the lowest. Food preparation had the most LPA and legal had the least. Construction had the highest MVPA while healthcare support had the lowest.

CONCLUSION Activity patterns have large variation across occupational categories, justifying occupation as an important determinant of activity and the workplace as a potential intervention setting.

Table 1 – Occupational Categories with the Least and Most Favorable CPM, SED, LPA, and MVPA

	Least favorable 3 categories	mean (SE)	Most favorable 3 categories	mean (SE)	p-value
CPM	Office and Administrative Support	338.2 (7.6)	Food Preparation and Serving	416.6 (19.9)	≤0.001
	Healthcare Support	341.7 (27.3)	Construction and Extraction	425.3 (17.7)	
	Architecture/Engineering	351.0 (20.9)	Building/Grounds Maintenance	428.4 (22.3)	
SED (hrs/d)	Architecture/Engineering	9.18 (0.22)	Personal Care and Service	7.58 (0.16)	≤0.001
	Legal	9.07 (0.21)	Building/Grounds Maintenance	6.88 (0.24)	
	Computer/Mathematical	9.03 (0.15)	Food Preparation and Serving	6.64 (0.21)	
LPA (hrs/d)	Legal	3.83 (0.14)	Personal Care and Service	4.79 (0.11)	≤0.001
	Computer/Mathematical	3.86 (0.10)	Healthcare Support	4.87 (0.19)	
	Arts/Entertainment/Sports/Media	4.00 (0.10)	Food Preparation and Serving	5.25 (0.14)	
MVPA (hrs/d)	Healthcare Support	0.45 (0.08)	Life/Physical/Social Sciences	0.71 (0.05)	0.0479
	Office and Administrative Support	0.50 (0.02)	Building/Grounds Maintenance	0.72 (0.06)	
	Community and Social Service	0.52 (0.05)	Construction and Extraction	0.73 (0.05)	

CPM=counts per minute; SED=total sedentary behavior; LPA=light physical activity; MVPA=moderate-to-vigorous physical activity

2004 Board #160 May 30 3:30 PM - 5:00 PM Association Between Cardiorespiratory Fitness And Continuous Cardiometabolic Syndrome Risk Score In Korean Men

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(No relevant relationships reported)

PURPOSE: We examined the hypothesis that cardiorespiratory fitness (CRF), defined as maximal oxygen uptake, predicts the risk of incident cardiometabolic syndrome (CMS) defined as having ≥3 relevant risk factors and is prospectively associated with continuous CMS risk score in healthy men. **METHODS:** Participants were 2,742 Korean men who underwent general health examinations and had no evidence of CMS, cardiovascular diseases, diabetes, and hypertension at baseline. Baseline CRF was directly measured by peak oxygen uptake (VO_{2peak}) and divided into quartiles. Incident CMS was defined as participants having ≥3 CMS components, and continuous CMS risk score was computed as the sum of z-score of five risk factors at follow-up. **RESULTS:** During a median follow-up of 5 years, 946 (34.5%) men developed CMS. The relative risks (RR) and 95% confidence interval (CI) of incident CMS in the highest quartile (>38.1 ml.kg.min) vs. the lowest quartiles of peak oxygen uptake (<31.8 ml.kg.min) was 0.62 (95% CI: 0.52-0.75) after adjusting for age, body mass index, smoking and alcohol intake. Baseline peak oxygen uptake was independently associated with continuous CMS risk score at follow up after adjusting for covariates ($\beta=-0.092$, $p<0.001$). **CONCLUSION:** The independent association between CRF and incident CMS and continuous CMS risk score, suggesting that improving CRF should be considered as an additional risk factor to predict the future likelihood of CMS in Korean men.

2005 Board #161 May 30 3:30 PM - 5:00 PM Differential Impacts Of Exercise Systolic Blood Pressure Response On The Risk Of Sudden Cardiac Death In Men With And Without A History Of Cardiovascular Disease

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(No relevant relationships reported)

PURPOSE: Although exercise systolic blood pressure (ESBP) response has been associated with different prognosis in men with and without known or suspected coronary artery disease, it remains unclear whether ESBP is associated with an increase or a decrease in the risk of sudden cardiac death (SCD) in both groups. We tested the hypothesis that ESBP would be associated with differential outcomes of SCD in men with and without a history of cardiovascular disease. **METHODS:** This prospective study was based on a population sample of 2,410 men, aged 42-61 years, who were followed up in the Kuopio Ischemic Heart Disease cohort study. Excessive ESBP was defined by a maximal SBP ≥210mmHg during progressive bike exercise testing to volitional fatigue. Participants were stratified by men with (n=884)

and without (n=1,526) a history of cardiovascular disease at baseline. **RESULTS:** During a median follow-up of 25 years, 226 SCDs occurred. After adjusting for age, each 10 mmHg increase in ESBP was associated with an increased or decreased risk for SCD in men without (HR=1.14, 95% CI 1.06-1.24) and with (HR=0.94, 95% CI 0.89-0.99) a history of cardiovascular disease, respectively. After adjusting for age, BMI, resting SBP, smoking, alcohol intake, LDL-C, HDL-C, family history of heart disease, diabetes, and maximal oxygen uptake, an increased risk of SCD was observed with excessive ESBP response in men without a history of cardiovascular disease (HR 1.73, 95% CI 1.07-2.82). A trend for a reduction in the SCD risk was observed with excessive ESBP response in

men with history of cardiovascular disease (HR 0.92, 95% CI 0.60-1.41).

CONCLUSION: Our findings indicate that ESBP response was associated with the risk of SCD in both groups. However, the heightened risk of SCD associated with excessive ESBP response appeared in men without a history of cardiovascular disease, whereas excessive ESBP response may have opposite results in men with a history of cardiovascular disease.

2006 Board #162 May 30 3:30 PM - 5:00 PM Moderators Of The Relationship Between Worksite Walkability And Physical Activity

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Purpose: This study examined traditional and novel moderators (i.e., age, sex, race, income, # of children <18 yrs, ratio of cars to drivers, home walkability) of the relationship between worksite neighborhood walkability (WNW) and physical activity (PA).

Methods: Participants (n = 512, mean 44 yrs, 59% female, 70% White) were employed (not at home) during the baseline phase of a larger trial. Measures included self-reported PA (total min/week, min/week of transport-PA inside (TPAin) and outside (TPAout) the home neighborhood; NPAQ) and Actigraph-measured PA (min/week moderate-to-vigorous PA in bouts [MVPA] and sedentary-light PA [SLPA]). GIS-assessed WNW (500m network buffer of residential, intersection, and transit densities; land use mix). Negative binomial regression estimated associations of WNW with PA, each moderator, and WNW x moderator (i.e., age, sex, race, income, # of children <18, car:driver ratio, home walkability) interactions. Alpha level set at 0.10 to probe conditional effects. Main effects of covariates (residence tenure, distance to work, reason moved to residence, total household members; and in accelerometer models, wear time) were included.

Results: Sex and # of children <18 yrs moderated relationships of WNW with MVPA and SLPA. Race moderated the relationship of WNW with TPAout. For women, the conditional effect of WNW on MVPA was positive (p = .04) while the conditional effect of WNW on SLPA was negative (p = .04); effects not different from zero for men. For adults with no children <18, the conditional effect of WNW on MVPA was positive (p = .01) while the conditional effect of WNW on SLPA was negative (p = .01); not different from zero for those with at least 1 child. For White participants, the conditional effect of WNW on TPAout was negative (p = .07); not different from zero for non-Whites. No other moderators (age, income, car:driver ratio, or home walkability) interacted with WNW.

Conclusions: For women, adults without young children, and Whites (but not men, those with young children, and non-Whites), PA is influenced by walkability of worksite environments in mostly expected directions. An underexplored aspect of behavioral ecological models is identifying who is sensitive to the environmental conditions that can bolster health promotion efforts.

2007 Board #163 May 30 3:30 PM - 5:00 PM Association of Leisure Time Physical Activity and Back Pain in Brazilian adults

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(No relevant relationships reported)

Leisure time physical activity (PA) may reduce the risk of back pain. A recent meta-analysis found that moderate to high PA during leisure time protects against low back pain by up to 16%. However, there is no study investigating this association in a developing country like Brazil (the biggest nation in Latin America).

PURPOSE: To investigate the association of leisure time PA and back pain in adults from the Brazilian National Health System (NHS).

METHODS: Data were obtained from 557 adults (410 women) enrolled in the Brazilian NHS in 2016. Participants were 50 years or older, registered for at least

one year in the NHS, and received at least one medical visit in the past six months. Leisure time PA was estimated using the Baecke questionnaire. Participants were classified according to tertiles of PA score: active, moderately active and insufficiently active. Presence of back pain was assessed through standardized questionnaire about health condition. Binary logistic regression was used to estimate values of odds ratios (ORs) and 95% confidence intervals (95% CIs). Reference group was the bottom tertile. Health status, sociodemographic and behavioural covariates were potential confounders.

RESULTS: In overall sample, mean age was 69.0 ± 8.40 years, 214 (38.4%) were physically active, 189 (33.9%) were moderately active and 154 (27.6%) were insufficiently active. Back pain was present in 344 (61.8%) adults. In the adjusted model, physically active participants were less likely to have back pain when compared to insufficiently active group (OR: 0.59; 95%CI = 0.36 to 0.95).

CONCLUSION: In this sample, leisure time PA was inversely associated with the presence of back pain.

Supported by São Paulo Research Foundation (FAPESP) Grant 2015/17777-3 and 2016/11140-6.

- 2008** Board #164 May 30 3:30 PM - 5:00 PM
Agreement Between Measured BMI and Reported BMI Obesity Definitions in a Brazilian Civil Servants
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 (No relevant relationships reported)

Body mass index (BMI) is a worldwide used method for obesity identification. It is an easy and low-cost method recommended for large samples assessment. Concerns exist regarding the risk of misclassification when BMI is calculated based on reported height and weight as compared to the measured height and weight for BMI calculation.

PURPOSE: We compared the prevalence of obesity categorized by measured BMI (m-BMI) and reported BMI (r-BMI) among Brazilian civil servant. **METHODS:** We evaluated 398 randomly selected volunteers (42.2% men), aged 44.8 ± 8.7 yrs, m-BMI: 25.6 ± 4.7 kg/m², from a federal labor court. Volunteers reported weight and height in a health questionnaire without knowing that they would be subsequently measured in an anthropometric scale (Welmy-RI W200). Both m-BMI and r-BMI were calculated using the Quetelet formula: BMI = (weight in kg)/(height in m²). Obesity was defined as BMI ≥ 30.0 kg/m². Due to lower sensitivity among women, a BMI ≥ 29.0 kg/m² alternative cut-off point was also tested. Agreement analyses was done considering m-BMI as reference, using following indices: 1) total agreement (TA) as the sum of the percentage of true positive and true negative values (TA=TP+TN); 2) sensitivity = [TP / (TP+FN)] X 100, were FN is false negative; 3) specificity = [TN / (TN+FP)] X 100. All indices were calculated as their point value and 95% interval of confidence (95%IC). **RESULTS:** Agreement indices are shown on Figure 1. When the 29.0 kg/m² cut-off point was used in the r-BMI, we found a much higher sensitivity (88.2%) with small reductions on TA (-1.4%) and specificity (-3.1%). **CONCLUSION:** We observed very high agreement between r-BMI as compared to m-BMI in the total sample and among men. The accuracy of r-BMI to identify obesity among women was lower than among men, probably affected by its lower prevalence. Using the 29.0 kg/m² alternative cut-off point for women resulted on a sensitivity as good as in men. r-BMI also showed to be a highly specific method to exclude obesity.

Figure 1. Agreement between measurement BMI (kg/m²) and reported BMI in Brazil civil servant (n= 398)

		Measurement BMI			Total N
		≥ 30 kg/m ²		Total N	
		Yes N (%)	No N (%)		
Reported BMI ≥ 30 kg/m ²	Yes	55 (94.8%)	3 (5.2%)	58	340
	No	10 (2.9%)	330 (97.1%)	340	
Total		65	333	398	

MEN AND WOMEN

Agreement: 96.7% (95%CI 94.5–98.1)

Sensitivity: 84.6% (95%CI 73.9–91.4)

Specificity: 99.1% (95%CI 97.4–99.7)

MEN (n= 168)

Agreement: 98.2% (95%CI 94.9–99.4)

Sensitivity: 90.3% (95%CI 75.1–96.6)

Specificity: 100.0% (95%CI 97.3–100.0)

WOMEN (n= 230)

Agreement: 95.7% (95%CI 92.2–97.6)

Sensitivity: 79.4% (95%CI 63.2–89.6)

Specificity: 98.5% (95%CI 95.6–99.5)

- 2009** Board #165 May 30 3:30 PM - 5:00 PM
The Overwatch League: A Pilot Study of Professional Video Gamers
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 (No relevant relationships reported)

A pilot study of professional video gamers reveals the presence of subclinical cardiovascular disease

PURPOSE:

Sedentary behavior in contemporary society is typically coupled with extended screen time (i.e. hours spent in front of a television / computer screen). In November 2016, the commercial video game developer, Blizzard Inc.TM, announced the creation of the Overwatch League (OWL), an international e-gaming association built on the model of a traditional professional sports league.

The purpose of this pilot study was to establish the feasibility of a larger project and to evaluate for the presence of subclinical pathology in members of the OWL team representing Boston.

METHODS:

The members of the Boston Uprising (n=10, age=20±2) were tested using electrocardiography, cardiac imaging (echocardiography), vascular function testing (applanation based tonometry) and multiple neurocognitive tests (testmybrain.org). Additionally, a questionnaire was administered that obtained information on health history as well as gaming history of the young subjects.

RESULTS:

All participants were in their first season of professional e-gaming and reported e-game screen time exposure of 54 ± 14 hours/week over the last 12 months with <1 day/month with complete freedom from screen time. Cardiovascular health metrics derived from the study document evidence of subclinical cardiovascular disease. Specifically, 50% of the subjects had either pre-hypertension (n=4, SBP >120 mmHg) or hypertension (n=1, SBP >140 mmHg). Additionally, 40% of the subjects measured in the 80th percentile for age and height in measured vascular stiffness (assessed by pulse wave velocity).

CONCLUSION:

This study demonstrates the feasibility of onsite data collection in an OWL team and suggests the presence of subclinical cardiovascular disease in these young individuals. Larger scale study is planned, and confirmation of the findings would indicate that this group of young individuals requires attention to cardiac risk factor modification and may benefit from a regular exercise routine being incorporated into their 'training.' These findings may have a public health impact given the large number of sedentary Americans with high amounts of screen time.

- 2010** Board #166 May 30 3:30 PM - 5:00 PM
Age-related Health State Over European Countries: The Context May Be The Difference
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The age-related life quality in aged population has been widely reported in literature including muscular functioning and self-reported health state. The EQ-5D-5L questionnaire is widely used at population level and comprises five dimensions including mobility, self-care, usual activities, pain/discomfort and anxiety/depression. Grip strength and walking ability are known to be associated with muscular functioning and activities of daily living. Little research has examined the differences throughout European countries. **Purpose:** this study aimed to investigate the relationship between the health state and health predictors, among elderly from 4 different European countries [Portugal (PT), Italy (IT), Bulgaria (BL) and Hungary (HU)]. **Methods:** 324 (81 PT, 119 IT, 76 BL and 48 HU) older adults (68.9 ± 6.3 yrs, 73.6 ± 12.7 Kg, 1.61 ± 0.08 m), male (24%) and female (76%), were recruited from local population. The subjects completed the EQ-5D-5L and were assessed as handgrip test (HandT), 6 minutes walking test (6MW). EQ-5D-5L index (EQ_index) was calculated to assess the quality-adjusted life years (QALYs). ANOVA was performed to detect country group differences. Pairwise comparisons was executed with Tukey post hoc test and Cohen D. Pearson coefficient of correlation was used to assess relationship between determinants. Significance was set at $p < 0.05$. **Results:** Pairwise comparisons showed that BL has lower scores than HU, IT and PT in EQ_index (differences ranged between -17% to -28%, $p < 0.05$, $d = 0.80$ to 1.30). HandT (differences ranged between -29% to -69%, $p = 0.000$; $d = 2.60$ to 3.98); and 6MW (differences ranged between -72.33% to -82%, $p = 0.000$; $d = 4.58$ to 12.03), for both sexes. In all counties the EQ_index was moderately and positively correlated with HandT ($r = 0.453$; $p = 0.000$) and 6MW ($r = 0.533$; $p = 0.000$). However the pattern was not cross-country homogeneous, as HU showed lowest correlations ($r = 0.124$; $p = 0.400$; 6MW, $r = -0.016$; $p = 0.913$).

Conclusions: Different environments promote different life quality in aged population. BL evidences poorer quality of life and fitness status than other European countries. HU seems to well promote healthy life style. Further investigation is need to better understand the present findings.

2011 Board #167 May 30 3:30 PM - 5:00 PM

Impact Of Physical Activity On N-glycan Profile In Older Adults

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The biological mechanisms underlying the beneficial effects of regular physical activity (PA) on prevention of chronic diseases are not fully understood. It is currently suggested that N-linked enzymatic glycosylation, a post-translational modification modulating the biological function of several proteins, may contribute to disease development. Nevertheless, the influence of PA on N-glycans in humans has never been explored. **PURPOSE:** To explore serum N-glycan profile in a sample of community-dwelling older women with different objectively assessed PA levels and metabolic risk status. **METHODS:** Components of the metabolic syndrome (MetS) and serum N-glycans analyzed using DSA-FACE technology were assessed in 109 older community-dwelling women (65-70 yrs). Ten peaks, each representing a unique N-glycan structure were detected. Adherence to PA guidelines was determined using accelerometry. Participants daily engaged in 30 minutes of MVPA were classified as meeting PA guidelines.

RESULTS: Significant differences in N-glycan peaks were indicated when comparing women adhering to the PA guideline to those less active: when adjusted by MetS, a 12% ($p = 0.006$) and a 13% ($p = 0.004$) lower level of NA3 (peak 8) and NA4 (peak 10), respectively, were evident among the physically active women compared to those less active. In contrast to findings based on the MVPA threshold, no differences in N-glycan peaks were observed between PA groups when based on the lower intensity threshold, which may indicate that the influence on N-glycan levels by PA is intensity-sensitive.

CONCLUSIONS: Adherence to PA guidelines is related to a favorable N-glycan profile, regardless of metabolic risk status. This proposed effect on N-glycans only occurs above the moderate PA-intensity threshold. Our findings support the promotion of a physically active lifestyle as a supporting non-pharmacological public health approach.

D-62 Free Communication/Poster - Protein Metabolism

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2012 Board #168 May 30 2:00 PM - 3:30 PM

Post-exercise Cooling Impairs Muscle Protein Synthesis Rates In Healthy Young Males

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Protein ingestion and cooling are strategies employed by athletes to improve post-exercise recovery and, as such, to facilitate muscle reconditioning following exercise. However, whether post-exercise cooling affects postprandial protein handling and subsequent muscle protein synthesis rates during recovery from exercise has not been studied.

Purpose: This study assessed the impact of post-exercise cooling on acute postprandial (hourly) and prolonged (daily) myofibrillar protein synthesis rates during recovery from resistance-type exercise over a 2-week period.

Methods: Twelve healthy, male adults (age: 21 ± 1 y) performed a single session of resistance-type exercise followed by water immersion of both legs for 20 min. One leg was immersed in cold water (8°C : CWI) while the other leg was immersed in thermoneutral water (30°C : CON). After water immersion, a beverage was ingested containing 20 g intrinsically L-[1- ^{13}C]-phenylalanine and L-[1- ^{13}C]-leucine labelled milk protein with 45 g of carbohydrates. In addition, primed continuous L-[ring- $^2\text{H}_5$]-phenylalanine and L-[1- ^{13}C]-leucine infusions were applied, with frequent collection of blood samples and muscle biopsies to assess myofibrillar protein synthesis rates in

vivo over a 5-h recovery period. In addition, deuterated water ($^2\text{H}_2\text{O}$) was ingested with the collection of saliva, blood and muscle biopsies over 2 weeks to assess the effects of post-exercise cooling with protein intake on myofibrillar protein synthesis rates during more prolonged resistance-type exercise training.

Results: Incorporation of dietary protein-derived L-[1- ^{13}C]-phenylalanine into myofibrillar protein was significantly lower in CWI compared to CON (0.016 ± 0.002 vs 0.021 ± 0.002 MPE; $P = 0.016$). Post-exercise myofibrillar protein synthesis rates were lower in CWI compared to CON based upon L-[1- ^{13}C]-leucine (0.058 ± 0.003 vs $0.072 \pm 0.005 \cdot \text{h}^{-1}$, respectively; $P = 0.024$) and L-[ring- $^2\text{H}_5$]-phenylalanine (0.042 ± 0.003 vs $0.053 \pm 0.004 \cdot \text{h}^{-1}$, respectively; $P = 0.025$). Daily myofibrillar protein synthesis rates assessed over 2 weeks were significantly lower in CWI when compared to CON (1.48 ± 0.05 vs $1.67 \pm 0.11 \cdot \text{d}^{-1}$, respectively; $P = 0.042$).

Conclusion: Cold-water immersion during recovery from resistance-type exercise impairs myofibrillar protein synthesis rates.

2013 Board #169 May 30 2:00 PM - 3:30 PM

High-Protein Diet in Combination with Resistance Training Improves Performance without Changing Blood Parameters in Rats

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PURPOSE: The effects of consuming a normal or high-protein diet containing isolated whey protein (IWP) in conjunction with resistance training (RT) is little known. This study aimed to determine the effects of IWP on performance, biochemical, hormonal and tissue parameters in rats completing a vertical ladder training protocol.

METHODS: Thirty-two 45-day-old male Wistar rats were divided into four groups ($n = 8/\text{group}$): normal protein diet (14% IWP) sedentary (NS) and trained (NT); high-protein diet (35% IWP) sedentary (HS) and trained (HT). RT consisted of 8 vertical ladder climbs/3x a week, over 6 weeks. In weeks 1-2, rats carried a load equivalent to 70% of the maximal load, determined by a maximal load test (MLT), performed on the first and last days of training. The load was adjusted to 80% and 85% of the MLT, respectively, every 2 weeks. At the conclusion of the study, the animals were anesthetized and euthanized after 12h of fasting. Quadriceps (Q), anterior tibial, gastrocnemius (G), soleus and long finger extensor, kidneys, liver and heart tissues were excised and weighed (g).

RESULTS: Performance values (g) on the last MLT improved in HT (964.8 ± 117.6) compared to HS (730.6 ± 89.7), NT (472.6 ± 72.7) and NS (323.0 ± 63.7). There was no difference in plasma levels of testosterone, IGF-1, hepatic enzymes, creatinine, and β -hydroxybutyrate, as well as hematological parameters. Levels of HDL-c ($p < 0.001$) were higher in HT (104.4 ± 26.0) and HS (100.7 ± 21.2) compared to NS (73.9 ± 15.7) and NT (60.8 ± 12.0). There was an observed difference in the relative weights of the kidneys ($\text{HS} = 0.72 \pm 0.05$, $\text{HT} = 0.70 \pm 0.04$, $\text{NS} = 0.58 \pm 0.04$, $\text{NT} = 0.59 \pm 0.02$, $p < 0.0001$), liver ($\text{HT} = 2.93 \pm 0.21$ $>$ $\text{NS} = 2.62 \pm 0.19$, $\text{NT} = 0.59 \pm 0.02$, $p = 0.004$) and heart ($\text{HS} = 0.32 \pm 0.02$ $>$ $\text{NS} = 0.28 \pm 0.02$, $\text{NT} = 0.27 \pm 0.01$, $p = 0.003$). In relation to the relative muscle weight of G ($p = 0.05$) and Q ($p = 0.02$), HT (1.16 ± 0.09 ; 1.67 ± 0.09) showed higher values in comparison to NT (1.04 ± 0.08 ; 1.53 ± 0.09).

CONCLUSIONS: A high-protein diet of 35% IWP in combination with RT improved performance as well as increased muscle and organ weight without damaging tissues related to protein metabolism (confirmed by unchanged hematological parameters). This finding may help to minimize the risk of developing cardiometabolic disorders in certain populations.

2014 Board #170 May 30 2:00 PM - 3:30 PM
Satiating Effect Of High Protein Diets On Resistance-trained Individuals In Energy Deficit.

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Short-term energy deficit strategies are employed by weight class and physique athletes to enhance strength:body-mass and body composition during training or prior to competition. During such phases, athletes may consume very high protein intakes to maximise satiety, maintain caloric deficit and minimise lean muscle losses despite

a paucity of research supporting any benefits. **PURPOSE:** To compare the satiating effect of two protein diets on resistance-trained individuals in short-term energy deficit. **METHODS:** Following University ethical approval, 16 resistance-trained participants (age: 28 ± 2 years; height: 1.72 ± 0.03 m; body-mass: 88.83 ± 5.54 kg; body-fat: $21.85 \pm 1.82\%$) were randomly assigned to a moderate (PRO_{MOD} : $1.8 \text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$) or high protein (PRO_{HIGH} : $2.9 \text{ g} \cdot \text{kg}^{-1} \cdot \text{d}^{-1}$) matched calorie-deficit diet for 7 days in a cross-over manner, including 4-week wash-out. Venous samples were collected (time-points T0, 60, 120 mins) for assessment of plasma ghrelin and protein YY concentrations to a fixed-protein ($0.7 \text{ g} \cdot \text{kg}^{-1}$) meal, along with perceived satiety ratings, following each diet. **RESULTS:** Following PRO_{MOD} mean ghrelin concentration ($\text{pg} \cdot \text{ml}^{-1}$) significantly reduced post-meal (T0: 972.8 ± 130.4 , T60: 659.7 ± 86.4 , T120: 613.6 ± 114.3 ; $p \leq 0.003$ compared to T0). Similar observations were reported for PRO_{HIGH} (T0: 1088.2 ± 158.8 , T60: 786.6 ± 117.3 , T120: 850.6 ± 147.7 ; $p \leq 0.015$). However, T120 responses differed between conditions, and further confirmed when data were normalised for relative change (PRO_{MOD} : -0.40 ± 0.06 , PRO_{HIGH} : -0.26 ± 0.06 ; $p = 0.015$). PYY concentrations ($\text{pg} \cdot \text{ml}^{-1}$) increased post-meal across time-points (PRO_{MOD} : 84.9 ± 8.9 to 147.1 ± 11.9 and PRO_{HIGH} : 100.6 ± 9.5 to 143.3 ± 12.0 ; $p < 0.001$), with no differences reported between diets. Perceived 'hunger', 'fullness' and 'satisfaction' were comparable between diets ($p > 0.05$). However, 'desire to eat' remained significantly blunted at T120 post-meal for PRO_{MOD} only ($p = 0.048$). **CONCLUSIONS:** PRO_{HIGH} does not confer additional satiating benefits in resistance-trained individuals during short-term energy deficit. Ghrelin response to a test-meal support the contention that satiety was sustained with PRO_{MOD} , with implication that high protein meals may be adequate to increase acute satiety when following a PRO_{MOD} energy-restricted diet.

2015 Board #171 May 30 2:00 PM - 3:30 PM
Effect Of Branched-chain Amino Acid Plus Glucose Supplement Timing On DOMS And Related Indicators After Eccentric Exercise
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PURPOSE: Nutrient timing is a strategic approach to maximize training effects, reduce risk of injury, and help with recovery. The present study examined the effect of BCAA plus Glucose on markers of muscle damage and Inflammation after eccentric exercise in male college students.

METHODS: 18 healthy college students were divided into control group (PLA) group and supplement (BCAA+G) group randomly. Each group was randomly assigned 4 people for pre-exercise supplementation and 4 people after exercise for the first time, and changed for the second time. Before or after supplementation, volunteers performed an eccentric exercise protocol. Muscle soreness (VAS), creatine kinase (CK), C-reactive protein (CRP) and interleukin-6 (IL-6) and 3-methylhistamine (3MH) assessments were performed before exercise and after 30min, 24, 48 hours.

RESULTS: The VAS score of the subjects increased significantly 24 hours after high-intensity eccentric exercise (2.86 vs 1.66 , $p < .05$), and the increase of serum CK level (364.45 vs. 151.02 U/L), CRP (4.77 vs. 3.28 mg/L) and IL-6 (279.00 vs. 110.63 pg/ml) increased significantly ($p < .05$); BCAA plus G supplement significantly reduced the VAS score (1.27 vs 2.86 , $p < .05$) and CK (258.74 vs. 364.45 U/L), CRP (3.75 vs. 4.77 mg/L), IL-6 (164.09 vs. 279.00 pg/ml) levels ($p < .05$), compared with pre-supplementation group, post-supplementation had lower VAS score (1.27 vs. 2.63), CRP (3.75 vs. 4.26 mg/L) and IL-6 (164.09 vs. 226.66 pg/ml) and 3MH (105.07 vs. 131.67 umol/L) response at 24 h after eccentric exercise ($p < .05$). **CONCLUSIONS:** High-intensity eccentric exercise caused DOMS with the elevation of damage and inflammatory markers as CK, CRP and IL-6. BCAA plus G supplementation can effectively reduce the level of DOMS, decrease muscle damage and inflammatory factors and protein breakdown. Compared with pre-exercise supplementation, post-exercise supplementation has a better effect on reducing inflammatory factors and protein breakdown caused by DOMS.

2016 Board #172 May 30 2:00 PM - 3:30 PM
Acute Effect Of The Order Of Resistance Exercise And Nutrient Intake On Muscle Breakdown
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Combined resistance exercise (RE) and nutrient intake synergistically interacts with muscle hypertrophic effect (MHE) (Phillips et al., 2006). Indeed, muscle breakdown (MB) is suppressed with acute RE and proper nutrient (amino acid + carbohydrate), reflected by decreases in 3-methylhistidine (3-MH), a MB marker in 24h urine collection. The study also suggested that the response of MB marker upon acute RE may reflect MHE in chronic RE training (Bird et al., 2006). However, the effect of the order of nutrient intake and RE on acute MB response remains unclear. Given that MB

acutely responds to RE (Louis et al., 2007), it is important to assess acute changes in MB markers upon nutrient intake and RE. **PURPOSE:** The aim of this study was to investigate the effect of the order of nutrient intake and RE on acute changes in urinary MB marker and thus MHE.

METHODS: Twelve healthy men were divided into three conditions: 1) nutrient intake before RE condition (Pre), 2) nutrient intake after RE condition (Post), and 3) RE without nutrient intake condition (No). They performed 5 types of multiple RE at 70% RM intensity. In all conditions, RE was performed from 8:30 to 9:30. The time of nutrient intake in the Pre was at 7:00, while in the Post was at 9:30. The standard Japanese lunch menu with 21 g of whey protein and 200 ml of milk (total energy, 1019 kcal; Protein, 53.4 g; fat, 25.1 g; carbohydrate, 139.5 g) was provided. Urinary samples were collected at 7:00, 10:00, 12:00, 15:00, and 18:00, and urea nitrogen (UN), creatinine (Cre), and 3-MH concentrations were measured, and 3-MH and UN, were normalized by Cre. **RESULT:** The acute responses of MB markers were validated by the result that the time-course change in the total amount of UN and UN normalized by Cre were consistent at any given time point. The area under the curve (AUC) of 3-MH was significantly higher in Pre than that in No ($P < 0.01$). There was no significant difference between Post and No in the AUC of 3-MH. The AUC of UN was significantly higher in Pre than that in Post ($P < 0.05$) and No ($P < 0.01$). **CONCLUSION:** These results suggest that nutrient intake before RE may have no substantial MHE. Supported by Grant-in-Aid for Scientific Research from the Japanese Ministry of Education, culture, Sports Scientific, and Technology (Grants 26702029 and 15KK0358).

2017 Board #173 May 30 2:00 PM - 3:30 PM
Different Amounts Of Protein Intake Influence Body Composition And Performance In Elite Cyclists
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PURPOSE: The ideal amount of protein intake for endurance athletes has been poorly investigated. The aim of our study was to evaluate the physiological impact of different dietary protein intakes on body composition and performance outcomes in a group of elite cyclists. **METHODS:** Thirty-four elite cyclists (1600-1800 km/month) participated to the study. Subjects were divided in 4 groups with different levels of protein intake: normal (NP, 1.2 g/kg), moderate (MP, 1.6 g/kg), high (HP, 2.0 g/kg) or very high (VHP, 2.4 g/kg) protein for 8 wk. In the diets fats were maintained constant whilst energy from carbohydrate and protein was modified to maintain an isocaloric diet. Body composition was assessed via Dual X Ray Absorptiometry (DXA) and via ultrasound to calculate cross sectional area (CSA) of the anterior thigh. $\text{VO}_{2\text{max}}$, peak power output and 1 RM half squat test were also performed. **RESULTS:** After two months both HP and VHP showed a significant improvement of 1 RM (HP pre $133 \pm 14 \text{ Kg}$ vs post $141 \pm 12 \text{ Kg}$, $p < 0.001$; VHP pre $137 \pm 12 \text{ Kg}$ vs post $144 \pm 11 \text{ Kg}$, $p < 0.001$), PPO (HP pre $505 \pm 78 \text{ W}$ vs post $534 \pm 67 \text{ W}$, $p < 0.001$; VHP pre $512 \pm 55 \text{ W}$ vs post $541 \pm 76 \text{ W}$, $p < 0.001$), and $\text{VO}_{2\text{max}}$ (HP pre $62.1 \pm 5.8 \text{ mlO}_2/\text{Kg}$ vs post $64.5 \pm 5.9 \text{ mlO}_2/\text{Kg}$, $p < 0.001$; VHP pre $61.2 \pm 5.5 \text{ mlO}_2/\text{Kg}$ vs post $64.1 \pm 7.6 \text{ mlO}_2/\text{Kg}$, $p < 0.001$), without differences between groups. There were no significant changes of 1 RM and $\text{VO}_{2\text{max}}$ for both NP and MP whilst NP showed a significant decrease of PPO. Both HP and VHP showed a significant increase of lean body mass (LBM) (HP pre $64.72 \pm 1.9 \text{ Kg}$ vs post $65.99 \pm 2.2 \text{ Kg}$, $p < 0.001$; VHP pre $65.52 \pm 2.0 \text{ Kg}$ vs post $67.61 \pm 1.7 \text{ Kg}$) whilst both NP and MP showed a significant decrease (NP pre $63.31 \pm 2.1 \text{ Kg}$ vs post 62.4 ± 2.3 , $p < 0.05$; MP pre $66.88 \pm 1.8 \text{ Kg}$ vs post 65.80 ± 2.9). HP and VHP showed a significant increase of anterior thigh CSA (HP pre $50.5 \pm 7.8 \text{ cm}^2$ vs post $53.4 \pm 6.7 \text{ cm}^2$, $p < 0.001$; VHP pre $51.2 \pm 5.5 \text{ cm}^2$ vs post $54.1 \pm 7.6 \text{ cm}^2$). No changes of blood values are detected.

CONCLUSIONS: Our data suggest that a higher protein intake (2.0 and 2.4 g/Kg) may help elite cyclists to improve performance and to increase muscle mass without differences between the two levels of protein intake. Instead 1.2 and 1.6 g/Kg of protein seemed to be not sufficient and could impair performance and muscle mass.

2018 Board #174 May 30 2:00 PM - 3:30 PM
The Association Between The Number Of Meals With Adequate Protein Intake And Maximal Deadlift Strength

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(No relevant relationships reported)

PURPOSE: To analyze the association between the number of meals with adequate protein intake and maximal deadlift strength in college athletes.

METHODS: We evaluated 250 (107 women) college athletes previous to a national contest. Maximal strength was assessed with one repetition maximum (1RM) on deadlift and was adjusted for body mass (kg lifted weight/kg body mass). The protein intake per meal was assessed with 24-h dietary recalls. The reported protein intake was expressed as absolute (g) and relative (g/kg body mass). Adequate protein intake per meal was deemed as ≥ 20 g and ≥ 0.3 g/kg. Next, we calculated the number of meals that achieved these thresholds and were grouped as ≤ 1 , 2, 3, ≥ 4 meals for each criterion. Then, 1RM was compared between groups with and without adjustment for covariables (age [years], lean body mass [kg, bioelectrical impedance], height [cm], sex, relative protein intake [g/kg/d]) for each criterion.

RESULTS: For ≥ 20 g criterion, the ≥ 4 meals group showed significantly higher 1RM than ≤ 1 group for the unadjusted model. When it was corrected for age, lean body mass, height, and sex, it remained significant. However, the differences were no longer significant when the model was also adjusted for relative protein intake. As the model was adjusted, the number of meals decreased their contribution to the model. The same pattern was observed with the ≥ 0.3 g/kg criterion (Table).

CONCLUSIONS: The number of meals with adequate protein intake is associated with higher deadlift 1RM. However, its importance decreased when were adjusted for relative protein intake. Therefore, the association between protein intake and deadlift 1RM could be mediated by total relative protein intake, and the number of meals with adequate protein intake could serve as a strategy to eat more protein rather than playing a "timing" role.

Table. Comparison of maximal deadlift strength by number of meals with adequate protein intake.

≤ 1	n	Number of meals with adequate protein intake				p	R ²	R ² #
		2	3	≥ 4				
20 g/meal	n	52	73	91	34			
	1 RM (kg/kg)*	1.35 ± 0.055 a	1.52 ± 0.047 ab	1.57 ± 0.042 b	1.60 ± 0.069 b	0.008	0.047	0.047
	1 RM (kg/kg) †	1.36 ± 0.055 a	1.49 ± 0.044 ab	1.56 ± 0.041 b	1.62 ± 0.099	0.020	0.04	0.204
	1RM (kg/kg) ‡	1.43 ± 0.063	1.51 ± 0.046	1.54 ± 0.043	1.52 ± 0.108	0.586	0.008	0.218
0.3 g/kg/meal	n	56	78	86	30			
	1 RM (kg/kg)*	1.34 ± 0.053 a	1.53 ± 0.045 b	1.55 ± 0.043 b	1.69 ± 0.072 b	0.001	0.067	0.067
	1 RM (kg/kg) †	1.40 ± 0.051 a	1.49 ± 0.043 ab	1.49 ± 0.043 ab	1.71 ± 0.092 b	0.032	0.036	0.188
	1RM (kg/kg) ‡	1.49 ± 0.061	1.52 ± 0.044	1.46 ± 0.044	1.57 ± 0.106	0.621	0.007	0.211

Data expressed as mean \pm standard error. Different letters denote significant differences between groups ($p < 0.05$). 1RM: One repetition maximum (kg of weight lifted/kg body mass). * Unadjusted model. † Adjusted for age, lean body mass, height, and sex. ‡ Adjusted for age, lean body mass, height, sex, and relative protein intake. # R² for number of meals within the model. # R² for the model.

2019 Board #175 May 30 2:00 PM - 3:30 PM
Correlation Between Dietary Protein Intake And Grip Strength In Inactive Vegetarian And Vegan Females

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(No relevant relationships reported)

More than 5% of U.S. adults 18-35 y self-identify as vegetarian or vegan. While health benefits, including reduced risk for cardiometabolic diseases are promoted, concern remains over the potential of lower protein intake, which can lead to reduced muscle mass and strength.

PURPOSE: To examine the relationship between dietary protein and grip strength in inactive vegetarian and vegan female adults.

METHODS: Thirty-three self-reported inactive (< 150 min exercise/wk) female vegetarians and vegans (31 ± 9.6 ; $n = 23$ vegan) of at least 1 year were recruited for this study. A 24hr dietary recall was administered by a trained researcher and protein intake calculated using Food Processor software. Dominant handgrip strength was measured 3 times using a handheld dynamometer, and greatest score recorded. An *a priori* α of 0.05 was used and partial Pearson Product Moment correlation was determined between protein intake and grip strength when controlling for diet type (vegetarian vs. vegan). Independent samples t-tests were conducted to compare protein intake and grip strength in vegetarians vs. vegans.

RESULTS: Results showed significantly greater grip strength in vegans (26.7 ± 4.7 kg) as compared to vegetarians (23.5 ± 2.9 kg), $t(2.046)$ $p < .050$, and no difference in protein intake between groups $t(-.368)$ $p = .716$. Results show no correlation between protein intake (43.7 ± 15.2 g PRO/d) and grip strength (25.7 ± 4.4 kg) while controlling for diet type ($r(30) = .118$, $n = 33$, $p = .520$). It is noteworthy that mean grip strength in the sample was significantly below the reference value for North American females (31 kg).

CONCLUSION: This study provides evidence that there was no significant association between protein intake and grip strength in inactive female vegetarians; yet, the grip strength for this population fell significantly below region/gender-specific reference ranges.

2020 Board #176 May 30 2:00 PM - 3:30 PM

Combining Whey Protein Isolate with Eccentric Training Improved Quadriceps Strength in Patients with ACL Rupture

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Anterior cruciate ligament (ACL) rupture results in significant quadriceps weakness, which will then cause abnormal gait and knee instability. Eccentric training (ET) can produce larger effects on muscle strength than concentric training¹, which may be further augmented by protein supplement². **Purpose** To examine the effects of combining whey protein supplement with preoperative isokinetic ET on quadriceps strength and function after ACL rupture. **Methods** Thirty-seven male subjects aged 18-40 years with ACL rupture were randomly assigned to isokinetic ET (IET, N=19) group or isokinetic ET with whey protein isolate (IET+WP, N=18) group. Both groups received preoperative isokinetic ET for six weeks, containing 3-4 sets per day with 8-10 repetitions for each set, twice a week. Subjects in IET+WP consumed whey protein isolate 22 g per day. Cross-Sectional Area (CSA) of quadriceps was scanned by MRI, and strength and knee function were measured before and after the trials. **Results** After intervention, CSA of the involved quadriceps increased by 3.7% (NS) in IET and 7.6% ($P = 0.012$) in IET+WP. The ratio of side-to-side increased by 3.9% (NS) in IET and 4.8% ($P = 0.002$) in IET+WP. The peak torque of quadriceps during eccentric contraction at 60 degree/s, concentric contraction at 60, 180 and 300 degree/s increased by 27.9% ($P < 0.001$), 35.9% ($P < 0.001$), 34.3% ($P = 0.002$) and 27.3% ($P = 0.003$) in IET, and increased by 44.2% ($P < 0.001$), 42.3% ($P < 0.001$), 37.4% ($P = 0.002$) and 36.7% ($P < 0.001$) in IET+WP, respectively, with no differences between the two groups. Lysholm and IKDC2000 knee function score in IET+WP increased by 24.7% ($P = 0.001$) and 12.9% ($P = 0.001$). **Conclusions** Combining whey protein supplement with ET tends to be more effective on improving CSA of quadriceps, knee function and quadriceps strength when compared to ET alone after ACL rupture, even though the results did not reach statistical differences. **References** [1]. Douglas, J., et al., 2017. [2]. Cermak, N.M., et al., 2012. Supported by The National Key Research and Development Program (No.2016YFD0400603)

2021 Board #177 May 30 2:00 PM - 3:30 PM

The Effect of Protein Supplementation on Recovery From Exercise-Induced Muscle Damage

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The Effect of Protein Supplementation on Recovery From Exercise-Induced Muscle Damage

Brooke E. Starkoff, Elizabeth Lenz, Craig O. Mattern, Danny Too, and Heidi K. Byrne. *The College at Brockport- SUNY, Brockport, NY; Valparaiso University, Valparaiso, IN* Macronutrient consumption is a crucial component to recovery from vigorous physical activity. Specifically, carbohydrates and protein play a substantial role in recovery from strenuous physical activity. **PURPOSE:** To determine whether or not a carbohydrate plus protein (CHO-P) supplement (containing branched chain amino acids) invoked improved recovery from exercise-induced muscle damage (EIMD) when compared to an isocaloric carbohydrate (CHO) only control supplement, while simultaneously controlling for diet. **METHODS:** Twenty resistance-trained college males (22.1±3.9 yrs, 176.0±6.9 cm, 84.2±17.6 kg) participated in a ten-day, double-blind, randomized trial. Subjects consumed a provided diet (60±5% carbohydrate, 25±4% fat, 15±3% protein) and a daily supplement of 60 g carbohydrates or 40 g carbohydrates plus 20 g protein for eight days. On the fifth day, subjects completed a 100-box jump EIMD protocol. Measures of creatine kinase and myoglobin were obtained prior to EIMD and at 12, 24, 48, and 72 hours post exercise. Muscle soreness and lower body muscle force production were measured pre-EIMD and at 24, 48, and 72 hours post-EIMD. **RESULTS:** Creatine kinase levels (U/L) were elevated at 12 (227.1±18.5), 24 (216.1±17.0), 48 (189.6±18.3), and 72 (168.1±18.0) hours post-EIMD when compared to baseline (121.4±15.2). Myoglobin levels (ng/mL) were elevated at 12 (60.4±56.6) hours post-EIMD when compared to baseline (8.745±6.3). Although the elevations in creatine kinase and myoglobin indicate that EIMD was produced, there were no significant differences in creatine kinase or myoglobin between CHO and CHO-P groups at any time points measured. Although muscle soreness was increased at all time points post-EIMD, there were no significant differences between the CHO and CHO-P conditions. **CONCLUSION:** These data suggest that a CHO-P supplement does not elicit greater recovery from EIMD when compared to a CHO supplement alone.

2022 Board #178 May 30 2:00 PM - 3:30 PM
Associations Among Dietary Protein Intake, Physical Activity, and Muscle Quality in Young Adults

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It is well established that moderate-vigorous intensity physical activity (MVPA) and resistance training (RT) positively influence muscle capacity and quality and health across the lifespan. Dietary protein intake is also known to influence muscle health. Data suggest that MVPA, RT, and dietary protein intake differ in young men and women, which may impact muscle capacity and quality; however, research in recreationally active young adult cohorts is lacking. **PURPOSE:** The aim of this study was to determine the associations between dietary protein intake quantity and source and muscle capacity (MC) and quality (MQ), controlling for MVPA and RT, in young men and women. **METHODS:** Young adults (n=122; 18-22 yr; 54% female) were assessed for a) total, animal and plant protein intakes via 3-day diet recall with analysis by Nutrition Data Systems for Research software; b) body composition via DXA scans, and c) knee extensor muscle strength (MC-S) and power (MC-P) via isokinetic dynamometry and Nottingham leg extensor power rig, respectively. Muscle quality was calculated as strength (MQ-S) and power (MQ-P) relative to leg lean mass. MVPA was determined using accelerometry and RT was determined from questionnaire. **RESULTS:** Compared to females, males ingested more animal protein when normalized per body weight, as a percentage of total kcal, and as a percentage of total protein intake (all p<.05). Males also had more lean mass and greater MC-S, MC-P, and MQ-S than females (all p<.05); however, there was no sex difference in MVPA, RT, or MQ-P (all p>.05). Additionally, males had a significant relationship between total protein, total animal protein, and total plant protein intake and MC-S whereas females did not. Controlling for sex, MVPA, and RT, higher total dietary protein and total animal protein intake were associated with greater MC-S (r = .29 and .25, respectively, both p<.05). Higher relative animal protein intake was positively related, whereas higher relative plant protein intake was inversely related to MQ-P (both p<.05). **CONCLUSIONS:** This data suggests that young adult males and

females differ in their dietary protein intake patterns. Moreover, dietary protein intake is modestly related to muscle capacity and quality with effects being stronger in males compared to their female counterparts.

2023 Board #179 May 30 2:00 PM - 3:30 PM
Association of Protein Intake at Three Meals With Muscle Mass in Healthy Young Subjects

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(No relevant relationships reported)

PURPOSE: In addition to importance of total daily protein intake for regulation of muscle mass, protein intake over 0.24 g/body weight (BW) from each meal may be necessary to maximize postprandial muscle protein synthesis in young population. Therefore, we hypothesized that if individuals do not achieve protein intake over 0.24 g/BW at least one of three meals (breakfast, lunch, and dinner), muscle mass can be decreased. This cross-sectional study examined the association of protein intake at three meals with muscle mass among healthy young subjects. **METHODS:** We collected 3-day dietary records to evaluate dietary intake. We calculated total fat free mass (FFM) and appendicular (AppFFM) with dual-energy X-ray absorptiometry, and TotalFFM% and AppFFM% were also calculated as FFM relative to BW. The 266 subjects were categorized into two groups: AP group, achieving over 0.24 g/BW of protein intake at all three meals; or NP group, not achieving 0.24 g/BW of protein intake at least one meal. **RESULTS:** There was no linear association between total protein intake above the recommended dietary allowance (RDA) and both TotalFFM% and AppFFM%. Consequently, we examined the association of protein intake at three main meals with muscle mass in subjects consuming total daily protein intake above the RDA. Regardless of potential confounders (e.g. sex, physical activity, and energy intake), we demonstrated that TotalFFM% (77.0 ± 0.5 vs 75.2 ± 0.4%, P = 0.008) and AppFFM% (34.7 ± 0.3 vs 34.1 ± 0.2%, P = 0.058) in AP group was greater than in NP group consuming total protein intake above the RDA. **CONCLUSION:** This finding suggests that even if individuals achieve total protein intake above the RDA, not achieving protein intake over 0.24 g/BW at least one meal may lead to decreased muscle mass in young population. This work was supported by the Japanese Council for Science, Technology and Innovation (SIP, Project ID 14533567), and the grant "Technologies for creating next-generation agriculture, forestry and fisheries" (funding agency: Bio-oriented Technology Research Advancement Institution, NARO).

2024 Board #180 May 30 2:00 PM - 3:30 PM
Effects Of Soy Milk Ingestion On Running Anaerobic Sprint Test (RAST) Performance

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PURPOSE: Pre-exercise feeding is crucial in ensuring individuals are well-fuelled and able to perform at high intensities. Soy protein supplementation have shown to improve performance and recovery, in endurance or resistance exercises. However, there is sparse research on its effects in the repeated anaerobic sprint test (RAST) which is a valid and reliable method in measuring anaerobic capacity. The purpose was to investigate the effects of soy milk ingestion on anaerobic performance using the RAST. **METHODS:** 10 males (age: 23.2 ± 1.23 years, height: 174.3 ± 5.84 cm, weight: 65.39 ± 6.44 kg) participated in the study. They performed two RAST with a soy milk intervention (SOY: 500mL soy milk + 4g stevia sweetener) and a placebo control (CON: 500 mL water + 4g stevia sweetener) over a 7-day period. The RAST consisted of six 35 m sprints with 10 seconds recovery between each sprint; sprint times, heart rate (HR), rating of perceived exertion (RPE), hunger and fullness, blood glucose and lactate levels, mean power output (MP) and fatigue index (FI) were measured. **RESULTS:** The total effort time(seconds) was not significant between SOY (32.77 ± 1.23) and CON (33.28 ± 1.71), p = 0.179. FI in SOY (31.64 ± 5.20) was significantly lower than CON (37.30 ± 5.70), p = 0.023. MP (Watts) (Soy: 499.27 ± 62.72; Con: 486.39 ± 86.13, p = 0.410) and relative power output (Watts)(Soy: 9.34 ± 1.02; Con: 9.55 ± 1.51, p = 0.461) were not significant. No significance were found between trials for the peak blood lactate (PBL) (mmol.L⁻¹) (Soy: 9.75 ± 1.61; Con: 10.24 ± 1.90, p = 0.488) and peak blood glucose (PBG) (mmol.L⁻¹) (Soy: 23.94 ± 3.90; Con: 25.09 ± 4.61, p = 0.497) levels. PBL (r = - 0.654) and PBG (r = - 0.662) concentrations were inversely associated with MP in the SOY trial. No significance were found in mean HR (SOY: 111 ± 40.43; CON: 112 ± 38.69, p = 0.448) and median RPE (p = 0.391) between both trials. There were no significant differences in the ratings for hunger (p = 0.844) and fullness (p = 0.853) between both trials. **CONCLUSIONS:** The soy milk intervention in RAST significantly lowered the FI, but had no significance in any of the variables investigated. The significant decrease in FI and earlier peak lactate levels post-exercise may indicate the possibility of soy milk reducing fatigue. Future studies are required to examine the ergogenic effects of soy milk.

- 2025** Board #181 May 30 2:00 PM - 3:30 PM
Effects Of Menstrual Cycle On Branched-chain And Aromatic Amino Acids During Endurance Exercise In Female Athletes
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Cyclic fluctuations in ovarian hormone (estrogen and progesterone) levels that play an important role in reproductive function are a unique characteristic of adult women. However, these changes in ovarian hormone levels affect physical and mental condition. Previous studies have reported that levels of branched-chain amino acids (BCAA) and aromatic amino acids (AAA) in the blood are related to fatigue. **PURPOSE:** This study investigated the effects of the menstrual cycle on the concentration of BCAA and AAA during endurance exercise and the recovery period in female athletes. **METHODS:** Seven eumenorrheic female athletes (lacrosse players; age, 21.7 ± 0.5 years; height, 157.4 ± 5.1 cm; weight, 52.7 ± 4.6 kg), who usually exercised 4 h/day, 5 days/week, were recruited. Subjects performed endurance exercise on a cycle ergometer for 60 min at 65% of their $\dot{V}O_{2\text{peak}}$, measured in a preliminary trial, during the follicular phase (FP) and luteal phase (LP) of their menstrual cycles. After exercising, subjects rested in a chair for 60 min and their post-exercise recovery was observed. Blood samples were taken: pre-exercise (0 min); 30 min after the start of exercise (30 min); 45 min after the start of exercise (45 min); immediately post-exercise (60 min); 30 min post-exercise (90 min); and 60 min post-exercise (120 min). Levels of estradiol, progesterone, BCAA (valine, leucine, isoleucine), and AAA (tyrosine, phenylalanine) in the blood were assessed. The Fischer ratio(BCAA/AAA) was calculated using the following formula: BCAA/AAA = (valine + leucine + isoleucine)/(tyrosine + phenylalanine). **RESULTS:** Estradiol and progesterone levels were significantly lower in the FP than in the LP (estradiol: 40.2 ± 15.4 pg/mL vs. 170.8 ± 75.2 pg/mL, $p < 0.01$; progesterone: 0.5 ± 0.1 ng/mL vs. 11.3 ± 6.5 ng/mL, $p < 0.05$). The Fischer ratio significantly decreased from exercise initiation to exercise conclusion during both phases (FP: 3.6 ± 0.4 (0 min), 3.2 ± 0.3 (60 min), $p < 0.05$; LP: 3.6 ± 0.4 (0 min), 3.3 ± 0.6 (60 min), $p = 0.05$); however, no significant differences were observed between the FP and LP. **CONCLUSION:** No differences in the levels of BCAA and AAA in the blood were observed between the FP and LP of the menstrual cycle pre-, during, or post-exercise.

D-63 Free Communication/Poster - Cognition and Emotion

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

- 2026** Board #182 May 30 2:00 PM - 3:30 PM
Semantic Memory fMRI in Healthy Older Adults After Acute Exercise and Rest
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An extant literature suggests that regular participation in long-term exercise enhances cognitive function. However, less is known about the beneficial effects of acute exercise on semantic memory.

PURPOSE: This study investigated brain activation during a semantic memory task after a single session of exercise in healthy older adults (ages 55-85) using functional magnetic resonance imaging (fMRI). **METHODS:** We used a within-subjects counterbalanced design where 26 participants (ages 55-85) underwent two experimental visits on separate days. During each visit, participants engaged in 30 minutes of rest or stationary cycling exercise immediately prior to performing recognition of Famous names and Non-Famous names during fMRI scanning. **RESULTS:** There were no significant differences in the Famous Name Task (FNT) response time (RT) or accuracy after exercise and rest. Acute exercise was associated with significantly greater semantic memory activation (Famous > Non-Famous) in bilateral middle temporal gyrus, right cerebellum, and left fusiform gyrus. A post-hoc analysis showed significantly greater activation in the bilateral hippocampus after exercise compared to rest. **CONCLUSIONS:** Greater brain activation following a single session of exercise suggests that exercise may increase neural processes underlying semantic memory activation in healthy older adults. These effects were

localized to the known semantic memory network, and thus do not appear to reflect a general or widespread increase in brain blood flow. Coupled with our prior exercise training effects on semantic memory-related activation, these data suggest the acute increase in neural activation after exercise may provide a stimulus for adaptation over repeated exercise sessions.

- 2027** Board #183 May 30 2:00 PM - 3:30 PM
The Effects Of Continuous and Interval Exercise on Cognitive Performance in Young Adults
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 (No relevant relationships reported)

Exercise has been shown to increase cognitive performance. However, there are few studies that have compared exercise types to determine different effects. **PURPOSE:** The purpose of the present investigation was to compare changes in cognitive function after two different forms of work matched exercise. **METHODS:** The participants were 22 healthy college age males. Participants were randomly assigned an order of treatment consisting of work matched continuous (CONT) and interval exercise (INT) protocols. The continuous exercise treatment consisted of 20:24 min of 50% $\dot{V}O_{2\text{max}}$ on the cycle ergometer. The interval exercise treatment consisted of 6 cycles of 2:00 min 40% $\dot{V}O_{2\text{max}}$ and 1:00 min 90% $\dot{V}O_{2\text{max}}$ on the cycle ergometer for a total of 18 minutes. Pre and post exercise blood samples were collected to quantify brain-derived neurotrophic factor (BDNF) and participants completed a battery of assessments on the CogState software platform. The cognitive function battery exam included tests of reaction skills, memory skills, psychomotor skills, visual attention, working memory, and spatial working memory. Additionally, blood pressure was continuously measured during the 2 hours post exercise using a non-invasive finger cuff system. **RESULTS:** Repeated measures ANOVA analysis did not reveal any difference in serum BDNF levels by time ($F = 0.237$, $p = 0.629$; pre: 388.9 ± 196.4 , post: 464.3 ± 222.4) or treatment by time ($F = 0.896$, $p = 0.349$). Non-parametric analysis of cognitive data revealed significant ($p < 0.02$) changes in attention (identification speed test) in both CONT and INT (baseline: 460.6 ± 69.3 sec, post CONT: 513.8 ± 99.2 sec, post INT: 504.5 ± 85.6 sec). For the executive function (Groton's maze) only the INT resulted in a significant increase ($p < 0.01$) from baseline (baseline: 48.2 ± 11.7 , post INT: 38.4 ± 13.8). There were significant correlations between systolic blood pressure during recovery for both INT and CONT and improvements in executive function (CONT $r = 0.567$, $p < 0.01$; INT $r = 0.570$, $p < 0.01$). **CONCLUSION:** It appears that both CONT and INT exercise promote some increases in cognitive function related to elevated recovery systolic blood pressure and independent of serum BDNF. Moreover, INT exercise may increase executive function more than aerobic exercise, though more investigation into this effect is warranted.

- 2028** Board #184 May 30 2:00 PM - 3:30 PM
The Effects Of A 30-min Moderate Aerobic Exercise On Autonomic And Inhibitory Control - ERP Study
 Yiu Man Lee, Stanley Sai-chuen HUI, FACSM. *Chinese University of Hong Kong, Hong Kong, Hong Kong.* (Sponsor: Prof. Stanley Sai-chuen HUI, FACSM)
 (No relevant relationships reported)

PURPOSE: The current study aimed at exploring whether inhibitory control would be changed after a 20-min bout of moderate cycling exercise plus 5-min warm-up and 5-min cool-down. The study hypothesized that subjects who demonstrated greater high frequency heart rate variability (HF-HRV) reactivity (i.e. larger HF-HRV decrease) under a mental stress evoked by a Stroop color-word test, would perform better on the Stroop tasks after acute aerobic exercise. **METHODS:** 40 young male adults (age = 21.3 ± 2.1 yrs. old) were randomly assigned to either an exercise intervention or no exercise (control) condition. Participants of intervention were asked to engage in a 20 min cycling exercise at 60% $\dot{V}O_{2\text{max}}$, while computerized Stroop color-word test was conducted before and after the cycling to examine the acute effects of aerobic exercise on inhibitory control. HRV was measured during the Stroop tasks by using the Electrocardiogram (ECG), which was recorded via two bipolar electrodes that were placed on the left and right chest of the participants. The electroencephalogram (EEG) signal was recorded continuously from a 32 scalp electrodes arranged according to the International 10-20 system. The EEG data was re-referenced offline to average of mastoid electrodes, and bandpass filtered at 0.1 to 20 Hz. Target-locked ERP analysis was restricted to the frontocentral midline electrodes (Fz, Cz, Pz) as Stroop interference effect were known to be maximum at the midline.

RESULTS: Two-way repeated measures MANOVA showed significant Intervention X Time interaction on Stroop interference at Pz location ($p < 0.03$). Meanwhile, significant Intervention X Time interaction on HF-HRV differences was revealed between the exercise intervention and control groups on the Stroop tasks ($p < 0.01$). Exercise group performed significantly lower score on Stroop interference and lower HRV reactivity at post-test than the control group ($p < 0.05$). Lower scores reflecting more adaptive response and enhanced cognitive performance.

CONCLUSIONS: A 30-min acute moderate aerobic exercise could elicit inhibitory control for young adults. The studies manifested the potential physiological mechanism between central nervous system and autonomous nervous system which were reflected by HRV index.

2029 Board #185 May 30 2:00 PM - 3:30 PM

Aerobic and Muscular Fitness Associations with Adolescent Cognitive Control

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(No relevant relationships reported)

Purpose: Physical activity supports greater cardiorespiratory fitness (CRF); a correlate of cognitive control. The relation of muscular fitness (MF) and cognitive control are less clear. The present study investigated the differential relationship of CRF and MF with cognitive control in older adolescents; a population subjected to social and academic stressors.

Methods: Students (15-17 years, N = 289, 122 females) from ten secondary schools completed tests of inhibition, working memory (WM), CRF (PACER), and MF (standing long jump, push-ups).

Results: Stepwise regression analyses accounted for demographic factors in step 1, and either CRF or MF in step 2. CRF predicted flanker response accuracy (RA) and reaction time (RT) across congruency conditions (β 's ≥ 0.14 , p 's < 0.05). In the 1-back WM task, CRF predicted greater RA, greater d' , and shorter non-target RT (β 's ≥ 0.15 , p 's < 0.05). In the 2-back WM task, CRF predicted greater non-target RA and d' (β 's ≥ 0.14 , p 's ≤ 0.05). Comparatively, MF only predicted 2-back target accuracy ($\beta = 0.14$, $p = 0.02$). Follow-up 3-step regressions assessed significant outcomes from the 2-step models to account for the contrasted fitness variable in step 2, and the fitness variable of interest in step 3. CRF remained a significant predictor for most cognitive outcomes (β 's ≥ 0.17 , p 's ≤ 0.05). However, with MF entered in step 2, CRF marginally predicted incongruent flanker RA and 1-back non-target accuracy (β 's ≤ 0.16 , p 's ≥ 0.06), and no longer predicted greater 2-back d' ($\beta = 0.11$, $p = 0.20$). Comparatively, MF marginally predicted 2-back target accuracy with CRF accounted for ($\beta = 0.12$, $p = 0.09$).

Conclusion: MF was unrelated to cognitive performance, especially with CRF included in the model. CRF's predictability of WM decreased with MF accounted for, particularly during conditions requiring greater WM demands. CRF was generally related to faster processing speed and greater RA during a task modulating inhibitory demands, suggesting that increased CRF may improve cognition via modulation of older adolescents' inhibitory control. Such findings highlight physical activity's value in aiding cognition underlying older adolescents' academic performance. Project funded by the National Health and Medical Research Council (APP1120518).

2030 Board #186 May 30 2:00 PM - 3:30 PM

Cortical Activation during Walking While Smartphone Texting: a Dual Task Based fNIRS Study

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BACKGROUND: Previous studies demonstrated that gait performance was decreased when walking while performing a cognitive task such as texting on a smartphone, which reflects a cognitive-motor dual-task interference. The neural bases of the interference are not well studied. **Purpose:** To investigate the cortical activation during a dual task of walking while smartphone texting in young healthy adults using the functional near-infrared spectroscopy (fNIRS). **Methods:** In a crossover study design, 39 right-handed college students (21.3 \pm 2.5 years, 46.1% females) randomly undertook the following three task conditions separated by a minimum of 48 hours: smartphone texting only (T task), walking only (W task), and dual task of smartphone texting while walking (TW task). Cortical oxygenation during the three tasks was monitored using a 38-channel fNIRS (NIRx Medical Technologies LLC, USA). Walking was conducted on a treadmill with a speed of 2.0 km/hour. Texting task was performed with a typing APP on a smartphone. **Results:** There was no significant difference in texting speed between T task and TW task (71.7 \pm 10.4 vs. 71.0 \pm 12.9 chars/min, $P > 0.05$). Texting enhanced hemodynamic response in frontopolar area (e.g., Ch1_{T task vs. W task} 1.10 \pm 1.93 vs. -0.12 \pm 0.14 a.u., $P < 0.01$; Ch1_{TW task vs. W task} 0.89 \pm 1.05 vs. -0.12 \pm 0.14 a.u., $P < 0.01$) dorsolateral prefrontal cortex (e.g., Ch6_{T task vs. W task} 0.24 \pm 0.43 vs. -0.15 \pm 0.42 a.u., $P < 0.01$; Ch6_{TW task vs. W task} 0.21 \pm 0.33 vs. -0.15 \pm 0.42 a.u., $P < 0.01$) and Broca's area (e.g., Ch35_{TW task vs. W task} 0.99 \pm 0.81 vs. 0.47 \pm 0.75 a.u., $P < 0.01$). In addition, W task evoked an increased activation in temporopolar area (e.g., Ch8_{T task vs. W task} 0.04 \pm 0.12 vs. 0.75 \pm 1.30 a.u., $P < 0.01$) and superior temporal gyrus (e.g., Ch15_{T task vs. W task} 0.22 \pm 0.64 vs. 0.76 \pm 0.84 a.u., $P < 0.01$) than T task. There were no significant differences in those regions between T task and TW task. **CONCLUSIONS:** The

findings indicated that walking on a low speed requires less cognitive resources from the prefrontal cortex, while the temporal lobe is involved. When walking while texting on a smartphone, the brain areas (temporopolar area and superior temporal gyrus) involved in gait were activated, and areas in prefrontal cortex were also activated. Thus, more cognitive resources were allocated to smartphone texting during the dual task.

2031 Board #187 May 30 2:00 PM - 3:30 PM

Can Repeated Bouts Of Exercise Improve Equally Post-exercise Inhibitory Control As Single Bout Of Exercise?

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PURPOSE: We previously demonstrated that post-exercise improvements of inhibitory control (IC) are associated with increase in exercise volume (Tsukamoto et al. Med Sci Sports Exerc. 2017). Previous studies reported that repeated bouts of moderate-intensity exercise (Repeated), which is performed with a short rest interval during exercise program, may be a useful strategy in improving metabolic function, potentially by enhancing lipid metabolism compared with volume-matched single bout of moderate-intensity exercise (Single) (Goto et al. J Appl Physiol. 2007). However, it remains unknown whether Repeated would be effective in improving post-exercise IC. In this study, we compared the effect of Repeated and Single on post-exercise IC. **METHODS:** Fifteen healthy men (age: 20.6 \pm 0.4 years) performed Repeated and Single in randomized order. The Repeated was consisted of twice moderate-intensity cycling exercise (60% $\dot{V}O_{2\text{ peak}}$) for 20 min which was separated by a 20-min sitting rest, while the Single was performed for 40 min without rest. To evaluate IC, the Stroop task was administered before exercise, immediately after exercise, and every 10 min during the 30-min post-exercise recovery period. At the same time points, blood was collected for glucose and lactate measurement, and psychological arousal level was assessed by the felt arousal scale. **RESULTS:** The exercise-induced increase in mean arterial pressure was significantly lower in Repeated than in Single ($P < 0.05$), but not heart rate and ratings of perceived exertion. Psychological arousal level in post-exercise recovery did not differ significantly between the two conditions. Similarly, there were no significant differences for blood glucose and lactate immediately after exercise and post-exercise recovery between conditions. IC was significantly improved immediately after both Repeated and Single ($P < 0.05$), but it did not differ significantly between two conditions. **CONCLUSION:** The present findings suggest that Repeated can similarly elicit IC improvements as Single.

2032 Board #188 May 30 2:00 PM - 3:30 PM

The Differential Relationships Between Physical Activity and Adiposity with Cognitive Function in Preadolescent Children.

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PURPOSE: To identify the effects of adiposity and a physical activity (PA) intervention on cognitive and neuroelectric indices of inhibitory control in preadolescent children. **METHODS:** Children were randomly assigned to either a 9-month afterschool physical activity (PA) or a wait-list control (CON) group. Children completed a task that manipulated inhibitory control at pre- and post-test while measures of task performance and the P3-event related potential (ERP) were assessed. Children were further grouped according to weight category. 76 children with obesity (39 PA; 37 CON) completed testing. A sample of normal weight children (NW) (n=76) were matched to the sample of children with obesity based on treatment allocation and demographic variables of age, sex, IQ, SES, and fat-free $\dot{V}O_{2\text{ max}}$. Changes in adiposity measures included whole body percent fat (%Fat), subcutaneous abdominal adipose tissue (SAAT), and visceral adipose tissue (VAT). The influence of physical activity and adiposity on task performance and brain function was examined. **RESULTS:** Children in the PA group decreased %Fat from pre- to post-test ($p=.011$); an effect not observed in the CON group. Children in the CON group gained SAAT and VAT from pre- to post-test ($p \leq 0.001$), whereas children in the PA group did not. The PA group showed larger P3 amplitude from pre- to post-test ($p=.026$); an effect not seen in the CON group. P3 amplitude did not differ between groups at pre-test for children with obesity; however, the PA group demonstrated larger P3 amplitude compared to the CON group at post-test ($p=.006$). Children with obesity in the CON group had smaller P3 amplitude at post-test compared to pre-test ($p=.003$), an effect not seen in NW children. Results suggest that physically inactive children with obesity

have increased adiposity and smaller P3 amplitude over 9 months. Furthermore, results suggest that a PA intervention may be particularly beneficial for children with obesity, as they showed increased P3 amplitude from pre- to post-test. **CONCLUSION:** PA is beneficial for brain function in pre-adolescent children, especially in those with obesity. Given that childhood obesity is a public health concern with an array of health complications, these results have important implications for the physical and cognitive health of children.

2033 Board #189 May 30 2:00 PM - 3:30 PM
Association of School Day Segmented Physical Activity with Children's Physical and Cognitive Health

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Purpose: Around 32% of children are overweight or obese and do not meet the 60-minute moderate-to-vigorous physical activity recommendation (MVPA; SHAPE America, 2016). Given that physical activity is highly variable between children across the school day and during specific segments (CDC, 2013), it is unclear which segmented MVPA during school contributes the most physical and cognitive health benefits. This study aimed (1) to investigate associations between time spent in MVPA during recess, lunch, physical education (PE), and physical fitness components (BMI, cardiorespiratory and muscular fitness), as well as cognitive health, respectively; and (2) to test the indirect effect of segmented MVPA on cognitive health through physical fitness among 8-9 years old children.

Methods: Participants were 340 8-9 years old children ($M_{age} = 8.40$, $SD = 0.49$) recruited in the southwest region of the U.S. Time spent in MVPA during recess (RE_MVPA), lunch (LU_MVPA) and PE (PE_MVPA) segments were measured by accelerometers across five school days. The FITNESSGRAM® test battery was used to assess physical fitness components including PACER, curl-up, push up, and BMI. Children's cognitive health was measured by also the 6-item PedsQL™ Cognitive Functioning Scale (Varni et al., 2011).

Results: The time spent in MVPA during recess was positively associated with physical fitness (cardiorespiratory and muscular fitness; $r = .27$, $r = .40$, $p < .01$) and had low, but positive correlation with cognitive function ($p < .05$). Both cardiorespiratory ($r = .26$, $p < .01$) and muscular fitness ($r = .12$, $p < .05$) were significantly related to cognitive health. The structural equation modeling analyses suggested a significant indirect effect of time spent in MVPA during recess and PE on children's cognitive function through physical fitness with sound goodness-of-fit indices: $\chi^2/df = 109.46/58$, CFI = .93, RMSEA = .051; (90% CI [0.04, 0.07]).

Conclusion: The results suggest that school segmented MVPA in PE and recess provide children with opportunities to maintain appropriate levels of physical fitness and cognitive health. This study fills the research gap by identifying unstructured physical activity periods such as recess that can provide greater room to implement physical activity and health promotion strategies in school-age children.

2034 Board #190 May 30 2:00 PM - 3:30 PM
Relationship Between Fitness and Active-Sedentary Behavior with Cognitive and Emotional Recognition in Elderly: Core Study

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The decline in cognitive function and emotional regulation in aging have broad negative implications for independence, social competence and behavior that affect health. These impaired conditions can be exacerbated by increased sedentary behavior (SB) and lower levels of physical activity (PA) and fitness. However, it is not clear which of these have a higher relationship with cognitive function and emotional regulation in elderly.

PURPOSE: To investigate the relationship between cognitive function and emotional regulation with physical fitness, PA and SB in the elderly.

METHODS: This preliminary analysis of the Cardiovascular, Cognitive and Exercise Study in the Elderly (CORE) included 60 volunteers (64±3.47 years; female n: 39), who performed a cognitive task (Wisconsin cards sorting test) and an emotional facial recognition task, physical fitness test (senior fitness test and handgrip strength), PA level (Minnesota Leisure-time Physical Activity Questionnaire) and sedentary behavior questionnaire (Longitudinal Aging Study Amsterdam). Bivariate correlations using Spearman's rho (p) were used with statistical significance set at 5%.

RESULTS: Significant relationship between cognitive performance with, leg strength (total correct response, $p=0.28$; total errors, $p=0.28$; and non-perseverative errors, $p=0.28$), 6-min walking test (total correct response, $p=0.31$; total errors, $p=0.31$;

and non-perseverative errors, $p=0.30$) and SB (perseverative errors $p=0.27$). Also, the reaction time (RT) during the emotional facial recognition had a significant relationship with upper body strength (RT positive $p=0.26$; RT negative $p=0.33$) and PA level (MET, hr/w) (RT negative $p=0.31$). Also, a significant relationship between worse cognitive performance with handgrip strength (non-perseverative errors, $p=0.26$) and SB (perseverative errors, $p=0.27$).

CONCLUSIONS: These preliminary results suggest that physical fitness and SB are associated with cognitive performance. Also, PA level and upper body strength are associated with emotional performance. These findings suggest the importance between the balance of maintaining an active behavior and the inclusion of aerobic and resistance exercises to improve cognition and emotional regulation in the elderly.

2035 Board #191 May 30 2:00 PM - 3:30 PM
Cardiovascular Risk Moderates Aerobic Training Efficacy on Executive Function in Older Adults

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(No relevant relationships reported)

PURPOSE: To examine whether the Framingham Cardiovascular Risk Profile Score (FCRP) moderates the effect of a 6-month progressive aerobic training program (AT) on executive function in older adults with mild subcortical ischemic vascular cognitive impairment.

METHODS: This is a secondary analysis of a proof-of-concept randomized controlled trial in 71 older adults, who were randomized to either a 6-month, thrice-weekly, progressive AT program (AT), or usual care plus an education program (CON). At baseline and trial completion, three executive processes were measured: 1) response inhibition by Stroop Colour Word Test; 2) working memory by digits backward test, and 3) set shifting by the Trail Making Test (B-A). Baseline cardiovascular risk was calculated using the FCRP, and participants were classified as either low risk (<20% FCRP score; LCVR) or high risk (>20% FCRP score; HCVR). A complete case analysis (n=57) was conducted using an analysis of covariance (ANCOVA) to evaluate between-group differences in the three executive processes. Age, baseline Montreal Cognitive Assessment score, education, and baseline score for the outcome variable were entered as covariates in all models.

RESULTS: A significant interaction was found between FCRP and group (AT or CON) for the digit span backward ($F(1,49)=4.67$, $p=0.03$) and the Trail Making Test ($F(1,50)=4.09$, $p=0.04$). There was no significant interaction for the Stroop Colour Word Test ($F(1,48)=.802$, $p=.38$). On the digit span backward test, AT improved performance compared to CON (3.74±.33 vs. 2.75±.46) in those with LCVR, while in those with HCVR, AT did not improve performance compared to CON (2.97±.45 vs. 3.76±.41). Similarly, for the Trail Making Test (B-A), AT improved performance compared to CON (52.66±13.27 vs. 80.12±17.82) in those with LCVR, while AT was not beneficial compared to CON in those with HCVR (98.80±18.06 vs. 59.92±17.09).

CONCLUSION: We found that cardiovascular risk significantly moderates the efficacy of aerobic exercise on working memory and set shifting in older adults with vascular cognitive impairment. Our findings highlight the importance of intervening early in the disease course of vascular cognitive impairment, when cardiovascular risk may be lower, to reap maximum benefits of aerobic exercise.

2036 Board #192 May 30 2:00 PM - 3:30 PM
A Single Bout of Exercise Improves Accuracy in Video Gaming: a Pilot Study

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(No relevant relationships reported)

There are 2.3 billion of video gamers worldwide and this number is expected to grow to more than 2.7 billion by 2021. Research has demonstrated negative associations between the number of hours spent in front of a screen and physical inactivity. Video gamers are thus at a great risk of experiencing long-term health issues associated to excessive sedentarism. Cardiovascular exercise has been proven to be an effective intervention in reducing the risk of cardiometabolic clinical conditions as well as enhancing brain health and function. However, whether exercise has positive effects on video game performance is not known.

PURPOSE: To investigate the effects of a single bout of cardiovascular exercise on the performance of "League of Legends" (LoL), a video game played daily by more than 30 million players. **METHODS:** 14 healthy young (18-28 yo) LoL gamers played an individual LoL task of 20 min preceded by either 15 min of a high-intensity interval exercise or rest. The two conditions were administered on two separate days in a counterbalanced fashion. Video game performance was assessed as the number of targets destroyed, as well as accuracy, defined as the ability to destroy a target with only one attack. Attacks that required more than one attempt to destroy a target

were counted as accuracy errors. **RESULTS:** Exercise improved the capacity of participants to successfully destroy targets, but differences between exercise (119.43 [4.23]) and rest (111.50 [3.98]) did not reach statistical significance (paired t-test; $t=1.81$; $p=0.094$). Exercise enhanced accuracy, with fewer errors after exercise than after rest (paired t-test; $t=-2.38$; $p=0.033$). Self-reported sitting time was negatively associated with total score after the rest condition ($r=-0.55$; $p=0.040$). Neither other variable (cardio-respiratory fitness, BMI, cognitive level) was associated with game performance. **CONCLUSION:** Exercise performed before playing LoL improves video game performance increasing accuracy. The fact that players with less sitting time showed better performance reinforces the importance of reducing sedentary behaviors in this group. The implementation of exercise routines in video gamers may improve their general health and their gaming performance. Supported by FRQS Junior I Salary Award (MR) and by the McGill Faculty of Medicine (OL).

2037 Board #193 May 30 2:00 PM - 3:30 PM
ASsocation Between Cognitive Funtion And Handgrip Strength In Physical Education College Students

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(No relevant relationships reported)

PURPOSE: To analyze the association between cognitive function and handgrip strength in a sample of university students of Physical Culture in Bogotá, Colombia. **METHODS:** the cross-sectional study included a total sample of 104 voluntary university students of Physical Culture, 18 - 25 years old, from Bogotá, Colombia. The handgrip strength was determined by the digital dynamometer and the cognitive function was evaluated individually by trained personnel through the Paced Auditory Serial Addition Test (PASAT), to evaluate the speed and flexibility of the processing of auditory information, the sustained and divided attention, as well as the calculation capacity, a standardized audio was used in the speed of the stimulus, presenting the individual digits every 3 seconds (PASAT-3), adding each new digit to the previous one immediately. The shorter stimulus intervals were used in 2 seconds (PASAT-2), increasing the difficulty. The association between cognitive function and handgrip strength adjusted for weight, was performed using the linear logistic regression model in the statistical package SPSS v25. **RESULTS:** The sample was middle-aged (Age=19.8±2.4yrs; N=87 men). The logistic regression model showed a strong association between hand grip strength adjusted to weight and cognitive function, through the stimulation of PASAT-2 ($p=0.026$, Beta = 0.219), compared with PASAT-3 ($p=0.062$; Beta = 0.184) where no significant difference was found, however a low tendency is identified. **CONCLUSION:** the results of this study show that hand grip strength is associated with a better cognitive response in speed and flexibility of processing in college students of Physical Culture of Bogotá, Colombia, for which it is suggested to promote the regular practice of exercise physical that stimulates muscle strength, in order to improve cognitive performance in college students.

2038 Board #194 May 30 2:00 PM - 3:30 PM
Exercise Intensity Influences Prefrontal Cortex Oxygenation During Cognitive Testing

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Various types of exercise therapies, including high and low intensity aerobic exercise, along with mind-body exercise (e.g., yoga) have been implemented into treatment for those suffering from psychological disorders and traumatic brain injury. The prefrontal cortex (PFC), which houses key cognitive constructs is responsive to exercise, and is commonly measured using functional near infrared spectroscopy (fNIRS). Evidence suggests that exercise mediates neural adaptation through increased blood flow and neurogenesis, which enhances neural activation leading to improved cognitive performance. However, the type and intensity of exercise that has the most robust impact on brain blood flow is currently unknown. **PURPOSE:** Therefore, the primary aim of the study is to compare PFC activation during cognitive tasks performed after low-intensity, high intensity, and yoga exercises. We also aim to determine if markers of cardiovascular and metabolic stress influence brain activity after each exercise bout. **METHODS:** Eight subjects (4 male, 4 female), aged 35 ± 5 years completed a control, high intensity, low intensity, and yoga exercise trial followed by administration of a cognitive task (NIH Toolbox Fluid Cognition). Left and right PFC oxygenation were measured during the post-exercise cognitive assessment using fNIRS technology. **RESULTS:** Oxygenation during the cognitive task was higher in the left PFC region after low intensity exercise compared to all other trials (control, high intensity, yoga). Regression model analysis showed that a 10% increase in %HRmax up to 70% intensity predicts an increase in left PFC oxygenation by 2.11 umol. No relationship

was detected between PFC oxygenation and cognitive performance or the lactate response among participants in the current study, however a relationship between control levels of brain derived neurotrophic factor (BDNF) and processing speed was detected. **CONCLUSIONS:** Acute exercise below 70% aerobic intensity increased brain blood flow during a post-exercise cognitive task. Therefore, it may be beneficial for those who engage in any cognitive related activity to perform a brief bout of low intensity exercise prior to the task. This may include people who participate in academic-based testing, cognitive behavioral therapy, or motor training.

2039 Board #195 May 30 2:00 PM - 3:30 PM
Exploring The Relationships Between Personality And High-intensity Exercise-affect In Men And Women

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(No relevant relationships reported)

In general, men are more likely to meet physical activity guidelines in comparison to women, and tend to report exercising at higher-intensities. However, less is understood in regards to how men and women differ in feeling states (e.g., core affect) during a high-intensity exercise bout. **PURPOSE:** Determine whether sex differences exist in personality traits and high-intensity exercise-affect. **METHODS:** Male (M; n=63) and female (F; n=101) undergraduates ($n=164$, 20±2yrs, 24±4 body mass index (BMI), 62% female, 82% regular exercisers) completed several personality surveys along with a 15-minute high-intensity circuit (HIC). Core affect (via Feeling Scale & Felt Arousal Scale) was assessed prior to, every 3-minutes during, and 20-minutes post (P20) condition. **RESULTS:** Multivariate ANOVAs revealed significant differences ($P<0.05$) in the personality traits extraversion ($F=46.2$, $M=42.2$, $d=.894$), neuroticism ($F=47.4$, $M=45.1$, $d=.644$), openness ($F=14.5$, $M=15.6$, $d=-.496$), intensity-preference ($F=26.4$, $M=29.0$, $d=-.535$) and intensity-tolerance ($F=25.2$, $M=28.4$, $d=-.651$). No sex differences ($P>0.05$) were observed for exercise-affect prior to, during, and following the HIC. **CONCLUSIONS:** Although sex differences exist in various personality traits, these differences did not influence how one felt prior to, during, and following a HIC. These findings support the notion that men and women respond similarly to exercise stimuli. More research is needed to understand why women exercise less and at lower-intensities in comparison to men.

2040 Board #196 May 30 2:00 PM - 3:30 PM
Acute After-School Screen Time in Children Decreases Impulse Control: A Randomized Crossover Trial

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(No relevant relationships reported)

PURPOSE: This study examined the effect of three hours of after school active play vs. sedentary screen time on executive function in children. **METHODS:** This study used a crossover design with treatment conditions that were randomized and counter-balanced. There were two experimental conditions: three hours of active play compared to three hours of sedentary screen time. Participants included 32 boys and girls age 8-9 yrs. Physical activity patterns were measured using an actigraph accelerometer. Executive control was measured using the Stroop color and word test. **RESULTS:** The mean age and BMI were 8.7 ± 0.4 years and 16.9 ± 2.2. On the active day, children spent 95 ± 28 minutes in MVPA after school compared to 3 ± 3 minutes on the sedentary day ($F=252.1$, $P<0.0001$). There was no difference between days in the Stroop Task performance for word reading or color naming. However, there was a significant difference between conditions for the incongruent task, with children performing better on the active day ($F=6.79$, $P=0.0150$). **CONCLUSIONS:** The results of this study demonstrate that active play after school improves executive function in children by increasing their ability to inhibit cognitive interference.

2041 Board #197 May 30 2:00 PM - 3:30 PM
Acute Exercise Alters Functional Connectivity During Cognitive Task

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(No relevant relationships reported)

PURPOSE: There is a growing body of evidence to show that acute aerobic exercise improves cognitive performance. Nevertheless, it remains largely unknown how acute

exercise improves cognitive performance. The purpose of this study was to test if alteration in functional connectivity is involved in improving cognitive performance induced by acute exercise.

METHODS: Participants were 10 healthy right-handed young men (age: 21.6 ± 1.4 yr., peak oxygen uptake = 46.5 ± 8.7 ml/kg/min). Experiments were conducted in a randomized crossover design. In the Exercise condition, subjects cycled at 40% peak oxygen uptake for 30 minutes. In the Control condition, subjects rested for 30 minutes without exercise. In both conditions, participants performed cognitive task (Go/No-Go task) before and after exercise (rest). We first analyzed regions specifically activated by exercise as region of interest. Then, we identified regions where functional connectivity was altered before and after exercise. We also identified regions where amount of alteration in functional connectivity was correlated with that of reaction time (RT).

RESULTS: RT was reduced in the Exercise condition (Pre: 420 ± 77 ms, Post: 388 ± 65 ms, $p = 0.02$), while it did not change in the Control condition (Pre: 416 ± 79 ms, Post: 417 ± 78 ms, $p = 0.82$). We observed significant increases in activation in the opercular and triangular parts of the left inferior frontal gyrus (IFG) and anterior cingulate cortex ($p < 0.01$, uncorrected). We observed an increase in functional connectivity between the opercular part of the left IFG and the left putamen (Pre: 0.02 ± 0.11 , Post: 0.12 ± 0.13 , $p = 0.08$). Alteration in the functional connectivity between these regions was negatively correlated with the alteration in RT ($r = -0.44$, $p = 0.06$).

CONCLUSIONS: Alteration in functional connectivity may be associated with improvement of cognitive performance after acute exercise.

2042 Board #198 May 30 2:00 PM - 3:30 PM
The Effects Of Exercise Intensity On Auditory Processing Speed And Flexibility: A Randomized Crossover Study.

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine how exercise, at a moderate and vigorous intensity, alters auditory processing speed and flexibility, and calculation ability. **METHODS:** One hundred and thirty-six men and women between the ages of 18-45 were recruited for this randomized crossover study. Participants were randomly assigned to each of the following exercise conditions: moderate (35% VO₂ max), vigorous (70% VO₂ max), and sedentary (no exercise). Each condition lasted 40 minutes and was separated by 7 days. After the exercise condition, a battery of cognitive tests were administered. The Paced Auditory Serial Addition Test (PASAT) was one of these tests and was used to measure the relationship between exercise intensity and auditory processing speed and flexibility. **RESULTS:** Eighty-one men (age= 23.2 , BMI= 23.9 ± 3.2) and fifty-five women (age= 20.9 , BMI= 22.4 ± 2.8) completed the study. There was no main effect of condition for the number of problems answered correctly ($F = 1.24$, $P = 0.2900$), the number of problems attempted ($F = 1.48$, $P = 0.2291$) and the percent of problems correctly answered ($F = 1.69$, $P = 0.1865$). There was a main effect for gender for the number of problems answered correctly ($F = 21.7$, $P < 0.0001$), the number of problems attempted ($F = 19.5$, $P < 0.0001$) and the percent of problems answered correctly ($F = 7.06$, $P = 0.0084$). However, there was no significant gender by condition interaction for any variable of interest ($P > 0.05$). **CONCLUSIONS:** The results of this study show that there is no significant relationship between exercise and auditory processing speed and flexibility, and calculation ability post exercise. These results suggest that exercise at a moderate or vigorous intensity does not hinder a person's ability to perform complex cognitive processing tasks.

2043 Board #199 May 30 2:00 PM - 3:30 PM
The Effects Of Acute Aerobic Exercise On BDNF Levels And Cognition In Postmenopausal Women

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine how menopausal status affects choice reaction time and peripheral BDNF levels after aerobic exercise. It was hypothesized that exercise would affect peripheral BDNF levels and choice reaction time similarly among pre and postmenopausal women. **METHODS:** The subjects consisted of 14 active females (7 premenopausal and 7 postmenopausal). Subjects went through two different trials: an exercise trial and a controlled reading trials. The exercise trial consisted of running on a treadmill at 75% of VO₂max for 30 minutes. The control trial consisted of a reading session. A computerized Stroop test was given to assess choice reaction time, and blood samples were obtained before, immediately after, and 30 minutes after the exercise and control trials. **RESULTS:** Exercise did not lead to a significant change in BDNF in either group. However, there was a statistical interaction ($P = 0.041$) between pre and postmenopausal women over time between

pre and post timepoints, with premenopausal women trending towards an increase in BDNF, and postmenopausal women trending towards a decrease in BDNF. There was a large effect size within this interaction represented with a partial eta squared value of .265. A Post Hoc test was done to further investigate the interaction. There was not enough statistical power ($P = .164$) to state that there was a difference in BDNF levels (pre to post) but that there appears to be a trend. Both age and FSH had indirect relationships with BDNF ($p < 0.05$); the greater the age or FSH, the lower the peripheral BDNF levels. There was a positive correlation between age and Stroop Test time over all time points ($P = .039$, $.089$, and $.027$; pre, post, and post30 exercise respectively). This indicated an age-related decline in choice reaction time capabilities. **CONCLUSION:** Within the study, there was not statistical evidence that acute exercise affects BDNF levels nor choice reaction time for the Stroop incongruent test, regardless of menopausal status. However, a clear decline in choice reaction time was noted with increase age. Additionally, there appears to be a blunting of exercise-induced increases in BDNF in postmenopausal women. Further investigation is required to clarify this relationship.

2044 Board #200 May 30 2:00 PM - 3:30 PM
Chronic Effect of Exercise on Working Memory in Children And Adolescents: A Meta-Analysis of Randomized Controlled Trials

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INTRODUCTION: Working memory (WM), generally considered executive function, is gaining attention due to its role in contributing to children and adolescents' academic achievement, especially verbal and quantitative reasoning, and sports-related tactical memory. Quantitative reviews regarding the effect of exercise interventions (EX) on this higher-level cognitive skill in these important cohorts are lacking.

PURPOSE: The aim of the study was to assess the chronic effect of EX on WM in children and adolescents and to evaluate potential moderators of this effect using a meta-analytic approach.

METHODS: A computerized literature search was conducted based on seven databases: SPORTDiscus, Google Scholar, PubMed, ScienceDirect, Dialnet Plus, SciELO, and MEDLINE. Studies needed to meet the following inclusion criteria: 1) a RCT design in children or adolescents, 2) EX with mode description, 3) published in English, Spanish, or Korean 4) WM as dependent variable, and 5) reported descriptives that permitted effect size (ES) calculation. The quality score was defined using a scale from 1 to 5. A random-effects model with a within-group design was used to calculate the ES. One-way analysis of variance of independent groups or Pearson's correlation coefficients were used to examine moderators.

RESULTS: 6207 articles published before Nov. 2016 were found, of which 10 studies representing 60 ES's and totaling 806 participants (males and females, 9.93 ± 8 yo) were included in the analysis. The mean quality for the studies was 4.4 ± 7 . An overall ES of .85 was found ($p \leq .001$; $CI_{95\%} = .47$ to 1.24 ; $z = 4.35$; $Q = 419.50$; $I^2 = 94.28\%$) suggesting a positive high effect of the EX to enhance WM. Age ($r = -.34$; $p = .048$), number of sessions ($r = .42$; $p = .03$), and sex ($F_{statistic} = 3.6$; $p = .04$), significantly moderated the effect. Neither a) quality of the studies ($r = .24$; $p = .17$), b) min/session ($r = -.28$; $p = .15$), c) weeks of intervention ($r = .24$; $p = .17$), nor d) type of exercise (i.e., aerobic, anaerobic, neuromotor; $r = .41$; $p = .53$) were significant moderators. No bias was found according to Egger's regression analysis ($p = .39$).

CONCLUSIONS: EX has a positive significant effect on children and adolescents' WM compared with their control peers. Different types of exercise appeared to be equally effective strategies for improving WM in these cohorts.

2045 Board #201 May 30 2:00 PM - 3:30 PM
Motivational Differences Between Crossfit And Traditional Resistance Training Participants

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PURPOSE: To investigate the motivational factors, behavioral regulations based on self-determination theory framework, and the relationships between basic psychological need satisfaction and actual exercise behaviors of CrossFit and resistance training (RT) participants.

METHODS: Have been evaluated 493 subjects (males = 351, females = 148), RT (n = 365, 279 males, 86 females) and CrossFit (n = 128, 69 males, 59 females) completed the follow online questionnaires: Behavioural Regulation in Exercise Questionnaire, Exercise Motivations Inventory-2, The Basic Psychological Needs in Exercise Scale.

RESULTS: The CrossFit participants presented higher levels of enjoyment, stress management, social recognition, affiliation, competition, and weight management. Conversely, RT participants reported higher motives for appearance. Intrinsic regulation to exercise was significantly higher in CrossFit, whereas RT clients scored higher controlled motivation. The CrossFit group reported higher levels of relatedness, while RT group presented more perception of autonomy. There was no significant difference between weekly exercise volume between groups; therefore, correlation and mediation analysis were conducted with pooled data. Autonomy and competence were significantly associated with more autonomous forms of motivation. Exercise frequency and weekly exercise volume were positively related to intrinsic motivation. When mediating model was evaluated, the social motives to exercise and intrinsic motivation were found to mediate the relationship between competence and weekly exercise volume (95% BCa CI of 2.47 to 11.91).

CONCLUSIONS: These findings suggested that CrossFit members attend the gym/CrossFit box predominantly for intrinsic reasons and social motives as compared to RT participants. Exercise professionals may consider the development of programs to increase social motives and exercise-related identity (e.g., interest, affiliation, and enjoyment) to promote intrinsic regulation in individuals from fitness centers.

2046 Board #202 May 30 2:00 PM - 3:30 PM
Neuroelectric Indices of Attentional Processing are Reduced During Low-Intensity Cycling

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Acute aerobic exercise exerts a small beneficial effect on cognition. A majority of studies have examined cognitive function following acute bouts of exercise, while very few have evaluated changes that may occur during exercise. The limited research that has been conducted in this area is mixed, demonstrating differential effects on cognitive performance depending on methodological decisions including exercise intensity and duration. **PURPOSE:** The primary purpose of this study was to examine the effects of low-intensity cycling on cognitive function, measured by behavioral performance (response accuracy and reaction time) and neuroelectric indices of attentional processing (P3 amplitude and latency). **METHODS:** Twenty-seven (Mage = 22.9 ± 3.0 years old) college-aged individuals were counterbalanced into low-intensity exercise (EX) and seated control (SC) conditions. During each condition, participants completed a 10-minute resting baseline period, 20 minutes of either sustained cycling or seated rest, and a 20-minute recovery period. Electroencephalography (EEG) data were recorded during a modified oddball paradigm in order to assess primary cognitive outcome measures at 10-minute intervals (5 blocks total) throughout each condition. **RESULTS:** Individuals in EX and SC conditions displayed lower accuracy to rare trials across time, $F(4,23) = 4.54$, $p = .008$, $\eta^2_p = .44$, suggesting reductions in performance to more difficult trials as testing sessions progressed. There were no significant differences in reaction time between EX and SC conditions. Significant reductions in P3 amplitude were observed only during the 20-minute cycling period compared to seated rest, $F(4,23) = 3.50$, $p = .023$, $\eta^2_p = .38$, while no differences in P3 latency were observed between EX or SC conditions. **CONCLUSIONS:** Taken together, results indicate that exercise at lower doses may have small but significant effects on behavioral and neuroelectric outcomes of cognitive performance. These changes may be due in part to the shifting of attentional resources from the cognitive task to the maintenance of exercise. Information gathered from this study may aid in the development of appropriate exercise prescription for populations looking to specifically target cognitive function deficits through acute aerobic exercise.

2047 Board #203 May 30 2:00 PM - 3:30 PM
Impact of Stress on Resting Skeletal Muscle Oxygen Consumption with and without Prior Exercise

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The effects of acute exercise on muscle metabolism are well established, however the impact of mental stress (MS) on muscle metabolism is not well understood. **PURPOSE:** To assess muscle oxygen consumption (mVO₂) after acute MS and evaluate the effect of acute exercise prior to MS on mVO₂. **METHODS:** Participants (N=15 males, 22 ± 2 yr, VO_{2peak} 40.8 ± 5.7 ml/kg/min) served as their own control in a randomized counter balanced design. Participants completed a total of three visits over 3-5 weeks. On the initial visit, a maximal oxygen uptake test on a cycle ergometer was performed. Near-infrared spectroscopy (NIRS) was used during a five-minute

cuff occlusion and the initial slope during the occlusion was used to assess mVO₂ in the gastrocnemius muscle. mVO₂ was assessed at baseline (BL), after rest (CON) or exercise (EX), and after mental stress (MS). On two separate days, participants either rested for 25 minutes (CON) or completed 25 minutes of exercise (EX) at 90% ventilatory threshold on cycle ergometer. MS was evoked by a serial subtraction test administered by two research assistants dressed in white lab coats. Data were analyzed using a 2x3 repeated measures ANOVA with Fishers LSD post hoc tests, and are presented as mean percent change ± SD. **RESULTS:** A significant interaction effect of Condition x Time on mVO₂ was observed ($F=6.3$ $p<0.05$, $\eta^2=0.326$). Post hoc comparisons indicated mVO₂ was significantly increased after EX compared to CON by 21.8 ± 26.0% ($p<0.05$). Within CON, MS increased mVO₂ by 12.6 ± 10.2% ($p<0.001$). In EX, there was an increase in mVO₂ from BL to after EX by 12.6 ± 16.0% ($p<0.05$) and from BL to after MS by 18.2 ± 64.1% ($p=0.053$). **CONCLUSION:** To our knowledge, these data are the first to suggest that acute MS increases the metabolic rate of resting skeletal muscle. Interestingly, the combination of prior EX and MS does not further augment metabolic activity beyond MS alone.

2048 Board #204 May 30 2:00 PM - 3:30 PM
Affective and Perceptual Responses to High-Intensity Interval Training: Comparing Graded Walking to Ungraded Jogging

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Benefits associated with high-intensity interval training (HIIT) are well-established. Research has also demonstrated that HIIT can be well-tolerated in a variety of populations, protocols, and modalities. Treadmill-based HIIT has almost exclusively included running interspersed with walking. Research to date has not investigated the delivery of HIIT by way of graded walking interspersed with ungraded walking. **PURPOSE:** Compare the effects of ungraded jogging to graded walking as a modality of HIIT on perceived exertion, affect, and enjoyment. **METHODS:** Nine healthy participants (5 males, 4 females; mean BMI = 25; mean age = 26) completed two 20-minute counterbalanced HIIT trials after completion of maximal testing. Both trials alternated between workloads associated with 85% of VO_{2max} and a brisk and comfortable walking speed (mean = 3.2 mph). The interval portions of the trials were performed at elevated grade (mean = 17%) for the WALK-HIIT trial and elevated speed (mean = 6.7 mph) for the RUN-HIIT trial. Affect, enjoyment, and perceived exertion, both overall (RPE-O) and legs only (RPE-L), were measured throughout each trial. Enjoyment was measured upon completion of each trial. **RESULTS:** Data was analyzed using dependent t-tests. RPE-O, RPE-L, affect, enjoyment, and HR (all p -values > 0.05; all ES values < 0.50) were not significantly different for the WALK-HIIT and RUN-HIIT trials. **CONCLUSIONS:** Findings indicate that WALK-HIIT and RUN-HIIT trials produce similar perceptual and affective responses, with each providing a significant exercise stimulus sufficient to improve cardiometabolic health. The production of relatively similar responses suggests that graded walking is a viable alternative to running for the delivery of the many benefits associated with interval-based exercise without negative impacts on the exercise experience.

2049 Board #205 May 30 2:00 PM - 3:30 PM
The Impact of Qigong Baduanjin on Cognitive Function & Mental State in Patients with type 2 Diabetes

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(No relevant relationships reported)

PURPOSE: This study aims to assess the clinic efficacy of Qigong Baduanjin (QBDJ) on cognition and mental status in patients with type 2 diabetes. **METHODS:** sixty-seven type 2 diabetic patients with mild cognitive impairment (MCI) (31 males and 36 females; aged 47-68 years; the educational background of all participants were above middle school) were screened and randomly divided into two groups: the QBDJ group (n=34), and the control group (n=33). Both groups were based on the routine treatment of diabetes. The QBDJ group received Baduanjin exercise forty minutes a time and five times per week for three months, whereas the control group without special exercise intervention. Montreal Cognitive Assessment (MoCA) and Hamilton Anxiety Scale (HAMA) were used to evaluate the change of cognitive function and mental status in all patients. All data were analyzed using SPSS Statistics for Windows v 17.0. Group differences in baseline characteristics were tested using the χ^2 test and the T test. For the outcome measures, independent-sample T test was performed to compare the changes between the QBDJ and control groups. The paired T test was used to compare the effects before and after treatment. The level of significance was established at $p \leq 0.05$. **RESULTS:** There was no significant difference in the scores of MoCA and HAMA between two groups before the intervention. After 3 months of Baduanjin practice, the total score of MoCA, the score of visuospatial/executive, and the score of delayed recall were significantly higher in the QBDJ group than in the

control group ($P < 0.05$). QBDJ training also contributed to improving the ability of emotion regulation. Compared with the control group, participants in the QBDJ group had significantly lower total HAMA score ($P < 0.05$). **CONCLUSIONS:** These results indicate that regular QBDJ exercise can effectively improve cognitive function and produce positive effects on mental state in type 2 diabetic patients with MCI.

TABLE 1. COMPARISON OF SCORES FOR ALL MoCA SUBTESTS IN TWO GROUPS

	Control group(n=33)		QBDJ group(n=34)	
	Before intervention	After intervention	Before intervention	After intervention
Visuospatial/executive	3.01 ± 0.74	3.06 ± 0.82	3.04 ± 0.57	3.98 ± 1.04**
Naming	2.51 ± 0.63	2.53 ± 0.71	2.48 ± 0.59	2.55 ± 0.91
Attention	4.43 ± 0.75	4.46 ± 1.01	4.44 ± 0.63	4.62 ± 0.88
Language	2.02 ± 0.46	2.04 ± 0.53	2.03 ± 0.57	2.11 ± 0.70
Abstraction	0.98 ± 0.27	1.01 ± 0.36	1.02 ± 0.33	1.15 ± 0.54
Delayed recall	1.94 ± 0.66	2.02 ± 0.71	1.91 ± 0.58	3.37 ± 0.89**
Orientation	5.78 ± 0.53	5.81 ± 0.42	5.73 ± 0.64	5.89 ± 0.76
Total score	20.83 ± 1.34	21.14 ± 1.52	20.59 ± 1.21	23.63 ± 1.63**

When the difference is significant ($p < 0.05$), the P value is marked with * (QBDJ group vs. Control group) and @ (compared with before intervention in QBDJ group)

TABLE 2. COMPARISON OF HAMA SCORE IN TWO GROUPS

	Control group(n=33)		QBDJ group(n=34)	
	Before intervention	After intervention	Before intervention	After intervention
HAMA	15.44 ± 3.58	16.25 ± 4.03	15.83 ± 3.32	10.63 ± 3.71**

When the difference is significant ($p < 0.05$), the P value is marked with * (QBDJ group vs. Control group) and @ (compared with before intervention in QBDJ group)

2050 Board #206 May 30 2:00 PM - 3:30 PM Self-Reported Physical Activity and Memory Performance among Adolescent Cannabis Users

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(No relevant relationships reported)

Prior work has found that heavy cannabis use (CU) is associated with learning and memory impairments, whereas physical activity (PA) has been linked to enhanced memory and cognition.

PURPOSE: To determine whether PA moderates the link between CU and memory among adolescents, such that CU leads to greater memory deficits in those who report less PA.

METHODS: Participants were 387 adolescents (ages 15-19) from a larger study, 198 of whom completed the Sports & Activity Involvement Questionnaire added after study onset. We used minutes reported in the past 6 months as our measure of PA. Frequency of CU (in days) was assessed over the last 6 months; 70% endorsed some CU. Participants completed the California Verbal Learning Test-II and Wechsler Memory Scales-IV Logical Memory and Designs subtests. We used composite scores from these tests' immediate and delayed free recall trials to derive latent constructs of immediate and delayed memory, respectively.

We examined the independent influence of CU and PA on our latent constructs of immediate and delayed memory in separate regression models. To assess whether PA moderates the association between CU and memory performance, we ran separate models for each memory construct with both predictors and their interaction term. We repeated these analyses controlling for lifetime alcohol, nicotine, and CU frequency to isolate the effects of recent CU.

RESULTS: Greater past 6-month CU frequency was associated with poorer immediate, $\beta = -.22$, $p < .001$, and delayed memory, $\beta = -.23$, $p < .001$. However, past 6-month PA was not associated with immediate, $\beta = -.01$, $p = .90$, or delayed memory, $\beta = .07$, $p = .19$. The PA X CU interaction effect was not significant for either immediate, $\beta = .03$, $p = .88$, or delayed memory, $\beta = .03$, $p = .85$. Results were unchanged after controlling for other substance use and lifetime CU frequency, which accounted for significant variance on immediate, $\beta = -.27$, $p = .03$, but not delayed memory, $\beta = -.11$, $p = .39$.

CONCLUSION: Our findings replicate the well-established link between CU and memory. However, self-reported PA did not influence this association in our adolescent sample. Future work should employ objective measures of PA to account for factors like activity intensity, aerobic fitness, and social biases inherent in self-report. Supported by NIH Grants R01 DA031176 & U01 DA041156.

2051 Board #207 May 30 2:00 PM - 3:30 PM

Action Boundary Perception Across 30 Days in an Isolated and Confined Environment

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Successful execution of operational tasks requires accurate and efficient action boundary perception. An action boundary is the task- and individual-specific threshold where an action is possible. The inability to accurately perceive changes in action possibilities due to changing action boundaries may increase the risk adopted during a task, possibly compromising mission success. Astronauts must maintain effective operational performance in isolated, confined and extreme (ICE) environments for extended timeperiods, similar to those expected on the proposed mission to Mars. It is unknown how these environments affect action boundary perception. **PURPOSE:** Investigate changes in action boundary perception behavior during a 30-day Human Exploration Research Analog (HERA) mission. **METHODS:** Sixteen subjects completed six trials of the perception-action coupling task (PACT), a novel tablet-based action boundary perception task, in the afternoon of days 3, 10, 17, 24 and 5 days post-mission. The 15-minute PACT presents a series of virtual balls and apertures varying in ball to aperture size ratio (B-AR) from 0.2 to 1.8 with a ratio of 1.0 representing the action boundary. Subjects determined whether the ball could fit through the aperture, then responded based on their perception of this action possibility. 8 (ratio) x 5 (time) repeated measures ANOVAs were performed to assess changes in response time (RT), accuracy (ACC) and lapses. **RESULTS:** No significant ratio x time interactions were observed. RT ($F_{4,68} = 3.631$, $p = 0.010$, $\eta^2_p = 0.195$) was faster on day 24 (0.738 ± 0.088s) than day 17 (0.768 ± 0.092s). No differences were observed between other timepoints. ACC and lapses did not vary during the mission ($p > 0.05$). RT ($F_{2,583,38,745} = 42.815$, $p < 0.001$, $\eta^2_p = 0.741$) and ACC ($F_{1,423,21,341} = 42.815$, $p = 0.002$, $\eta^2_p = 0.407$) were sensitive to changes in B-AR; responses were slower and less accurate near the action boundary. **CONCLUSION:** Minimal change in action boundary perception performance was observed in HERA ICE analog, with improvements in RT detected. Faster RT may reflect more efficient responses or behavioral changes due to ICE environments, suggesting action boundary perception is not compromised by a 30 day ICE analog assessment. This material was based on work supported by NASA (NNX15AC13G) PIs: Alfano and Simpson

2052 Board #208 May 30 2:00 PM - 3:30 PM Associations Of Cognition With Physical And Vascular Function In Patients With Chronic Kidney Disease.

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(No relevant relationships reported)

Cognitive impairment is prevalent in patients with chronic kidney disease (CKD), but little is known about its relationship with physical and vascular function.

Purpose: To investigate the relationship between cognitive function, and physical and vascular function in older adults with stage 3-4 CKD and preclinical cognitive impairment. We hypothesized that physical and vascular function would be related to cognitive function. **Methods:** Participants (n=28) with CKD and preclinical cognitive impairment (57% female, 68% black, eGFR 43.7, age 68) completed the Trail Making Test (TMT-A: psychomotor speed, and TMT-B executive control), and digit symbol coding (DSC) (visuomotor speed/complex attention). These are standard measures that are sensitive to cognitive decline. Physical function was determined via the short physical performance battery test (SPPB) and the 6-minute walk test (6MWT). Vascular function was determined via brachial artery flow mediated vasodilation (FMD) following 5-minutes of forearm occlusion. Correlations were assessed via Pearson's bivariate correlation. **Results:** All participants scored below the fiftieth percentile of age and sex specific normative values on the TMT; 32% scored below the tenth percentile on the TMT-A and 50% scored below the tenth percentile for TMT-B. Age, years of education, sex, or race did not correlate with TMT-A, TMT-B, or DSC. TMT-A were inversely correlated with 6MWT ($r = -.5$, $p = .007$), SPPB score ($r = -.65$, $p < .001$), and FMD ($r = -.4$, $p = .04$). TMT-B was inversely correlated with 6MWT ($r = -.39$, $p = .04$), but not with SPPB, or FMD. DSC was correlated with 6MWT ($r = .47$, $p = .01$), but not with SPPB, or FMD. **Conclusion:** In patients with CKD, psychomotor speed is associated with indicators of physical function and fitness levels, and with vascular function. Executive control, visuomotor speed, and complex attention was associated with physical fitness levels. These results indicate a concomitance between higher levels of fitness, physical, and vascular function, and higher scores in psychomotor speed and executive control in patients with CKD. The clinical

implications of our work remains to be further explored, but interventions to improve fitness levels, and physical and vascular function may contribute to lessening the impact of CKD-associated cognitive alterations.

2053 Board #209 May 30 2:00 PM - 3:30 PM
Effects Of Three Months Of A “Playing Actively And Learning” Program On Selective Attention Performance In Boys And Girls

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(No relevant relationships reported)

Physical education classes provide an opportunity for students to be physically active and also to help in school learning. **PURPOSE:** To compare the effects of physical education program combined with scholar contents named “Playing actively and Learning (PAL)” on selective attention in boys and girls. **METHODS:** 39 children with low academic achievement (9.5 ± 0.9 yr) from an elementary public school of vulnerability area at Brasília - Brazil, undertook Stroop test before and after intervention. The anthropometric data (weight and stature) were assessed for characterization of the sample. The stimuli at Stroop test Go/No-go was a colored bar and a colored word in congruent (e.g., RED in red ink) or incongruent (e.g., RED in blue ink) color ink. The participants had to match the color of the bar to the meaning of the word and press the correct key as soon as the stimuli appeared at computer screen. Nineteen boys (BG; $n=19$; 32.1 ± 4.5 kg; 138 ± 0.4 cm; 16.7 ± 1.7 kg.m²⁽⁻¹⁾) and twenty one girls (GG; $n=21$; 31.1 ± 7.3 ; 137 ± 0.4 cm; 16.4 ± 3.5 kg.m²⁽⁻¹⁾) participated on the study. Both BG and GG attended to 24 classes (60 min, twice a week for three months) during school journey. At those classes they learned the content of Portuguese and Mathematics while doing active plays (running, jumping and aerobic dance) (PAL) at moderate intensity (154.6 ± 17.2 bpm). ANOVA mixed was used to compare data before and after intervention. **RESULTS:** No differences were observed in congruent or incongruent conditions between groups. The reaction time decreased in incongruent Go condition in both groups after intervention for boys (958.3 ± 113.3 ms to 877.9 ± 105.6 ms; $P=0.004$) and girls (976.6 ± 91.5 ms to 904.6 ± 86.7 ms; $P=0.005$) (Figure 1). **CONCLUSION:** Three months of PAL resulted in improvement in a similar way in boys and girls at the most difficult part of Stroop test. To support these results studies with a neuroelectric analysis (i.e. event related potential component) can be recommended.

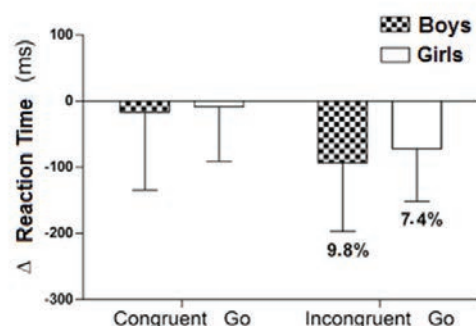


Figure 1. Improvement of Reaction Time in the congruent and incongruent Go condition of the Stroop test after PAL program in boys and girls.

2054 Board #210 May 30 2:00 PM - 3:30 PM
Physical Activity from Childhood to Adulthood and Cognitive Performance in Midlife

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The prevalence of cognitive deficits is increasing worldwide, making risk factor reduction a crucial target on the global public health agenda. Adulthood physical activity (PA) is suggested to protect against old-age cognitive deficits, but the independent role of childhood / youth PA for adulthood cognitive performance is unknown.

PURPOSE: We investigated the association between PA from childhood to adulthood and midlife cognitive performance.

METHODS: This study is a part of the Cardiovascular Risk in Young Finns Study. From 1980, a population-based cohort of 3,596 children (baseline age 3-18 years) have been followed-up for 31 years in 3-9-year intervals. PA was queried in all study phases. Cumulative PA was determined in childhood (age 6-12 years), adolescence (age 12-18 years), young adulthood (age 18-24 years) and adulthood (age 24-37 years). Cognitive performance was assessed using computerized neuropsychological test in 2011 among 2,026 participants aged 34-49 years.

RESULTS: High PA level in childhood (β 0.119, 95% confidence interval (CI) 0.055-0.182, $p=0.0002$), adolescence ($\beta=0.125$ SD, 95% CI 0.063-0.188, $p<0.0001$), young adulthood ($\beta=0.135$ SD, 95% CI 0.063-0.207, $p=0.0002$) and adulthood ($\beta=0.045$ SD, 95% CI 0.013-0.077, $p=0.006$) was independently associated with better reaction time in midlife. Additionally, an independent association between high PA level in young adulthood (β 0.101, 95% CI 0.001-0.200, $p=0.048$) and adulthood ($\beta=0.064$ SD, 95% CI 0.018-0.110, $p=0.006$) and better visual processing and sustained attention in midlife was found among men. Associations for other cognitive domains were not found.

CONCLUSIONS: Cumulative exposure to PA from childhood to adulthood was found to be associated with better midlife reaction time both in men and women. Furthermore, cumulative PA exposure in young adulthood and adulthood was associated with better visual processing and sustained attention in men. These associations were independent of PA levels in other measured age frames. Therefore, physically active lifestyle should be adopted already in early childhood, and continued into midlife to ensure the plausible benefits of PA on midlife cognitive performance. Concluding, this study provides novel insight into cost-effective and well-timed promotion of cognitive health.

2055 Board #211 May 30 2:00 PM - 3:30 PM
Patient Perceptions of a Cancer Rehabilitation Program Which Provides 12 Weeks Of Individualized Exercise Prescription

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(No relevant relationships reported)

Purpose: The purpose of this study was to determine why cancer patients choose to participate and remain in an exercise rehabilitation program. **Methods:** 79 participants in a cancer rehabilitation program were asked to complete a questionnaire consisting of 6 open ended questions asking 1. Who referred them, 2. What did they follow through with the referral, 3. Why they have chosen to remain in the program, 4. What their initial thoughts of the program were, 5. What their current thoughts about the program are, and 6. Are they satisfied with the program. This study was approved by the Saint Francis University IRB. **Results:** 38% of clients were referred by either an oncologist or family doctor, 25% by hospital staff, 24% by friend or support group and 13% by media outlets. 59% of clients followed through for their health, and 15% for supervision of their exercise sessions. 51% of clients continued in the program because of the results they obtained and 25% because they had not yet met their goals, while 24% continued because of their cancer exercise trainer. 73% of clients had positive thoughts about the program, and 99% had the same or improved thoughts. Finally 94% of clients were satisfied with the program. **Conclusion:** The majority of clients were referred by their oncologist, or hospital staff indicating the power that physicians and hospital staff have in providing guidance for their clients. Further, once clients join a cancer rehabilitation program the benefits motivate them to continue in the program.

Clearly they are satisfied with the program which is a program which provides individualized personalized exercise prescription and a cancer trainer for support and motivation.

D-64 Free Communication/Poster - Hydration/Fluid Balance

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2056 Board #212 May 30 2:00 PM - 3:30 PM Impact of Nutrient Intake During Exercise on Hydration Markers Following Exercise and Rehydration

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(No relevant relationships reported)

Endurance athletes commonly strive for optimal hydration status during and after events, and have vast nutrition options available to support performance and well-being. **PURPOSE:** We aimed to evaluate relationships among nutrients consumed during exercise and markers of hydration status. **METHODS:** Fifty-one cyclists (age mean=51y and range=21-72y; 49 males, 2 females) completing a 161km event (mean=26°C, 76%RH; maximum=30°C, 93%RH) recorded all dietary intake during the ride. Five hydration markers (urine color and specific gravity, plasma osmolality (P_{osm}), plasma copeptin (P_{cop}), and body mass change (BM)) were collected before and after (POST) the ride, and one hour after a 650mL water bolus (POST_{1h}). Linear regressions tested associations between hydration markers and eight predictor terms derived from nineteen nutrients merged into a reduced-dimensionality dataset through serial k-means clustering. As an indicator of water retention signaling, P_{cop} tertiles were analyzed via two-way ANOVA to evaluate nutrient intake influence. **RESULTS:** Five predictor clusters were significantly associated to hydration markers (number of associated hydration markers in parenthesis): 1) glycemic load + carbohydrates + sodium (one), 2) protein + fat + zinc (one), 3) magnesium + calcium (two), 4) pinitol (three), and 5) water (four); caffeine, potassium, fiber, betaine, and three sugar-alcohols did not associate with hydration markers. All hydration markers (except P_{osm}) associated to at least one nutrient predictor. P_{cop} POST tertiles (1st vs. 3rd tertile p=0.0047; 2217±1295 and 1747±1214 mg, respectively) and water intake (1st vs. 3rd and 2nd vs. 3rd, all p<0.0001; 1st=4910±1722, 2nd=4887±1011, 3rd=3837±1097 g). P_{cop} POST_{1h} tertiles (7.4±3.0, 22.0±5.4, and 54.2±36.7 pmol/L, respectively) differed by water intake (1st vs. 3rd and 2nd vs. 3rd, all p<0.0001; 1st=4921±1652, 2nd=4953±1063, and 3rd=3759±1072 g). **CONCLUSION:** These data suggest that some nutrients impact fluid-electrolyte balance and hydration markers. Nutrient intake appears to mediate urinary markers more than P_{cop} , and P_{cop} more than BM. Further, sodium and water appear to best mitigate water retention signaling following exercise and rehydration.

2057 Board #213 May 30 2:00 PM - 3:30 PM Effects of Caffeine Dose Timing on Total Urine Excretion during Sodium-Aided Hyperhydration Protocols.

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(No relevant relationships reported)

When used alone, both caffeine and sodium-aided hyperhydration (SAH) can be ergogenic. Although caffeine use in conjunction with SAH promotes diuresis, hyperhydration can be achieved, albeit at lower levels compared to SAH alone. Previous caffeine and SAH work has suggested most of the caffeine induced diuresis occurs within 15 min of consumption of a bolus of caffeine, sodium and water. This response suggests that caffeine-induces diuresis for only 15 min following its consumption, and/or that the diuretic effects of caffeine are dependent on hydration levels. **PURPOSE:** to determine the effects of caffeine, consumed at different

time-points, on diuresis during SAH protocols. **METHODS:** Subjects were 17 healthy males (23 ± 5 yr, 177 ± 8 cm, 83.4 ± 15.3 kg). Each performed 4, 90 min hyperhydration trials in a randomized, double-blind fashion. Protocols began with a bladder void and measurement of urine specific gravity (USG) followed by ingestion of 15 mL H₂O · kg⁻¹ · min⁻¹ with one of four treatments: Placebo (PL), 70.5 mg NaCl · kg⁻¹ · min⁻¹ (Na), or a combination of NaCl and caffeine consumed in two different strategies: 70.5 mg NaCl + 5 mg caffeine · kg⁻¹ · min⁻¹ taken at the start of the trial (NaCaf0), or 70.5 mg NaCl · kg⁻¹ · min⁻¹ taken at the start and 5 mg caffeine · kg⁻¹ · min⁻¹ taken at 75 min of the trial (NaCaf75). After consuming the water, subjects rested for 90 min performing a measured bladder void every 15 min. Total urine excreted (TUE) was expressed as a percentage of the total fluid consumed during the hyperhydration protocols. USG and TUE were compared using one-way repeated measures ANOVA with Sidak post hoc analyses. Levels of significance were set *a priori* at P < 0.05. **RESULTS:** USGs were 1.007 ± 0.003 (PL), 1.008 ± 0.003 (Na), 1.007 ± 0.004 (NaCaf0), and 1.009 ± 0.004 (NaCaf75) (P > 0.05). TUE for PL (87 ± 30%) was significantly higher than all other protocols (P < 0.05). TUE for NaCaf0 (73 ± 16%) was significantly higher than Na (56 ± 18%, P = 0.02) and NaCaf75 (52 ± 13% P < 0.01). NSD in TUE was observed between Na and NaCaf75. **CONCLUSION:** The results reaffirm that, when caffeine is consumed at the beginning of a SAH strategy, hyperhydration can be achieved, but at a lower level compared to SAH without caffeine. The results also suggest that waiting to consume caffeine until 75 min after water is consumed does not result in caffeine induced diuresis during a SAH protocol.

2058 Board #214 May 30 2:00 PM - 3:30 PM Dehydration Impairs Accuracy and Increases Brain Activity During a Rhythmic Bimanual Choice Reaction Time Task

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(No relevant relationships reported)

Dehydration impairs motor coordination but the influence on other fundamental cognitive-motor functions is unclear. **PURPOSE:** To determine the impact of dehydration on rhythmic bimanual choice performance (accuracy & reaction time) and brain function (electroencephalography). **METHODS:** Ten aerobically fit men (22.4 ± 2.5 y) completed three experimental sessions: control (seated rest; CON), dehydration (EHS-DEH) induced by 2.5 h intermittent walking in the heat (45°C, 15% RH), and euhydration (EHS; 2.5 h intermittent walking in the heat but matching sweat loss with water ingestion). Performance during a bimanual probabilistic choice reaction time task (PCRT; 32 min) consisting of randomly presented dominant (~67%) and non-dominant (~33%) stimuli was examined concurrently with visual evoked potentials. Perceived PCRT mental workload (NASA-TLX, 21-point scale) was assessed following task completion. **RESULTS:** PCRT reaction time was not different (p = 0.40) averaged across trials (CON: 538.3 ± 37.7, EHS: 542.6 ± 39.2, DEH: 532.6 ± 39.2 ms). EHS-DEH (67.3 ± 14.1%) reduced PCRT accuracy during non-dominant (less frequent) responses vs. CON (83.7 ± 5.8 %; p = 0.04) but not compared with EHS (74.6 ± 11.0 %; p = 0.18). Accuracy during dominant stimuli were not different across trials (p > 0.05). N1 amplitude in the occipital electrodes (perceptual processing) was higher following EHS-DEH (385.2 ± 141.3 uV*ms) compared to CON (241.8 ± 168.6 uV*ms; p = 0.001) but not vs. EHS (300.3 ± 171.1 uV*ms; p = 0.60). EHS and CON were not different from each other (p = 0.60). No differences (p > 0.05) were observed among trials for the contingent negative variation (movement anticipation) or N2 (stimulus categorization). EHS-DEH (6.4 ± 5.0) elicited greater levels of perceived effort vs. CON (3.7 ± 2.4; p = 0.03) and frustration vs. EHS (11.8 ± 5.0, 7.5 ± 5.1; p = 0.0004). **CONCLUSIONS:** Dehydration increased perceived effort, frustration, and perceptual processing demands, resulting in impaired accuracy for this cognitive-motor task requiring vigilance during prolonged fine motor movements. Prevention of dehydration during exercise-heat stress preserved cognitive-motor performance, brain activity, and mental workload similar to control conditions.

Supported by Carl V. Gisolfi Memorial Fund ACSM Foundation Grant

2059 Board #215 May 30 2:00 PM - 3:30 PM
Dehydration Has No Influence on Simulated Motor-race Performance Despite Greater Cardiovascular and Thermoregulatory Demand

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Purpose: Motor-racing drivers compete in hot compensable environments imposing high physiological strain. Dehydration may impact a driver's health, safety and race performance. This study examined the effect of heat-induced dehydration on performance and physiological outcomes during a simulated motor-race.

Methods: Fifteen healthy men [age: 25.2±5.4 y, body mass: 84.8±10.7 kg, $\dot{V}O_{2peak}$: 43.7±7.8 mL·kg⁻¹·min⁻¹ (mean±SD)] participated in this controlled crossover study. Participants were randomised (counter-balanced) to a no fluid trial [1.9±0.1% body mass loss (BML) via sauna exposure (wet bulb globe temperature (WBGT): 43.6±2.8°C)] and fluid trial [1.0±0.5% body mass gain via room temperature water consumption every 10 min during sauna exposure]. All participants completed ~60 min of Australian simulated motor-racing in a heated (WBGT: 33.7±0.7°C) laboratory with no fluid provided to both trials which resulted in a 1.3±0.4 and 0.9±0.2% BML for the fluid and no fluid trials respectively. Lap time, physiological strain, heart rate and core/skin temperature were measured throughout the task. Urine [specific gravity (USG) and osmolality (Uosm)], body mass, and serum [sodium (Na), osmolality (Sosm), and plasma volume (PV)] samples were collected pre- and post- sauna and race.

Results: Mean lap time was not different between trials (fluid=134.981±2.402 s, no fluid=134.718±2.147 s; $p=0.293$). The no fluid trial resulted in significantly higher ($p<0.05$) peak heart rate (129±16 vs. 121±16 beats·min⁻¹), core temperature (38.0±0.2 vs. 37.7±0.3°C), physiological strain (4.1±1.1 vs. 3.5±1.1), Sosm (310±4 vs. 300±4 mOsm·kg⁻¹), Na (138.7±2.1 vs. 135.8±4.5 mmol·L⁻¹), USG [median(interquartile range): 1.025(1.024-1.027) vs. 1.006(1.004-1.013)], U_{osm} [942(879-1010) vs. 221(186-497) mOsm·kg⁻¹], total body mass loss (2.7±0.3 vs. 0.9±0.4%) and change in PV (-7.9±4.2 vs. -3.3±4.2 %) than the fluid trial.

Conclusion: Dehydration of ~2.7% BML without fluid replacement had no influence on simulated race performance measured by mean lap time, despite significantly greater cardiovascular and thermoregulatory demand. Further research is warranted to assess the impact of greater cardiovascular and thermoregulatory demand from dehydration on the safety, health and well-being of drivers.

2060 Board #216 May 30 2:00 PM - 3:30 PM
Self-Reported Changes in Thirst and Alertness during Variable Prescribed Fluid Intake

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PURPOSE: To evaluate the relationship between self-reported thirst and alertness in people drinking variable amounts of prescribed water. **METHODS:** Subjects (n = 115, 59 males, 32 ± 10 y; 24.6 ± 4.4 kg·m⁻²) visited the lab 3 times over 10 days: V1, a baseline visit that prior to participants were drinking *ad libitum*; V2, following 3 days of fluid restriction (1 L·d⁻¹, of which 250 mL was consumed in the morning prior to the visit); and V3, the morning following a prescribed increase in water intake. The increase in water intake at V3 varied by group assignment: a control group (CON) maintained 250 mL of morning water consumption, while LOW and HIGH intake groups (n = 45 each) consumed 496 ± 82 mL and 878 ± 125 mL, respectively. At each visit, which occurred after the morning water consumption period, subjects indicated on an open-ended visual analog scale (VAS) how thirsty and alert they felt. Two-way ANOVA for thirst and alertness between groups from V1 to V2 and V2 to V3 were completed. Repeated measures correlation procedure was completed for change in alertness and thirst from V1 to V2 and V2 to V3. **RESULTS:** Groups were similar at baseline (V1) for fluid intake, thirst and alertness (all $p \geq 0.17$). Fluid restriction (V2) resulted in a main effect of time for both thirst and alertness (both $p < 0.01$), with no main effect of group. On average, thirst increased (35 ± 35 mm) and alertness decreased (-19 ± 31 mm) from V1 to V2. The prescribed increase in water intake (V3) revealed a significant interaction of time and group for both thirst and alertness (both $p < 0.01$). Independent-samples t-tests revealed that HIGH reduced thirst (-38 ± 37 mm) and increased alertness (18 ± 25 mm) significantly more than both LOW (thirst, -7 ± 37 mm; alertness -1 ± 24 mm) and CON (thirst, -6 ± 23 mm; alertness 0 ± 23 mm; all $p < 0.01$). There was no difference between LOW and CON (both $p > 0.92$). Repeated measures correlation analysis showed a negative relationship between change in alertness and thirst ($R^2 = 0.29$, $p < 0.01$). **CONCLUSION:** An inverse relationship

was observed between self-reported alertness and thirst. Following fluid restriction, drinking a larger volume of water (750-1000 mL) in the morning decreased thirst and increased alertness.

Investigation funded by Danone Research

2061 Board #217 May 30 2:00 PM - 3:30 PM
Exercise Induced Hypohydration Reduces Subsequent Ad-libitum Food Intake

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Reported Relationships: L.J. James: Industry contracted research; Funding from PepsiCo and LucozadeRibenaSuntory, with funds paid to the institution.

The relationship between hydration status and appetite regulation/energy intake is unclear. Animal models suggest hypohydration/reduced water availability suppresses food intake, but the effects in humans are less clear, with a paucity of research examining exercise-induced hypohydration. **PURPOSE:** To investigate the effects of exercise-induced hypohydration with or without post-exercise rehydration on *ad-libitum* energy intake, as well as selected appetite regulatory gut peptides.

METHODS: Twelve recreationally active, non-obese males (mean (SD) age 22±3 y; height 1.77 (0.06) m; body mass 77.7 (9.8) kg; $\dot{V}O_{2peak}$ 47 (9) mL/kg/min) completed a 75 min treadmill run at 65% $\dot{V}O_{2peak}$ in 24.5 (0.8) °C and 82 (4) % relative humidity without fluid intake, inducing body mass loss of 1.7 (0.4) %. Over the subsequent hour, subjects either rehydrated with water equivalent to 100% of body mass loss (REHY) or consumed no water so they remained hypohydrated (HYPO). A multi-item *ad-libitum* buffet lunch was then served, with subjects instructed to eat until 'comfortably full and satisfied'. Venous blood samples were taken before and after exercise and before lunch. **RESULTS:** Serum osmolality was higher, whilst plasma volume was lower pre-lunch during HYPO vs REHY ($P<0.05$). *Ad-libitum* energy intake at lunch was lower in HYPO (1149 (638) kcal vs 1399 (712) kcal; $P=0.024$), whilst *ad-libitum* water intake from drinks (733 (243) mL vs 344 (288) mL; $P=0.008$) and from food and drinks combined (1113 (330) mL vs 737 (366) mL $P=0.011$) were higher in HYPO. Additionally, fat ($P=0.042$) and salt ($P=0.046$) intake were lower in HYPO, whilst carbohydrate ($P=0.064$) and protein ($P=0.099$) intake tended to be lower in HYPO. Pre-lunch, acylated ghrelin concentration was lower in HYPO (48.7 (35.3) pg/mL vs 62.7 (33.5) pg/mL; $P=0.038$), but there was no difference between trials for PYY ($P=0.157$) or GLP-1 ($P=0.379$) concentrations. **CONCLUSION:** These data suggest that in healthy, non-obese males, exercise induced hypohydration without subsequent rehydration reduces acylated ghrelin concentration, as well *ad-libitum* energy intake. Exercise-induced changes in hydration should be carefully considered in situations where adequate post-exercise energy and nutrient replenishment are important. This project received no funding.

2062 Board #218 May 30 2:00 PM - 3:30 PM
Influence Of Different Hydration Levels On Artistic Gymnastics Performance In Preadolescent And Adolescent Gymnasts

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The effect of different hydration levels in artistic gymnastics performance has not been studied. **PURPOSE:** To examine the possible influence of different hydration levels in artistic gymnastics performance in preadolescent and adolescent gymnasts. **METHODS:** Eleven male preadolescent and adolescent artistic gymnasts [12.1 ± 0.8 (range 10-15) years old, 2.8 ± 0.2 (range 2-3.5) Tanner Stage; mean ± SE] performed two 3-hour identical training sessions separated by one week, while they ingested artificially sweetened water equivalent to either 50% (Low Volume; LV) or 150% (High Volume; HV) of the fluid lost in training. After training, in both trials participants performed the same programs in 3 apparatuses and were evaluated by an international level judge via the assistance of video. The fluid lost in training was identified during three similar preliminary training sessions, where gymnasts drank water *ad libitum*, and was observed that they replaced about 50% of their fluid lost. Hydration, dietary and training status were controlled before LV and HV trials which were performed in a random order and under similar environmental conditions (23.4 ± 0.3 °C and relative humidity 53-54 ± 2% in both LV and HV). Pre and post exercise differences between trials were analyzed using two-tailed t-tests, whereas responses over time were examined by 2-way ANOVA. **RESULTS:** The different volumes of

fluid provided established different hydration levels as indicated by the different urine specific gravity (USG) levels post-exercise (LV: 1.017 ± 0.002 vs. HV: 1.002 ± 0.001 ; $p < 0.001$), while pre-exercise USG were similar between conditions (LV: 1.018 ± 0.002 vs. HV: 1.015 ± 0.001 ; $p = 0.09$). The percentage of fluid lost was higher in LV ($1.2 \pm 0.2\%$) compared to HV ($0.4 \pm 0.1\%$) ($p = 0.02$), however, mean performance evaluation in the 3 apparatuses was not different between conditions (LV: 8.72 ± 0.21 vs. HV: 8.68 ± 0.20 ; $p = 0.57$). **CONCLUSIONS:** By ingesting fluid equivalent to about 50% of the fluid lost during a 3-hour training session, artistic gymnasts of about 12 years old maintain short-term hydration levels and avoid excessive dehydration ($> 2\%$). Ingesting a higher amount of fluid equivalent to about 1.5 times the fluid lost does not provide an additional benefit in terms of performance evaluation.

2063 Board #219 May 30 2:00 PM - 3:30 PM
The Effects of Mode of Rehydration on Subsequent Exercise-heat Challenge Performance

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PURPOSE: Athletes and soldiers routinely exercise in the heat for extended periods of time without matching fluid intake to sweat rate, risking impaired physiologic function and performance decrements. Intravenous and oral rehydration are both used to overcome performance decrements associated with dehydration. The purpose of this study was to examine the efficacy of mode of rehydration using athletically relevant dehydration-rehydration-exercise scenarios.

METHODS: Ten healthy, active men (age 23.3 ± 1.1 yr; height, 177.8 ± 2.8 cm; body mass, 81.4 ± 1.3 kg; body fat, $11.0 \pm 1.0\%$, $\dot{V}O_{2max}$, 58.8 ± 1.3 ml·kg⁻¹·min⁻¹) completed four trials consisting of overnight dehydration, exercise dehydration, rehydration, observation and an exercise-heat challenge (EHC) in a hot environment (35.6 ± 0.2 °C, $35.0 \pm 1.8\%$ relative humidity) differing only in rehydration mode. Participants were rehydrated to -2% of baseline weight over 30 minutes with intravenous (IV), oral (ORAL), $\frac{1}{2}$ IV + $\frac{1}{2}$ ORAL (I+O), or *ad libitum* (ADL) half-normal saline. For the EHC subjects completed a 25 min submaximal run followed immediately by an all-out maximal 0.5 mile run, five minutes rest, and five minutes of repetitive box lifting (RBL). Run time and number of boxes lifted per minute were recorded. Performance data was analyzed with a two-way repeated measures ANOVA.

RESULTS: Total number of boxes lifted was significantly lower in the ADL and ORAL trials (47.1 ± 9.5 , 46.3 ± 11.8 , respectively) compared to I+O (52.3 ± 11.1), but not IV (49.9 ± 12.2). Boxes lifted during minutes 1 and 5 were significantly higher than minutes 2, 3, and 4 for all trials. Performance times for the 0.5 mile run were not different among trials.

CONCLUSIONS: Partial rehydration via IV and oral fluids appears to have an ergogenic effect on high-intensity, total-body exercise in the heat possibly due to a combination of more rapid plasma volume restoration, oropharyngeal and gastric cues, as well as reduced gastric distention discomfort due to a lesser amount of oral fluids. These findings suggest a synergistic benefit to total-body performance with I+O between exercise bouts in the heat.

2064 Board #220 May 30 2:00 PM - 3:30 PM
Hydration And Gender Differences In Terms Of Non-oxidative Performance

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Nonoxidative performance is vital to the performance of many high level athletes (Armstrong, Johnson, McKenzie, Ellis, & Williamson, 2015; Chamari, Chaouachi, & Racinais, 2015). Many athletes are voluntarily hypohydrated through training as they do not properly rehydrate after a training session (Cengiz, 2015). The decrease in performance that accompanies changes in hydration can negatively impact athletes (Cengiz, 2015). **PURPOSE:** The present study examined the effect of hydration status on nonoxidative performance and to examine differences between the genders in terms of nonoxidative performance. **METHODS:** Twelve subjects, 6 males and 6 females, completed three sessions where a Wingate test was performed and lactate was measured. All subjects were NCAA Division III club or varsity athletes. The subjects completed a familiarization trial, a trial in the hypohydrated state and a trial in the hydrated state. The hypohydrated trial was completed after a 12 hr water restriction

in order to induce a 2-4% decrease in body weight. No weight was lost prior to the hydrated trial and urine specific gravity was below 1.010. **RESULTS:** No significant difference was found in terms of hydration and nonoxidative performance ($p = .082$, $\eta^2 = .27$). A significant difference was found in terms of gender and nonoxidative performance. Males had a higher nonoxidative capacity (9.01 W/kg ± 0.37 vs. 6.58 W/kg ± 0.37 , $p = .001$), nonoxidative power (13.51 W/kg ± 1.12 vs. 9.18 W/kg ± 1.12 , $p = .021$) and fatigue index compared to females (24.84 W/s ± 3.86 vs. 10.28 W/s ± 3.86 , $p = .024$). **CONCLUSION:** The results from this study indicate that hydration does not influence non-oxidative performance in NCAA Division III club or varsity athletes.

Female
 athletes within this study had a decreased nonoxidative performance compared to the male athletes. These results contradict previous findings that indicated that relative measures of nonoxidative performance did not vary between the genders when represented in relative terms (Maud & Shultz, 1986; Van Praagh, Fellman, Bedu, Falgairette & Coudert, 1990). Future research can be performed to look at differences in fat mass between the genders and the impacting collegiate athletes in terms of non-oxidative performance.

2065 Board #221 May 30 2:00 PM - 3:30 PM
Effects Of Caffeine Dose Timing On The Time-course Of Diuresis During Sodium-aided Hyperhydration.

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When used alone, both caffeine and sodium-aided hyperhydration (SAH) can be ergogenic. Caffeine, when used with SAH, promotes diuresis, but hyperhydration can be achieved, albeit at lower levels than with SAH alone. In previous caffeine and SAH work, caffeine induced diuresis occurred only within 15 min of consumption of a bolus of caffeine, NaCl, and H₂O. This suggests that caffeine-induced diuresis may occur for only 15 min after its consumption, and/or that the diuretic effect of caffeine is dependent on hydration levels. Caffeine has been shown to be ergogenic when taken as little as 5 min before exercise; thus, determining the temporal aspects of caffeine induced diuresis in conjunction with SAH may lead to better pre-exercise nutritional strategies. **PURPOSE:** To determine the effect of caffeine, consumed at different time-points, on diuresis over a 90 min SAH protocol. **METHODS:** Subjects were 17 males (23 ± 5 yr, 177 ± 8 cm, 83.4 ± 15.3 kg). Each performed 2, 90 min SAH trials beginning with a bladder void and measurement of urine specific gravity (USG) followed by ingestion of 15 mL H₂O · kg⁻¹ · min⁻¹ with one of two treatments: 70.5 mg NaCl + 5 mg caffeine · kg⁻¹ · min⁻¹ taken at the start of the trial (NaCaf0), or 70.5 mg NaCl · kg⁻¹ · min⁻¹ taken at the start and 5 mg caffeine · kg⁻¹ · min⁻¹ taken at 75 min of the trial (NaCaf75). After consuming the H₂O, subjects performed a measured bladder void every 15 min for 90 min. USGs were compared using a paired t-test. Urine excretions (UE) for each bladder void of the trials were expressed as a percentage of the total H₂O consumed and compared with a two-way repeated measures ANOVA and Sidak post hoc analyses. **RESULTS:** USGs were 1.007 ± 0.004 (NaCaf0), and 1.009 ± 0.004 (NaCaf75) ($P = 0.30$). UE for NaCaf0, and NaCaf75, respectively at the urine collection points were $15 \pm 9\%$, $7 \pm 6\%$ (15 min, $P < 0.01$), $15 \pm 5\%$, $9 \pm 2\%$ (30 min, $P < 0.01$), $18 \pm 5\%$, $14 \pm 4\%$ (45 min, $P = 0.05$), $15 \pm 5\%$, $11 \pm 6\%$ (60 min, $P = 0.05$), $10 \pm 5\%$, $8 \pm 6\%$ (75 min, $P = 0.25$), and $7 \pm 5\%$, $6 \pm 3\%$ (90 min, $P = 0.88$). **CONCLUSIONS:** Although consuming caffeine at the start of the trial resulted in significantly greater diuresis for the first 30 min of the trial, waiting to consume caffeine until 75 minutes after the consumption of the water and NaCl did not result in caffeine induced diuresis 15 min after consumption of the caffeine.

2066 Board #222 May 30 2:00 PM - 3:30 PM
Racial Differences in 24 Hour Urinary Hydration Markers

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Reported Relationships: W.M. Adams: Consulting Fee; Clif Bar & Company, BSX Technologies, Samsung. Industry contracted research; Statim Technologies, LLC.

Prior literature has investigated racial/ethnic differences in hydration status based on spot urine samples, however, no literature has examined these differences using 24 h urinary hydration measures.

PURPOSE: To examine 24 h urinary hydration markers in college-aged non-Hispanic White (WH) and non-Hispanic Black (BL) men and women.

METHODS: Thirteen men (BL, n=6; WH, n=7) and nineteen women (BL, n=16; WH, n=3) (mean \pm SD; age, 20 ± 4 y; height, 169.2 ± 12.2 cm; body mass, 71.3 ± 12.2 kg; body fat, $20.8 \pm 9.7\%$), combined from two separate research projects were included.

Participants provided a 24 h urine sample across 7 (n=13) or 3 (n=19) consecutive days (148 d total) for assessment of urine volume (U_{VOL}), urine osmolality (U_{OSM}), urine specific gravity (U_{SG}), and urine color (U_{COL}). Differences in 24 h hydration status between sex and ethnicity were assessed using linear mixed effects models with associated Bonferroni post hoc analyses. Significance was set a-priori at $p < 0.05$.

RESULTS: U_{VOL} was significantly lower in BL (0.85 ± 0.43 L) compared to WH college students (2.03 ± 0.70 L) ($p < 0.001$). Conversely measures of U_{OSM} , U_{SG} , and U_{COL} were significantly greater in BL (716 ± 263 mOsm \cdot kg $^{-1}$, 1.020 ± 0.007 , and 4.2 ± 1.4 , respectively) compared to WH college students (473 ± 194 mOsm \cdot kg $^{-1}$, 1.013 ± 0.006 , 3.0 ± 1.2 , and respectively) ($p < 0.05$). Independent of race, women were significantly less hydrated than men by measures of U_{VOL} (MD [95% CI]: -0.56 L [-0.823 , -0.308], $p < 0.001$), U_{OSM} (107 mOsm \cdot kg $^{-1}$ [24, 190], $p = 0.012$), U_{SG} (0.003 [0.001, 0.005], $p = 0.017$), and U_{COL} (-0.6 [-1.2 , -0.1], $p = 0.012$).

CONCLUSIONS: Based on 24 h urinary hydration markers, college-aged non-Hispanic Black men and women were inadequately hydrated compared to their non-Hispanic White counterparts when assessed over consecutive days. Furthermore, women were significantly less hydrated than men, independent of racial background. Given the importance of hydration on acute and long-term health, identifying populations that are inadequately hydrated may allow for the development of targeted strategies to improve habitual fluid intake. Future research examining 24 h hydration status coupled with fluid intake behaviors across a broader sample of races or ethnicities is warranted to further understand the determinants that guide drinking behaviors.

2067 Board #223 May 30 2:00 PM - 3:30 PM
Hydration Knowledge and Behavior in Youth Mountain Bike Teams

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Many youth sports organizations recognize the importance of educating on hydration practices and awareness, however, according to recent research current hydration education is not translating to effective practices. **PURPOSE:** The purpose of this study was to assess and describe the hydration knowledge and behavior of student-athletes participating in competitive youth mountain bike teams. **METHODS:** One hundred thirty-three student-athletes, 11-18 years were surveyed on hydration knowledge and behavior. Participants were apparently healthy and active members of a National Interscholastic Cycling Association Mountain Bike Team. **RESULTS:** The mean score for knowledge was 9.3 ± 1.5 (out of 15). Less than 30% of participants scored higher than 70% (≥ 10.5 out of 15). Adequate knowledge was described as $\geq 70\%$ of a maximal score of 15. Over 98% of participants understood the importance of fluids on performance, however, only 65% of participants received hydration education. Knowledge scores were significantly higher ($P < 0.05$) in those receiving hydration education; however mean knowledge scores were still low (9.5 ± 1.5). Mean knowledge scores increased by year in school but were still low. Post-exercise weight loss knowledge was varied between answers. Of those who felt their fluid intake during training or races was adequate, 70% had low knowledge scores. Girls reported they were less certain about being adequately hydrated than boys (Girls: 63%, Boys: 37%). Stopping in a race due to an excessive feeling of heat was significantly higher in boys (60%) than in girls (40%). **CONCLUSION:** Despite understanding the importance of keeping hydrated, mean knowledge scores indicated inadequate knowledge, while hydration behavior indicated inconsistency in translation of knowledge.

2068 Board #224 May 30 2:00 PM - 3:30 PM
Afternoon Urine Osmolality Is Equivalent To 24-h In Healthy 3-13 y Children

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While daily hydration is best assessed in a 24-h urine sample, using a urine spot sample can be more practical for healthcare professionals, researchers, and individuals. Although urine product is subject to circadian variation, 24-h urine concentration reported to be approximated from a mid- to late-afternoon spot urine sample in adults. However, no data exists in children. **PURPOSE:** To identify time windows during which spot values of urine osmolality (UOsm) is representative of 24-h values in healthy children.

METHODS: Among 541 healthy children (age: 3-13 y, female: 45%, BMI: 17.7 ± 4.0 kg \cdot m $^{-2}$), equivalent test was performed by comparing UOsm from specific time windows [morning (0600-1159), early afternoon (1200-1559), late afternoon (1600-1959), evening (2000-2359), overnight (2400-0559), and first morning (0600-0959)] to 24-h urine sample. The equivalency was determined when the mean difference and the confident interval between the spot and 24-h urine sample fell below the bound of 80 mmol \cdot kg $^{-1}$. The analysis was performed by using the first spot urine sample from each time window. Other spot urine samples after the first spot urine within each time window were not used to avoid unequally weighting data.

RESULTS: Equivalence test showed that the late afternoon (1600-1959) spot urine sample UOsm value was equivalent to the 24-h UOsm value in children ($P < 0.05$; mean difference: 62; CI: 45-78). The overall diagnostic ability of urine osmolality assessed at late afternoon (1600-1959) to diagnose elevated urine osmolality (> 800 mmol \cdot kg $^{-1}$) on the 24-h sample was "good" (area under the curve: 87.4%; sensitivity: 72.6%; specificity: 90.5%; threshold: 814 mmol \cdot kg $^{-1}$).

CONCLUSIONS: These data suggest that in free-living healthy children, 24-h urine concentration can be approximated from a late afternoon spot urine sample.

D-65 Free Communication/Poster -
Thermoregulation/Hyperthermia

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2069 Board #225 May 30 2:00 PM - 3:30 PM
Comparison of Skin Cleaning Methods for Measurement of Regional Sweat Electrolyte Concentrations

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Reported Relationships: S.D. Brown: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc..

Various skin preparation methods, ranging from MINIMAL (alcohol wipes) to more THOROUGH (e.g., shaving and cleaning), have been used to remove surface contamination prior to patch application for sweat electrolyte measurements. Using MINIMAL cleaning methods could improve athlete participation and the efficiency of sweat testing in the field, but it is unknown if this would result in higher sweat [Na^+], [Cl^-], and [K^+] due to insufficient removal of surface contamination. **PURPOSE:** To compare the effect of MINIMAL vs. THOROUGH skin cleaning methods on regional sweat [Na^+], [Cl^-], and [K^+].

METHODS: Thirteen subjects (7 male, 6 female; 23-45 y; 74.6 ± 15.8 kg) cycled at $\sim 80\%$ HR $_{max}$ in a warm laboratory (30°C, 50% rh) while sweat was collected from right (RDF) and left (LDF) dorsal forearms with absorbent patches (3M™ Tegaderm™ Pad). Prior to patch application (20 min before exercise), the RDF was shaved, cleaned with alcohol, wiped with deionized water, and dried with gauze (THOROUGH). The LDF was cleaned with alcohol wipes only (MINIMAL). Patches were removed upon adequate sweat absorption (0.60 ± 0.15 g, 57 ± 15 min). Sweat from absorbent patches was extracted via centrifuge and subsequently analyzed for [Na^+], [Cl^-], and [K^+] by ion chromatography. Regional sweating rate (RSR) was determined via gravimetry. **RESULTS:** There were no differences between MINIMAL and THOROUGH for sweat [Na^+] (54.4 ± 24.7 vs. 53.4 ± 23.8 mM, $p = 0.06$) or sweat [Cl^-] (45.2 ± 23.2 vs. 44.4 ± 22.2 mM, $p = 0.13$). Bland Altman 95% limits of agreement (LOA) were 4.0 to -2.2 mM and 4.8 to -3.0 mM for sweat [Na^+] and [Cl^-], respectively. Sweat [K^+] was higher with MINIMAL vs. THOROUGH cleaning (5.0 ± 0.8 vs. 4.5 ± 0.6 mM, $p = 0.001$; LOA: 1.3 to -0.3 mM). RSR was not different between cleaning methods (0.973 ± 0.411 vs. 0.954 ± 0.406 mg/cm 2 /min, $p = 0.75$; LOA: 0.435 to -0.397 mg/cm 2 /min).

CONCLUSIONS: MINIMAL cleaning of the skin with alcohol results in similar regional sweat [Na^+] and [Cl^-] compared with more THOROUGH preparation that includes shaving of hair and cleaning with alcohol and deionized water. Sweat [K^+] is statistically (but not practically) higher when MINIMAL cleaning is conducted. THOROUGH skin preparation prior to sweat testing may not be warranted; although future research in field conditions is needed to confirm that MINIMAL cleaning is adequate.

2070 Board #226 May 30 2:00 PM - 3:30 PM

Epifluidic Colorimetric Patch for On-Skin Analysis of Regional Sweat Chloride Concentration during Laboratory-based Exercise

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Reported Relationships: L.B. Baker: Salary; Gatorade Sports Science Institute, PepsiCo Inc. The views expressed in this abstract are those of the authors and do not necessarily reflect the position or policy of PepsiCo, Inc.

Assessing regional sweat electrolyte concentrations using standard patch techniques requires post-collection benchtop harvesting and analysis of sweat, which precludes real-time feedback to athletes. A technique enabling on-skin analysis is needed to advance the practicality of sweat testing. **PURPOSE:** To determine the accuracy and reliability of a novel epidermal microfluidic patch with built-in colorimetric assay (Epifluidic patch) to measure regional sweat [Cl⁻].

METHODS: Twenty-three subjects (15 male, 8 female; 18-42 y; 72.3±11.2 kg) cycled at 85% HR_{max} in a warm laboratory (30°C, 50% rh) while sweat was collected from the right and left ventral forearms with an Absorbent patch (3M Tegaderm+Pad) and Epifluidic patch (Epicore Biosystems, Inc.), respectively. A subset of subjects (n=9) completed two identical trials 2-4 days apart to determine test-retest reliability. Immediately after removal of the Absorbent patch, an image was taken of the Epifluidic patch on-skin with a digital single-lens reflex camera for analysis of [Cl⁻] via colorimetry. Sweat from the Absorbent patch was extracted via centrifuge and subsequently analyzed for [Cl⁻] by ion chromatography. Data are shown as mean±SD. **RESULTS:** There was no difference in sweat [Cl⁻] between Absorbent and Epifluidic patches (32.9±16.8 vs. 34.5±19.6 mmol/L, p=0.21). Bland-Altman Limits of Agreement between methods was -10.1 to 13.3 mmol/L. There was a significant correlation between patches (r=0.96, p<0.0001) and the coefficient of determination (r²) for predicting Absorbent from Epifluidic patch [Cl⁻] was 0.92. Based on Deming regression analysis, the slope and intercept of the regression line describing Absorbent vs. Epifluidic patch sweat [Cl⁻] were not different than 1 and 0, respectively. Sweat [Cl⁻] was not different between repeat trials for the Absorbent (1.4±4.4 mmol/L, p=0.36) or Epifluidic patch (-0.4±1.6 mmol/L, p=0.51) and test-retest CVs were 12% and 4%, respectively.

CONCLUSIONS: The Epifluidic patch provides accurate and reliable data for forearm sweat [Cl⁻] estimation during exercise in controlled laboratory conditions. Future research is needed to evaluate the Epifluidic Colorimetric Patch for on-skin analysis of sweat [Cl⁻] at other regional sites as well as during live practices and games.

2071 Board #227 May 30 2:00 PM - 3:30 PM

Skin Tattoos Do Not Affect Exercise-induced Sweat Rate Or Sodium Concentration.

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PURPOSE: Skin tattoos have been shown to reduce sweat rate and increase sweat sodium concentration when sweating is artificially stimulated. This study investigated whether similar responses are observed with exercise-induced sweating.

METHODS: Twenty-two healthy individuals (25.1±4.8 y (Mean±SD), 14 males) with a unilateral tattoo ≥11.4 cm² in size, >2 months in age, and shaded ≥50% participated in this investigation. Participants undertook 20 min of intermittent cycling (4 x 5 min intervals) on a stationary ergometer in a controlled environment (24.6±1.1°C, RH 64±6%). Resultant sweat was collected into absorbent patches applied at two pairs of contralateral skin sites (pair 1: Tattoo vs. Non-Tattoo; pair 2: Control 1 vs. Control 2 (both non-tattooed)), for determination of sweat rate and sweat [Na⁺]. Paired samples t tests were employed to determine differences between contralateral sites.

RESULTS: Tattoo vs. Non-Tattoo: Neither sweat rate (Mean±SD: 0.92±0.37 vs. 0.94±0.43 mg·cm⁻²·min⁻¹, respectively; p=1.000) nor sweat [Na⁺] (Median[IQR]: 36(32-53) vs. 37(31-45) mM·L⁻¹, respectively; p=0.827) differed. Control 1 vs. Control 2: Neither sweat rate (Mean±SD: 1.19±0.53 vs. 1.19±0.53 mg·cm⁻²·min⁻¹, respectively; p=0.917) nor sweat [Na⁺] (Median[IQR]: 29(26-41) vs. 31(25-43) mM·L⁻¹, respectively; p=0.147) differed. The non-significant differences for Tattoo vs. Non-Tattoo were within the range of normal variability (sweat rate CV=5.4%; sweat [Na⁺] CV=4.4%).

CONCLUSIONS: Skin tattoos do not appear to alter rate or [Na⁺] of exercise-induced sweat. The influence of skin tattoos on thermoregulatory responses to exercise may have been over-estimated.

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Comparison of Sports-Oriented Sweat Prediction Equation Performances During Running

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Reported Relationships: K.J. Sollanek: Other (please describe); Travel support for Dr. Sollanek provided by Sports Science Synergy, LLC.

PURPOSE: This study compared the performance of three sports-oriented sweat prediction equations against measurements made during outdoor running or indoor treadmill running with adequate airflow.

METHODS: Eleven open literature studies were identified where runner sweating rates (L/h) were carefully measured and reported from changes in body mass (n = 109). For studies that did not correct for non-sweat losses of body mass, a standardized correction of 0.20 g/kcal was subtracted from the reported sweating rates. Body mass, air temperature, relative humidity, running speed and distance or duration was provided in the published reports. A prospective field study of n = 37 volunteers was completed with n = 40 separate sweating rate observations made. Outdoor track testing was completed through a range of environmental conditions (temperature range: 10-31.3°C). The performance of three sports-oriented sweat prediction equations (H2QTM, Putnam, and Barr & Costill) was compared to measured sweating rates.

RESULTS: Measured sweating rates from the literature ranged from 0.417 to 2.129 L/h; track sweating rates ranged from 0.293 to 1.739 L/h. Agreement between measured (x-axis) and predicted (y-axis) sweating rates were assessed using the concordance correlation coefficient (CCC; ≥ 0.800). The relative error (RE; < 1.000) and accuracy (percent agreement; ≥ 70%) were also assessed using 0.250 L/h as an error acceptance threshold. For retrospective data (n = 109), the CCC ranged from 0.377 to 0.809; RE from 0.732 to 1.208; accuracy from 43 to 70%. For prospective data, the CCC ranged from 0.455 to 0.882; RE from 0.564 to 1.105; accuracy from 58 to 88%. In all instances the three equations performed better on the more highly controlled prospective data set. One equation (H2QTM) performed best on all three agreement parameters and on both data sets.

CONCLUSIONS: These results illustrate the difficulty of accurately predicting sweating rates in runners, but also the possibility of achieving good accuracy with the right equation.

2073 Board #229 May 30 2:00 PM - 3:30 PM

Validity And Reliability Of The CorTempTM Telemetric Pill During 50 H Of Reuse.

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Continuous measurement of rectal temperature using a telemetric pill (TP) inserted as a suppository has been validated. However, the use of TP may remain limited because of its high cost and single use. We have determined in our laboratory that the CorTempTM TP can be used repeatedly over time; in fact, it has a large battery autonomy, can be turned on and off at will and easily survives high-level disinfection. Reuse of the TP is made possible using a technique involving inserting the TP inside a condom, attaching it to a dental floss and introducing the TP inside the rectum with an over-the-counter suppository applicator. **PURPOSE:** The aim of the study was to examine the validity and reliability of CorTempTM TPs during repeated use in a water bath for a duration of 50 h. **METHODS:** Three TPs already used for less than 5 h each in a previous human study were tested in a water bath during 20 trials ranging from 1 to 5 h each, for a total of 50 h and with temperature variations ranging from 37 to 40°C. Trials were conducted in a randomized manner and temperatures of the TPs were compared to those of a wired rectal probe (YSI 401, WRP). After each trial, TPs were placed in a 2.5% glutaraldehyde solution for 20 min to achieve high-level disinfection, as recommended when a probe is used with a condom. The WRP and each TP were calibrated before the start of the experiment. Acceptable agreement between sensors was taken as a bias ≤ 0.2°C (sum of both instrument measurement errors). **RESULTS:** 50 h mean biases and random errors between TP 1, 2 and 3 and the WRP were of -0.09°C/±0.12°C, -0.10°C/±0.14°C and -0.12°C/±0.15°C, respectively. Mean biases and random errors at 17 h, 34 h and 50 h of reuse were of respectively -0.10°C/±0.11°C, -0.06°C/±0.11°C and -0.11°C/±0.11°C for TP 1 vs. WRP, -0.09°C/±0.13°C, -0.08°C/±0.12°C and -0.13°C/±0.16°C for TP 2 vs. WRP and -0.14°C/±0.17°C, -0.10°C/±0.13°C and -0.11°C/±0.12°C for TP 3 vs. WRP.

CONCLUSION: Our results indicate that the CorTempTM TP can be reused up to at least 50 h while still providing valid and reliable temperature readings. Furthermore, the CorTempTM TP can undergo high-level disinfection repeatedly while maintaining full structural and functional integrity.

2074 Board #230 May 30 2:00 PM - 3:30 PM
Validity of Calculated Core Temperature From Heart Rate Measured by an Electronic Vest

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 (No relevant relationships reported)

Recent technology has included development of ingestible pills and vests designed to monitor core and skin body temperatures. If accurate, they can be ideal in many field settings. However, little research has been performed to demonstrate the accuracy (validity) of this new technology. **PURPOSE:** We compared these new technologies with traditional modalities during 60 min of continuous cycle ergometer exercise at room (20° C) temperature. **METHODS:** Study participants included a convenience sample (N=18, 14 female, age:23.8±3.4 yr, wt: 70.4±11.6 kg, ht: 175.5±9.3 cm). Intensity for the first 30 min was set at a Power (watts, W) corresponding to individual participant RPE values of 12-13. Intensity increased to an RPE of 15-16 for the final 30 min of cycling, and W were adjusted accordingly. Heart rate (HR) was measured continuously (Polar). Core temperature was measured via a rectal (PROBE-C) thermistor and an ingestible pill (PILL). Skin temperature (PROBE-S) was measured at the arm, chest, thigh, and calf, and a mean value was calculated (Ramanathan, 1964). Core and skin temps were also estimated from a sensor electronics module located in a vest (VEST, Equivital) worn by each participant. Vest temperatures were calculated according to equations developed previously (Buller et al., 2013). Repeated measures ANOVA, Pearson correlations, and dependent t-tests were used to examine relationships among the various temperature measurement modalities (Alpha = p<0.05). **RESULTS:** HR averaged 125±25 and 151±18 b/min for the first and second 30 min of exercise, respectively. Likewise, Power averaged 81±22 and 97±22 W. While core temperatures were nearly identical at onset of exercise (~37.3° C), the three modalities differed after 60 min of cycling (PROBE-C; 37.9±0.8, PILL; 38.3±0.3, VEST; 38.6±0.4° C (p<0.05). Skin temperatures differed between PROBE-S and VEST at both beginning (31.2±1.1 vs 33.8±1.2° C) and end (32.9±1.5 vs 37.0±0.6° C) of exercise (p<0.01). Correlations among the various modalities were significant (p<0.05) and ranged from R=0.51 - 0.77, but did not differ from each other. **CONCLUSION:** The major study finding was that the vest estimated higher core and skin temperatures during exercise compared to traditional temperature measuring devices, overestimating work intensity at study ambient conditions.

2075 Board #231 May 30 2:00 PM - 3:30 PM
Physiological Strain Index Of Female Wheelchair Basketball Players During Competition

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Purpose: The purpose of this study was to assess the thermoregulatory responses and physiological strain of elite wheelchair (WC) basketball players during international competitions. **Methods:** Eleven female (n=11; 7 SCI and 4 Non-SCI) national team WC basketball players volunteered for the study. Testing occurred during a four-game series against the same international competitor (temp 22.1±1.2° C, RH 55±2%). Hydration habits were monitored and gastrointestinal temperature (T_{gi}), heart rate, and skin temperature (SkT) were recorded in real-time. **Results (mean±SD):** Athletes arrived hydrated for all games (urine specific gravity, 1.014±0.002). Players lost a mean of 0.5±0.1% body mass due to sweat loss and replaced ~69% of fluid losses. SCI athletes played 21±4 min and Non-SCI athletes played 14±6 min. SCI athletes had a mean SkT throughout the game of 35.2±0.2° C and Non-SCI of 36.2±0.2° C. SCI SkT rose a mean of 6.3±1.1° C and Non-SCI 6.8±0.9° C. SCI T_{gi} rose a mean of 1.0±0.2° C and Non-SCI a mean of 0.9±0.4° C. 2/10 players reached a T_{gi}>39° C (SCI athlete class 1, 39.4° C; Non-SCI class 4.5 athlete, 39.5° C). Mean physiological strain index (PSI) was 5.1±0.7 (range, 2.6-7.9). Athletes who played >50% of the game (n=4) had a mean PSI of 6.7±0.8 compared to athletes who played <50% of the game (n=6) who had a PSI of 3.9±0.7, with the greatest contribution to PSI from core temperature. **Conclusions:** Monitoring T_{gi} and PSI during competition is encouraged to understand competition specific responses and identify athletes more at risk of heat-related fatigue due to injury level and high playing time.

2076 Board #232 May 30 2:00 PM - 3:30 PM
Effects of Passive Heating on Perfusive and Diffusive Microvascular Oxygen Delivery

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 (No relevant relationships reported)

Previous studies have demonstrated that passive heating has led to increases in endothelial function and vasodilation of the brachial artery. The increase in

vasodilation is thought to originate from increased nitric oxide bioavailability, thus increasing blood flow into the limb. However, the different aspects of the downstream microvascular oxygen delivery (i.e. perfusive and diffusive) to the exercising muscle have yet to be described. **PURPOSE:** The purpose of this study was to determine the effect of seven days of passive heating on oxygen delivery during handgrip exercise. We tested the hypothesis that, 7 days of passive heating would result in a decrease in the diffusive oxygen delivery (total-[heme]) and an increase in the perfusive oxygen delivery (deoxy-[heme]) in the exercising muscle. **METHODS:** Three participants (2 women, 23.0 ± 1.0 yrs, 70.9 ± 15.7 kg, 171 ± 10.1 cm) participated in this study. Peak power was determined by an incremental two-hand handgrip exercise test. Subjects performed 10 minutes of dynamic handgrip exercise at 40% peak power pre and post 7 days of passive heating. Absolute concentrations of deoxy-[heme] and total-[heme] of the flexor digitorum superficialis muscle were measured continuously via frequency-domain multi-distance near-infrared spectroscopy (OxiplexTS, ISS). The passive heating protocol consisted of immersion up to the shoulder in a 40°C hot tub until rectal temperature reached 38.5°C or increased by 1°C for 60 minutes. Data reported as mean ± SE. **RESULTS:** From baseline to the last 30 seconds of exercise there was no significant difference in the Δ deoxy-[heme] (perfusive oxygen delivery) for pre (52.3 ± 2.2 μM) and post passive heating (47.6 ± 16.4 μM; p=0.822). However, the Δ total-[heme] (diffusive oxygen delivery) was significantly lower following passive heating (p<0.001). Pre and post passive heating Δ total-[heme] was 75.1 ± 13.8 μM and 30.7 ± 13.3 μM, respectively. **CONCLUSION:** The significant decrease in Δ total-[heme] after passive heating suggests that the diffusion of oxygen into the exercising muscle was reduced. This finding, along with no change in the perfusive oxygen delivery as represented by the Δ deoxy-[heme], suggests that the oxygen uptake of the exercising muscle was decreased.

2077 Board #233 May 30 2:00 PM - 3:30 PM
Effect of Heat and Humidity on the Inflammatory Response During Aerobic Exercise

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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the inflammatory responses via classical and trans signaling in response to aerobic exercise during exposure to different environmental conditions. **METHODS:** Recreationally active men (n=12, 24.4±3.1 yrs, 1.81±0.07m, 81.5±8.0kg, 47.2±4.8ml/kg/min) completed 5 experimental trials: a VO₂max test and cycling trials in 22°C/45% RH (MTMH), 22°C/70% RH (MTHH), 35°C/20% RH (HTLH), and 35°C/45% RH (HTMH). In each condition, participants cycled for 60 minutes at 60% VO₂max, rested for 15 minutes, cycled at 90% VO₂max until exhaustion (TTE), then recovered for 60 minutes. Blood was obtained before exercise (PRE), after the hour of cycling (60), after the TTE (90), and after recovery (REC). Blood was assessed for serum IL-6, IL-10, IL-1ra, TNF-α, sIL-6r, and IL-1β. Data were analyzed with repeated measures or Friedman's ANOVA. **RESULTS:** Main effects of time (F=97.13, p<0.001) and condition (F=4.08, p=0.018) were observed for IL-6. IL-6 increased from PRE (0.67±0.07 pg/ml) to 60 (4.79±0.77; p<0.001pg/ml) and 90 (p<0.001; 6.69±0.89 pg/ml), and decreased from 90 to REC (2.90±0.37 pg/ml; p=0.001). Concentrations were elevated during HTLH (4.16±0.54 pg/ml) compared to MTMH (3.42±0.53 pg/ml; p=0.037) and MTHH (3.30±0.43 pg/ml; p=0.041), and HTMH (4.17±0.34 pg/ml) compared to MTHH (p=0.038). A time effect for IL-10 (F=14.49, p=0.001) was observed with increases from PRE (0.34±0.04 pg/ml) to 90 (0.71±0.09 pg/ml; p=0.002), and no difference between conditions. An interaction was observed for IL-1ra (F=3.73, p=0.015), with concentrations increasing from PRE (276.67±29.28 pg/ml) to 90 (356.12±45.63 pg/ml; p=0.002), before peaking at REC (571.80±83.26 pg/ml; p<0.001). Changes were greater (p<0.05) during HTLH (467.81±78.82 pg/ml) and HTMH (440.29±61.85 pg/ml) than MTMH (295.06±21.08 pg/ml) or MTHH (325.45±60.03 pg/ml). An interaction was also observed for TNF-α (F=5.73, p=0.001) with increases during HTLH and HTMH from PRE (0.10±0.06 pg/ml) to 60 (1.06±0.07 pg/ml; p=0.002) and 90 (1.09±0.06 pg/ml; p<0.001). **CONCLUSIONS:** Data suggests high temperatures will initiate a pro-inflammatory response that may be countered by contraction-induced IL-6 response, and downstream increases in IL-1ra and IL-10.

Study partially funded by the Kent State University Research Council.

2078 Board #234 May 30 2:00 PM - 3:30 PM

Examining the Impact of a Prospective WBGT Heat Policy on High School Football PracticesRebecca M. Lopez, Patrick Gorrell, Gianluca Del Rossi.
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(No relevant relationships reported)

A wet bulb globe temperature (WBGT) policy with suggestions for practice modifications can potentially help decrease the number of exertional heat illnesses (EHIs) reported in high school football. It is unknown what impact such a policy would have on the number of outdoor football practices that would be cancelled or modified. **Purpose:** To assess WBGT during a full season of football at various high schools in Florida to determine how a regional WBGT policy would have impacted football practices. **Methods:** Environmental data was collected daily throughout the duration of the regular football season by athletic trainers stationed at 10 high schools in west central Florida. WBGT measures were recorded at approximately 4PM (R1) and again at 6PM (R2) to correspond with practice start and end times. These measures were then allocated into 5 previously defined, regional WBGT categories which corresponded to different activity modifications ranging from no modifications (WBGT < 27.8°C) to no outdoor practices (WBGT ≥ 33.4°C). An ANOVA was used to determine differences in WBGT between schools and across the various months during football season. **Results:** There were no statistical differences in the WBGT measures between the 10 schools at the R1 ($P = 0.655$) and R2 ($P = 0.446$) timepoints. Nearly 39% ($n = 169$) of all WBGT measures at R1 (~4PM) across the 10 schools were < 27.8°C and would not have required any practice modifications. Only 7.5% ($n = 33$) of the measures for this same R1 timepoint were ≥ 33.4°C which would have resulted in cancellation of practice. Fifty-seven percent ($n = 208$) of R2 WBGT measures were < 27.8°C while only 1.1% ($n = 4$) were ≥ 33.4°C. Also, the maximum WBGT measurement in August ($33.1 \pm 0.7^\circ\text{C}$) was significantly higher than in October ($28.6 \pm 0.7^\circ\text{C}$; $P = 0.000$) but similar to maximum WBGT in September ($32.7 \pm 0.9^\circ\text{C}$) and November ($31.0 \pm 1.9^\circ\text{C}$; $P > 0.05$). **Conclusion:** Our findings revealed that if existing regional heat guidelines would have been applied in Florida during our study, the policy would have resulted in the cancellation of outdoor practices on only a few days. It is also clear that the risk of dangerously elevated WBGT was not limited to preseason practices in August. Finally, delaying practices to later in the afternoon would likely decrease the risk of EHI and minimize the number of practices affected by a heat policy.

2079 Board #235 May 30 2:00 PM - 3:30 PM

An Evaluation of Race Car Cockpit Temperature as an Indicator of Thermal Strain in Race Car DriversSamuel C. Barthel, David P. Ferguson. *Michigan State University, East Lansing, MI.*

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(No relevant relationships reported)

Under current Federation Internationale de l'Automobile (FIA) rules, in endurance sports car racing, if ambient temperatures inside the cockpit of a racing car exceed 32°C, then the maximum time a driver spends in the race car is reduced. However, teams have instituted air conditioning in the car which may render this rule obsolete. **PURPOSE:** To evaluate if cockpit temperature of a racing car effects the thermal strain of racing driver with and without an air conditioning (AC) system. **METHODS:** Four male racing drivers had heart rate (HR), core temperature (T_{core}), physiological strain index (PSI) measured continuously during over 38 driving sessions including testing, practice, qualifying and a race. **RESULTS:** Cockpit temperature elicited a positive relationship, with each measured variable (slope \pm SE, r^2 , p -value); HR (1.842 ± 0.01655 , 0.62, <0.0001), T_{core} (0.08519 ± 0.002723 , 0.32, <0.0001), PSI (0.1899 ± 0.007706 , 0.24, <0.0001). There were no significant differences in slope with AC on or AC off when compared in each variable. HR with AC on (1.867 ± 0.0191) displayed no significant difference to AC off (1.784 ± 0.05187 , $p = 0.1332$). T_{core} with AC on (0.8546 ± 0.002751) exhibited no change compared to AC off (0.7572 ± 0.01899 , $p = 0.6118$). Lastly, PSI with AC on (0.1910 ± 0.007686) showed no difference with AC off (0.1561 ± 0.06305 , $p = 0.5828$). **CONCLUSIONS:** Air conditioning systems that are administered through the driver's helmet do not change the thermal strain caused by an increase in cockpit temperature. This concludes that the FIA's current use of cockpit temperature remains the most accurate way to estimate the thermal strain on the driver.

2080 Board #236 May 30 2:00 PM - 3:30 PM

Relationships between Body Temperatures Changes with Exercise PerformanceAdam R. Jajtner¹, Brittany N. Followay², Jeremiah A. Vaughan³, Elliott Arroyo¹, Brandon M. Gibson¹, Joseph A. Laudato¹, Ellen L. Glickman, FACSM¹. ¹Kent State University, Kent, OH. ²Ripon College, Ripon, WI. ³Bemidji State University, Bemidji, MN.

(Sponsor: Ellen Glickman, FACSM)

(No relevant relationships reported)

Purpose: To examine the relationship between changes in body temperature, and time spent above critical temperatures with aerobic performance and drinking behavior.

Methods: 12 recreationally active men (24.4 ± 3.1 yrs; 1.81 ± 0.07 m; 81.5 ± 8.0 kg; 47.2 ± 4.8 ml/kg/min) completed five experimental visits: a $\dot{V}O_{2\text{max}}$ test, and a cycling trial in 23°C/45%RH, 23°C/70%RH, 34°C/20%RH and 34°C/45%RH. During each cycling trial, participants completed 60 minutes of cycling at 60% $\dot{V}O_{2\text{max}}$, a 15min rest and a time to exhaustion (TTE) at 90% $\dot{V}O_{2\text{max}}$. Water intake, and TTE performance was collected in each condition. During each exercise session, participants were monitored continuously for their rectal temperature (T_{re}) and skin temperatures at five locations: Chest, Triceps, Forearm, Thigh and Calf. Total skin temperature (T_{sk}) and whole body temperature (T_{wb}) were calculated using weighted averages. The Area Under the Curve with respect to increase from baseline (AUCi) was then calculated for T_{re} , T_{sk} and T_{wb} . Data were analyzed as Pearson Product Moment Correlations between AUCi for T_{re} , T_{sk} and T_{wb} with water intake and TTE performance. Furthermore, the time spent above specific critical temperatures for T_{re} (37.5, 38.0, 38.5 and 39.0°C) and T_{wb} (35.0, 36.0, 37.0 and 38.0°C) were related to water intake at TTE performance using stepwise linear regression. **Results:** Significant correlations were observed between water intake with T_{sk} ($r = 0.469$; $p = 0.003$) and T_{wb} ($r = 0.511$; $p = 0.001$), though no significant correlation was observed for T_{re} ($p = 0.059$). Time spent with a T_{wb} above 35°C related to total water intake ($r = 0.521$; $p = 0.001$), though no critical T_{re} temperature was observed. TTE performance was significantly correlated with and T_{wb} ($r = -0.338$; $p = 0.036$), but not with T_{re} ($p = 0.179$) or T_{sk} ($p = 0.058$). Time spent with a T_{wb} above 37°C and T_{re} above 38.5°C was related to TTE performance ($r = 0.409$; $p = 0.010$; $r = 0.481$; $p = 0.002$, respectively). **Conclusions:** Data indicate that total water intake is driven by T_{wb} , and likely not influenced by T_{re} . TTE performance, however, is influenced by both T_{wb} and T_{re} . Future research should focus on establishing critical body temperatures to determine the points at which performance declines on an individualized basis. *This investigation was partially funded by Kent State University Research Council.*

2081 Board #237 May 30 2:00 PM - 3:30 PM

Comparison of Physiological Strain Index and Core Temperature Rise for Classifying Heat Tolerance Among WarfightersJay H. Heaney¹, Andrew J. Ordillie², Katherine M. Wilson³, Douglas M. Jones³. ¹Naval Health Research Center, San Diego, CA. ²Innovative Employee Solutions, San Diego, CA. ³Leidos Inc., San Diego, CA.

(No relevant relationships reported)

The heat tolerance test (HTT) is used by the military to assist with return-to-duty decisions for heat-injured warfighters. Criteria for determining heat tolerance are generally accepted as core temperature (T_{core}) < 38.6°C and heart rate (HR) < 160 bpm during 120 min of treadmill walking in a compensable heat stress environment. Additional information for classifying heat tolerance may be gained by evaluating the final 60 min of an HTT, as Druryan et al. (2013) determined a limit of < 0.45°C T_{core} increase during the final 60 min ($\Delta T_{\text{coreF60}}$). Use of calculations that encompass both T_{core} and HR, such as the physiological strain index (PSI), may also provide useful information to aid in return-to-duty decisions.

PURPOSE: To determine the validity of PSI increase during the final 60 min ($\Delta\text{PSI}_{\text{F60}}$) of an HTT for classifying heat tolerance and compare it with the $\Delta T_{\text{coreF60}}$ criterion established by Druryan et al. **METHODS:** Using traditional HR and T_{core} criteria, 15 males were classified as heat-tolerant (HT) (age: 27 ± 5 yrs, height: 177.2 ± 6.5 cm, weight: 82.4 ± 10.1 kg) and 15 males were classified as heat-intolerant (HI) (age: 27 ± 7 yrs, height: 177.3 ± 7.6 cm, weight: 86.7 ± 14.5 kg). $\Delta\text{PSI}_{\text{F60}}$ values were calculated for all subjects and compared with a previously determined $\Delta\text{PSI}_{\text{F60}}$ limit of 1.82 to confirm validity. Additionally, $\Delta\text{PSI}_{\text{F60}}$ was calculated for a sample of 77 male warfighters (age: 25 ± 5 yrs, height: 178.5 ± 7.1 cm, weight: 84.8 ± 10.1 kg) who were classified as HT/HI according to $\Delta\text{PSI}_{\text{F60}}$ and $\Delta T_{\text{coreF60}}$ thresholds. The number of misclassifications for $\Delta\text{PSI}_{\text{F60}}$ and $\Delta T_{\text{coreF60}}$ (Druryan et al.) were then compared. **RESULTS:** $\Delta\text{PSI}_{\text{F60}}$ threshold of 1.82 was validated by comparing it to $\Delta\text{PSI}_{\text{F60}}$ for HT and HI warfighters (HT: 0.54 ± 0.64 , $p < .001$; HI: 1.95 ± 0.72 , $p = .318$). Misclassifications of HT/HI for $\Delta\text{PSI}_{\text{F60}}$ and $\Delta T_{\text{coreF60}}$ were 8 (10%) and 7 (9%), respectively. Sensitivity and specificity of the proposed $\Delta\text{PSI}_{\text{F60}}$ HT/HI criterion were 97% and 54%, respectively, versus 95% and 70% for $\Delta T_{\text{coreF60}}$. **CONCLUSION:**

Findings suggest that $1.82 \Delta\text{PSI}_{\text{F60}}$ and $0.45^\circ\text{C} \Delta\text{T}_{\text{coreF60}}$ thresholds to determine heat tolerance yield a similar number of misclassifications. Future work should aim to refine these techniques to reduce the number of HT/HI misclassifications.

2082 Board #238 May 30 2:00 PM - 3:30 PM
Establishing a Physiological Strain Index Criterion During the Final Sixty Minutes of Heat Tolerance Testing

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(No relevant relationships reported)

The heat tolerance test (HTT) assesses cardiorespiratory and thermoregulatory capacity during heat stress using heart rate (HR) and core temperature (T_{core}) as pass/fail criteria, where HR and T_{core} may not exceed 160 bpm and 38.6°C , respectively. Additional information regarding physiological stress and heat tolerance may be derived from the physiological strain index (PSI), which provides a singular physiological strain value using HR and T_{core} measurements. To our knowledge, the change in PSI during the final 60 min of an HTT ($\Delta\text{PSI}_{\text{F60}}$) has not been evaluated as a potential criterion for classifying heat tolerance/intolerance during HTT. **PURPOSE:** The purpose of this study was to establish a criterion threshold for $\Delta\text{PSI}_{\text{F60}}$ and report on its ability to classify heat tolerance/intolerance during an HTT. **METHODS:** Seventy-seven US military men (age: 25 ± 5 yr, ht: 178.5 ± 7.1 cm, wt: 84.8 ± 10.1 kg) completed up to 120 min of continuous treadmill walking (3.3 mph, 4.0% grade) in 40°C and 40% relative humidity and were classified for their heat tolerance ($n = 64$) or heat intolerance ($n = 13$) using established T_{core} and HR criteria. A $\Delta\text{PSI}_{\text{F60}}$ was calculated for, and compared between, heat tolerant (HT) and heat intolerant (HI) subjects using an independent sample *t*-test. A maximal normal accepted value for $\Delta\text{PSI}_{\text{F60}}$ was calculated by taking the mean value of $\Delta\text{PSI}_{\text{F60}}$ for HT subjects plus two standard deviations. **RESULTS:** $\Delta\text{PSI}_{\text{F60}}$ was significantly less in HT subjects than in HI subjects (0.54 ± 0.64 vs 1.95 ± 0.72 ; $p < .001$). For HT subjects, a $\Delta\text{PSI}_{\text{F60}}$ maximal normal accepted value was determined to be 1.82. **CONCLUSION:** Findings indicate that $\Delta\text{PSI}_{\text{F60}}$ appropriately differentiated HT from HI subjects during an HTT in this population of military personnel. Therefore, we report that exceeding a $\Delta\text{PSI}_{\text{F60}}$ of 1.82 may serve as an additional criterion for classifying heat intolerance during HTT. Further work on the validation of this maximal normal accepted value for $\Delta\text{PSI}_{\text{F60}}$ is needed.

2083 Board #239 May 30 2:00 PM - 3:30 PM
Interpretations of Physiological Strain Index During Heat Tolerance Testing

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(No relevant relationships reported)

The heat tolerance test (HTT) assesses cardiorespiratory and thermoregulatory capacity during heat stress using core temperature (T_{core}) and heart rate (HR) as pass/fail criteria. Additional information regarding physiological stress and heat tolerance may be derived from the physiological strain index (PSI), which provides a representation of total physiological strain using T_{core} and HR measurements. Currently, there is minimal information available on the efficacy of various PSI interpretations, with respect to accurately identifying differences in physiological strain between those that have passed and failed an HTT. **PURPOSE:** To report different methods to evaluate physiological strain during HTT using PSI. **METHODS:** Eighty-two military personnel (age: 25 ± 5 yrs, height: 178.2 ± 7.2 cm, weight: 84.5 ± 9.9 kg) completed up to 120 min of continuous treadmill walking (3.3 mph; 4.0% grade) in 40°C and 40% relative humidity. PSI was calculated from T_{core} and HR measurements that were recorded every 5 min. PSI was then interpreted as trial mean, end of test (EOT), slope, and time-weighted (0 min - EOT) area under the curve (AUC) for subjects that passed and failed an HTT and compared using independent samples *t*-tests ($p < .05$). **RESULTS:** The trial mean PSI was significantly less in those that passed compared with those that failed the HTT (3.7 ± 0.7 vs 4.8 ± 0.3 ; $p < .001$). Similarly, EOT PSI was significantly less for subjects that passed compared with those that failed (4.7 ± 1.1 vs 6.8 ± 0.6 ; $p < .001$). Graphed as a function of time, the slope of the best-fit line for PSI was less in those that passed compared with those that failed (0.02 ± 0.01 vs 0.07 ± 0.03 ; $p < .001$). PSI was also calculated as AUC (pass: 416 ± 141 , fail: 453 ± 87 ; $p = .299$) and, when adjusted for trial time, resulted in a significantly lower PSI value for those that passed compared with those that failed (3.8 ± 0.7 vs 4.8 ± 0.3 ; $p < .001$). **CONCLUSION:** Findings indicate all PSI parameters investigated appropriately differentiated between subjects that passed and failed the HTT, resulting from either cardiorespiratory stress, thermoregulatory stress, or a combination of the two. Further work on the use of this index and its evaluation is warranted, as there are no defined criteria for HTT fail using PSI as an integrative value of total thermal strain.

2084 Board #240 May 30 2:00 PM - 3:30 PM
Thermal Behavior Does not Differ Between Sexes During and Following High Intensity Aerobic Exercise

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 (No relevant relationships reported)

Females utilize thermal behavior more than males during low intensity aerobic exercise. Core temperature is elevated during high vs. low intensity aerobic exercise because of greater heat production. Thus, thermal behavior is greater during high intensity exercise because of the heightened stimulus to behave. It is unknown if sex modulates thermal behavior during high intensity exercise.

Purpose: Test the hypothesis that thermal behavior differs between males and females during high intensity exercise and recovery.

Methods: 10 males (M) and 10 females (F) (23 ± 3 yr) underwent 30 min of cycling exercise at a power output that elicited $80 \pm 5\%$ (F) and $78 \pm 4\%$ (M) of $\text{VO}_{2\text{peak}}$ ($P = 0.28$) followed by 120 min seated recovery in a $27 \pm 1^\circ\text{C}$, $21 \pm 2\%$ relative humidity environment. Subjects were instructed to maintain a thermally comfortable neck temperature throughout using a custom-made neck device. Neck device temperature provided an index of thermal behavior. Mean skin (10 site) and core (intestinal) temperatures, mean skin wettedness (8 site), neck device temperature, skin blood flow (laser Doppler) and local sweat rate (ventilated capsule) were measured continually.

Results: There were no sex differences in heat production during exercise (F: 399 ± 68 , M: 429 ± 62 W/m^2 , $P = 0.39$). During exercise, core and mean skin temperatures, skin wettedness, skin blood flow and local sweat rate increased, while neck device temperature decreased (all $P < 0.01$). There were no sex differences in core (F: 37.7 ± 0.2 , M: $37.9 \pm 0.3^\circ\text{C}$, $P \geq 0.50$), mean skin (F: 32.6 ± 0.3 , M: $32.6 \pm 0.3^\circ\text{C}$, $P \geq 0.99$) or neck device (F: 12.1 ± 0.6 , M: $11.9 \pm 0.2^\circ\text{C}$, $P \geq 0.25$) temperatures, mean skin wettedness (at 30 min: F: 0.50 ± 0.06 , M: 0.53 ± 0.04 au, $P \geq 0.99$), skin blood flow (F: 163 ± 50 , M: 172 ± 36 PU, $P \geq 0.99$) or local sweat rate (F: 0.72 ± 0.20 , M: 0.85 ± 0.27 $\text{mg/cm}^2/\text{min}$, $P \geq 0.33$) during exercise (data reported at 30 min). During recovery, core and mean skin temperatures, mean skin wettedness, skin blood flow and local sweat rate decreased, and neck device temperature increased back towards pre-exercise levels (all $P < 0.01$). There were no differences in the dynamics of these changes between sexes (all $P \geq 0.16$).

Conclusions: Thermal behavior during and following high intensity aerobic exercise does not differ between males and females.

This study was funded by lululemon athletica inc.

2085 Board #241 May 30 2:00 PM - 3:30 PM
Exercise Intensity Independently Modulates Thermal Behavior During Exercise Recovery, But Not During Exercise

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Purpose: High intensity (HI) exercise stimulates greater heat production than moderate intensity (MI) exercise, but also reduces perceptual thermal sensitivity. Thus, thermal behavior may differ between HI and MI exercise. We tested the hypothesis that thermal behavior is greater during HI compared to MI exercise and recovery.

Methods: In a $27.0 \pm 0.4^\circ\text{C}$, $21 \pm 3\%$ RH environment, 20 subjects (10 females) cycled for 30 min at MI ($53 \pm 6\%$ $\text{VO}_{2\text{peak}}$) or HI ($78 \pm 6\%$ $\text{VO}_{2\text{peak}}$), followed by 120 min seated recovery. Mean skin (10 site) and core (telemetry pill) temperatures, and mean skin wettedness (8 site) were recorded continuously. Participants maintained a thermally comfortable neck temperature throughout using a custom-made device. Neck device temperature provided an index of thermal behavior. The weighted average of mean skin and core temperatures, and mean skin wettedness provided an indication of the mean afferent stimulus to thermally behave.

Results: Mean skin (by $+0.4 \pm 0.7^\circ\text{C}$, $P < 0.01$) and core (by $+0.4 \pm 0.3^\circ\text{C}$, $P < 0.01$) temperatures were higher at end exercise in HI. Mean skin temperature was not different between trials by 10 min recovery ($P \geq 0.96$). Core temperature was higher in HI until 90 min recovery ($P \leq 0.01$). Mean skin wettedness (by $+0.04 \pm 0.06$ a.u., $P = 0.03$) and the mean afferent stimulus (by $+2.5 \pm 3.5$ a.u., $P = 0.01$) were greater at 10 min of exercise in HI, and remained until 60 min into recovery ($P < 0.01$). The decrease in neck device temperature was greater in HI during exercise (at 30 min: by $-4.9 \pm 9.6^\circ\text{C}$, $P \leq 0.06$), but did not differ after 20 min recovery ($P \geq 0.60$). There were negative relationships between the mean afferent stimulus and neck device temperature for exercise (HI: $r = -0.91$, MI: $r = -0.96$, both $P < 0.01$) and recovery (HI: $r = -0.98$, MI: $r = -0.96$, both $P < 0.01$). During exercise, there were no differences in the slope (HI: -0.93 ± 0.31 ; MI: $-0.87 \pm 0.14^\circ\text{C/a.u.}$, $P = 0.49$) or y-intercept (HI: 43.4 ± 11.6 a.u., MI:

43.8±4.9°C a.u., $P=0.91$). During recovery, the slope was steeper (-0.94 ± 0.06 vs. $-0.77\pm0.78^\circ\text{C/a.u.}$, $P<0.01$) and y-intercept higher (49.3 ± 0.2 vs. $41.7\pm2.3^\circ\text{C}$, $P<0.01$) in HI.

Conclusions: Thermal behavior is greater during HI exercise due to a greater afferent stimulus to behave. However, the withdrawal of thermal behavior is augmented following HI versus MI exercise.

This study was funded by lululemon athletica inc.

2086 Board #242 May 30 2:00 PM - 3:30 PM Circulating Mcp-1 Associated With Prolonged Cycling In Hot Temperature

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(No relevant relationships reported)

Purpose: The purpose of this investigation was to examine the recruitment of classical monocytes during prolonged aerobic exercise in high temperature and humidity conditions. **Methods:** Seven recreationally active men (23.4 ± 3.0 yrs; 180.9 ± 5.8 cm; 85.1 ± 11.3 kg; 3.7 ± 0.27 L·min⁻¹) completed five trials: a graded exercise test, and four cycling trials in 37°C/23% Relative Humidity (RH)(HTLH), 37°C/33%RH (HTMH), 24°C/38%RH (MTMH), and 24°C/51%RH (MTHH) in a counterbalanced fashion. During the exercise protocol, participants rested supine for 15 minutes before completing 60-min of cycling at 60% $\dot{V}O_{2\text{max}}$, a 15-min rest, and cycling until exhaustion at 90% $\dot{V}O_{2\text{max}}$ (TTE), before 60 minutes of recovery. Blood samples were obtained prior to exercise (PRE), after 60 minutes of cycling (60), after the TTE (90) and following one hour of recovery (REC). Blood was assessed for plasma concentrations of Monocyte Chemoattractant Protein 1 (MCP-1) via ELISA, and CCR2 expression on classical monocytes (CD14+CD16-) via flow cytometry. Briefly, CCR2 expression was determined as fold change over fluorescence minus one (FMO). Data were analyzed using within-subjects repeated measures ANOVA. **Results:** A main effect for time was observed ($F = 8.9$; $p = 0.003$; $\eta^2_p = 0.560$) for MCP-1 in circulation. MCP-1 increased from PRE (183.8 ± 59.7 pg·mL⁻¹) to 60 (215.8 ± 74.1 pg·mL⁻¹; $p = 0.009$), 90 (231.6 ± 83.8 pg·mL⁻¹; $p = 0.006$), and REC (216.0 ± 88.3 pg·mL⁻¹; $p = 0.019$). Concentrations also increased from 60 to 90 ($p = 0.018$). A main effect of time was also observed ($F = 11.6$; $p = 0.009$; $\eta^2_p = 0.659$) for CCR2 expression on classical monocytes. No differences in CCR2 expression were observed between PRE (147.4 ± 50.6), and 60 (146.0 ± 70.8 ; $p = 0.869$), however decreases from PRE were observed at 90 (131.1 ± 39.7 ; $p = 0.023$), and REC (102.2 ± 37.1 ; $p < 0.001$). **CONCLUSION:** These data indicate that high temperature and/or humidity conditions do not impact recruitment of classical monocytes. Furthermore, prolonged cycling appears to increase circulating MCP-1 and decrease CCR2 expression on classical monocytes. Collectively, this may indicate a limited effect of aerobic exercise on the overall recruitment of classical monocytes, although further research is warranted.

This investigation was partially funded by the Kent State University Research Council.

2087 Board #243 May 30 2:00 PM - 3:30 PM Heat Acclimation Causes Profound Post-Exercise Hypotension and Favorable Improvements in Lipid and Immune Profiles

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(No relevant relationships reported)

Purpose: We have previously reported that passive hyperthermic exposure causes an acute hypotensive response. The animal literature has shown that chronic heat stress causes alterations in metabolic and lipid metabolism. However, it is unknown if heat acclimation also causes chronic blood pressure and lipid responses in humans. This project tested the hypothesis that 10-day exercise-heat acclimation (HA) would cause greater post-exercise hypotensive responses and alter metabolic, lipid, and immune profiles compared to 10-day exercise under neutral conditions (CON).

Methods: Twelve healthy sedentary subjects (7M/5F, 28±6y, 78±17kg), completed a 10-day (90min/day exercise bout) clamp controlled (internal work-rate) hyperthermia HA (42°C, 28% RH) and control (CON: 23°C, 42% RH) protocols in a counterbalanced design separated by at least 2 months. Pre- and post-exercise HA/CON blood pressure was taken post-exercise over 1 hour after day 1 and day 10 exercise. Metabolic, lipid and immune panels were taken pre-post HA/CON.

Results: Exercise under heat stress had greater post-exercise hypotension (systolic; -6mmHg, diastolic -8mmHg; and mean arterial pressure, -7mmHg) on day 1 and day 10 compared to exercise under neutral conditions (main effect for condition,

$P<0.004$). Only from pre-to-post HA, total cholesterol (170 ± 22 to 152 ± 15 ; $P<0.02$) and triglycerides (130 ± 63 to 93 ± 27 ; $P<0.03$) were reduced. A trend for changes in glycemic control (%A1c; 5.4 ± 0.3 to 5.3 ± 0.4 ; $P<0.06$) neutrophils ($52.3\pm5.6\%$ to $57.5\pm4.0\%$; $P<0.09$), lymphocytes ($37.9\pm5.7\%$ to 32.9 ± 3.0 ; $P<0.07$), and eosinophils (2.4 ± 1.7 to 3.1 ± 0.1 ; $P<0.06$) were found after HA.

CONCLUSIONS: These preliminary data indicate that HA causes a profound post-exercise hypotensive response and favorable metabolic, lipid, and immune profile changes. Further examination of heat acclimation on vascular, metabolic, and immune responses will offer insight for benefits in other clinical populations with vascular, metabolic and immune dysfunction.

2088 Board #244 May 30 2:00 PM - 3:30 PM Quantifying the Environmental Thermal Conditions that Exist During Summer Track Meets in South Texas

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(No relevant relationships reported)

Purpose: To quantify the environmental thermal conditions that track & field officials, volunteers and track & field athletes are exposed during June and July in south Texas. **Methods:** Five summer track meets were selected from the Texas Amateur Athletic Federation (TAAF) competition season during June and July for analysis. Air temperature, heat stress index, web bulb globe temperature, relative humidity, thermal work limit, and ultraviolet index (UVI) were recorded at 8 a.m., 10 a.m., Noon, 2 p.m., and 4 p.m. with a handheld wet bulb globe temperature (WBGT) Kestrel 0854TAN Heat Stress Tracker (TEquipment.net). **Results:** The mean temperature reading, standard deviation, and standard error for the five track meets throughout the duration of the track meets were 8 a.m. $81.4^\circ\text{F} \pm 2.02$ (0.9); 10 a.m. $86.36^\circ\text{F} \pm 3.73$ (1.7); Noon: $91.68^\circ\text{F} \pm 5.20$ (2.3); 2 p.m. $91.84^\circ\text{F} \pm 6.34$ (2.8); and 4 p.m. $92.38^\circ\text{F} \pm 10.16$ (4.5). The mean heat stress values were 8 a.m. 89.56 ± 2.82 (1.3); 10 a.m. 98.66 ± 9.40 (4.2); Noon: 106.22 ± 9.27 (4.1); 2 p.m. 102.68 ± 8.19 (3.7); and 4 p.m. 103.68 ± 10.49 (4.7). The mean wet bulb globe temperature readings were 8 a.m. 76.8 ± 2.94 (1.3); 10 a.m. 82.2 ± 4.65 (2.1); Noon: 81.4 ± 4.98 (2.2); 2 p.m. 80.32 ± 7.62 (3.4); and 4 p.m. 78.76 ± 5.95 (2.7). The mean relative humidity readings were 8 a.m. 80.32 ± 4.75 (2.1); 10 a.m. 72.8 ± 6.89 (3.1); Noon: 55.92 ± 7.97 (3.6); 2 p.m. 54.52 ± 11.03 (4.9); and 4 p.m. 59.08 ± 9.76 (4.4). The mean thermal work limit readings were 8 a.m. 161.56 ± 12.06 (5.4); 10 a.m. 155.8 ± 17.76 (7.9); Noon: 139.54 ± 26.98 (12.1); 2 p.m. 152.2 ± 46.21 (20.7); and 4 p.m. 166.56 ± 33.78 (15.1). The mean UVA index readings were 8 a.m. 0.1 ± 0.0 (0.0); 10:00 a.m. 2.68 ± 1.11 (0.5); Noon: 8.14 ± 1.60 (0.7); 2 p.m. 8.56 ± 2.23 (1.0); and 4 p.m. 6.66 ± 2.11 (0.9). **CONCLUSIONS:** Data suggests that the thermal conditions from June to July in south Texas are considered "low alert" based on the Event Alert System used by the ACSM and other organizations, such as the Bank of America Chicago Marathon. Based on UVA index data, participants and track meet officials should wear sunscreen. Although data suggest "low alert," track & field officials should consider starting summer track meets at 4 p.m. when heat variables begin to diminish.

2089 Board #245 May 30 2:00 PM - 3:30 PM Metabolic Recovery Response During Seated Rest In Hot Environment

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(No relevant relationships reported)

Purpose: The purpose of this study was to examine the metabolic recovery response during seated rest in a hot and moderate environmental condition after a prolonged cycling bout. **Methods:** Eleven recreationally active men (23.6 ± 2.6 yrs; 180.9 ± 6.8 cm; 85.3 ± 10.8 kg; 3.8 ± 0.42 L·min⁻¹) completed a recovery session under two conditions: 22°C/45%RH (MT) and 35°C/45%RH (HT). Prior to recovery session, each participant completed a 60-min cycling trial at 60% $\dot{V}O_{2\text{max}}$ and a time-to-exhaustion trial at 90% $\dot{V}O_{2\text{max}}$. Data were collected during the 3min (M3), 15min (M15) 30min (M30), and 60min (M60) of the 60-min recovery. Metabolic variables assessed were $\dot{V}O_2$, RER, VE, and HR. Data were analyzed using within-subjects repeated measures ANOVA. **Results:** A significant interaction was observed for $\dot{V}O_2$ ($F = 2.788$, $p = 0.043$, $\eta^2 = 0.258$). Post-hoc analysis indicated a main effect of time during MT ($F = 8.097$, $p < 0.001$, $\eta^2 = 0.503$), but not HT condition ($F = 2.433$, $p < 0.065$, $\eta^2 = 0.213$). Specifically, during the MT, $\dot{V}O_2$ was significantly lower at M15 ($p < 0.001$), M30 ($p = 0.015$), M45 ($p < 0.001$) and M60 ($p < 0.001$) compared to M3. Furthermore, $\dot{V}O_2$ was significantly lower during the HT condition compared to MT during M60 ($p < 0.001$). No significant interaction was observed for VE ($F = 1.384$, $p = 0.261$, $\eta^2 = 0.148$). A significant main effect of time was observed ($F = 11.818$, $p < 0.001$, $\eta^2 = 0.596$). M15, M30, M45, and M60 were significantly lower compared to M3 ($p = 0.05$). No significant interaction was observed for RER ($F = 1.566$, $p = 0.207$,

$\eta^2 = 0.164$). A significant main effect of time was observed for RER ($F = 3.319$, $p = 0.022$, $\eta^2 = 0.293$). M15, M30, M45 and M60 were significantly lower compared to M3 ($p = 0.05$). A significant interaction was observed for HR ($F = 2.702$, $p = 0.046$, $\eta^2 = 0.231$). Post-hoc analysis indicated a main effect of time during both MT ($F = 21.441$, $p < 0.001$, $\eta^2 = 0.704$) and HT ($F = 11.022$, $p < 0.001$, $\eta^2 = 0.524$). Specifically, during both MT and HT, HR was significantly lower at M15, M30, M45, and M60 ($p < 0.05$) compared to 3M. Furthermore, HR was significantly lower during the MT compared to the HT condition during all time points ($p < 0.05$), except M30 ($p = 0.081$).

Conclusion: Data suggests recovery is moderately impacted in a high temperature conditions compared to a moderate condition after a submaximal and maximal exercise bout determined by elevated HR.

2090 Board #246 May 30 2:00 PM - 3:30 PM
Wireless Real-Time Transistor-Based Skin Temperature Data Acquisition System

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 (No relevant relationships reported)

Environmental physiology studies rely on the accurate measurement of skin and internal temperatures. Many traditional skin temperature systems utilize thermistor or thermocouple measurements. However, utilizing a transistor-based sensor allows for a more linear data set, which could provide more stability, thus allowing for a more robust and accurate measurement over a range of environmental conditions. Field Programmable Gate Arrays (FPGA) are relatively low cost and low power consuming programmable hardware devices that allows for a signal to be processed and viewed in real time. Combining the processing power of the FPGA and the heightened accuracy of transistor-based analog temperature sensors, a modernized data acquisition (DAQ) system could provide linearized real time data.

PURPOSE: To design a wireless patch-type transistor-based skin temperature DAQ system that will provide a more accurate and linear set of data for measurement in hot/humid/cold/altitude environments, and will be sufficiently robust for outdoor field studies.

METHODS: We designed and built a prototype wireless transistor-based skin temperature DAQ that implements a precision analog temperature sensor to acquire skin temperature and FPGA technology for signal processing. The tested accuracy for the precision analog temperature sensor is ± 0.05 - 0.1°C in a temperature range of 20°C to 42°C . By utilizing FPGA technology, the system will process, pack, and wirelessly send data to a computer for real time monitoring.

RESULTS: In preliminary testing, the FPGA system showed an overall lower power consumption in addition to less variability in Voltage (V), the signal upon which temperature measurements depend. Over a 5°C temperature change it was seen that the FPGA system had a variance of 3.7×10^{-11} V, while a thermistor based temperature system had a variance of 1.3×10^{-3} V. In most settings, this will result in a substantially lower power consumption using our new system.

CONCLUSION: Our data suggest that our new FPGA approach is superior to traditional skin temperature measurements in its ability to rapidly attain and maintain accurate temperature readings. Next steps include field testing the device over a wide range of temperature, wind and humidity conditions.

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2091 Board #247 May 30 2:00 PM - 3:30 PM
Prefrontal Cortex Oxygenation and Haemodynamics during a Long Duration Incremental Exercise Protocol while wearing Personal Protective Equipment

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(No relevant relationships reported)

Heat stress has been shown to effect cerebral oxygenation and haemodynamics. There is although limited research evaluating the effects of rapid and uncompensable core temperature (T_c) acquisition, as which occurs when one is wearing personal protective equipment (PPE), on cerebral oxygenation and haemodynamics. **PURPOSE:** To determine the effects of rapid and uncompensable T_c acquisition on cerebral oxygenation and haemodynamics. **METHODS:** Fourteen male subjects (33.6 ± 12.1 years) performed an incremental treadmill test to a termination point in a control session (CON) and an experimental session (PPE). Changes in oxy-haemoglobin (O_2Hb), deoxy-haemoglobin (HHb), total haemoglobin (tHb), and tissue oxygen saturation index (TSI %) were monitored in the left and right prefrontal cortex (PFC) using near-infrared spectroscopy (NIRS). Heart rate (HR), thermal comfort scale (TCS) and thermal sensation (TS) were also recorded at each 0.5°C increase in T_c . **RESULTS:** Time to termination (TTT) was significantly different ($p \leq 0.05$) between CON (77.3 ± 22.8 min) and PPE (50.3 ± 12.4 min). Subjects also showed significantly lower ($p \leq 0.05$) HR throughout CON (pre = 76.8 ± 8.6 bpm; post = 161.1 ± 20.7 bpm) when compared to PPE (pre = 86.5 ± 9.3 bpm; post = 179.6 ± 11.7 bpm). Significant differences were also between CON and PPE end-exercise T_c ($\text{CON} = 38.57 \pm 0.3^\circ\text{C}$;

$\text{PPE} = 39.01 \pm 0.3^\circ\text{C}$), TCS ($\text{CON} = 3.57 \pm 0.6$; $\text{PPE} = 4.63 \pm 0.3$), and TS ($\text{CON} = 7.57 \pm 0.5$; $\text{PPE} = 8.67 \pm 0.3$). Lastly, there was a $0.04^\circ\text{C}/\text{min}$ increase in T_c during PPE and a $0.02^\circ\text{C}/\text{min}$ increase in T_c during CON. Important NIRS results were a plateau in left-side O_2Hb and tHb at $T_c 38^\circ\text{C}$ in both CON and PPE, 80% of TTT in CON, and 60% of TTT in PPE. Additionally, there was increased left-side PFC activation during PPE as indicated by a significant decrease ($p \leq 0.05$) in TSI % from start to end of exercise (Start = $70.9 \pm 4.9\%$; End = $68.2 \pm 5.9\%$) and double the decrease in TSI %/min in PPE when compared to CON. **CONCLUSION:** These data suggest that rapid and uncompensable T_c acquisition causes an altered cerebral oxygenation and haemodynamic response in the left-side PFC. There were no changes in the cerebral oxygenation and haemodynamic response during CON. The left-side response during PPE could have implications for cognitive processes during and/or following exercise in the heat.

2092 Board #248 May 30 2:00 PM - 3:30 PM
The Effect of Rapid and Slow Heat Acquisition on Body Weight and Blood Glucose Levels

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(No relevant relationships reported)

Body water loss due to thermoregulation during exercise in a hot environment may cause a significant decrease in body mass, affecting blood plasma volume and consequently parameters such as blood glucose (BG) concentration. It is not known if the increased rate of thermal acquisition that occurs as a result of exercise in a microclimate such as personal protective equipment impacts BG concentrations differently than a slower rate of thermal acquisition. **PURPOSE:** The purpose of this study was to determine if rapid heat acquisition impacts body mass, urine specific gravity (USG) and BG concentration differently than slow heat acquisition during exercise. **METHODS:** Fourteen healthy male subjects (mean age, 33.6 ± 12.1 years) performed an incremental exercise test to a termination criterion in a control session (CON) and an experimental session (PPE). Body mass, USG and BG were measured before and after each trial. **RESULTS:** Rate of thermal acquisition was significantly different ($p < 0.001$) between CON ($0.02 \pm 0.04^\circ\text{C}/\text{min}$) and PPE ($0.04 \pm 0.19^\circ\text{C}/\text{min}$). Time to termination (TTT) was also significantly different between CON (77.3 ± 22.8 min) and PPE (50.3 ± 12.4 min) and subjects also showed a lower HR throughout CON (pre = 76.8 ± 8.6 bpm; post = 161.1 ± 20.7 bpm) when compared to PPE (pre = 86.5 ± 9.3 bpm; post = 179.6 ± 11.7 bpm). Both conditions resulted in an identical and significant loss of total body mass (1.45 ± 0.62 kg; $p < 0.05$), with a corresponding increase in USG ($p < 0.01$). Despite body water loss, no significant change in blood glucose concentration occurred pre- to post-exercise in either condition ($\text{BG}_{\text{CON}} = -0.04 \pm 853$ mmol L^{-1} ; $\text{BG}_{\text{PPE}} = 0.34 \pm 93$ mmol L^{-1}). **CONCLUSION:** This data suggests that constant levels of blood glucose concentration are maintained regardless of rate of heat acquisition and despite body water loss that would affect plasma concentration.

2093 Board #249 May 30 2:00 PM - 3:30 PM
Effect of Dietary Nitrate Supplementation with Beet Root Juice on Thermoregulatory and Cardiovascular Responses to Extreme Heat in Aged Humans

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(No relevant relationships reported)

PURPOSE: To test the hypothesis that dietary nitrate supplementation with beet root juice attenuates cardiovascular and thermal strain in aged individuals during prolonged non-encapsulated environmental heat stress. **METHODS:** Study participants were eight healthy, normotensive, non-obese, aged individuals (66 ± 5 years; BMI: 24.6 kg/ m^2 ; five females). Before (PRE) and after (POST) 1 week of daily nitrate supplementation with concentrated beet root juice (140 ml twice daily), participants were exposed to 42.5°C and 35% relative humidity conditions for 2 h. Core and skin temperatures, arterial blood pressures, heart rate, cutaneous blood flow and vascular conductance, and forearm blood flow and vascular conductance were measured throughout the exposure. **RESULTS:** Following nitrate supplementation, mean arterial pressure decreased from 88 ± 5 to 80 ± 7 mmHg ($P = 0.02$) in thermoneutral conditions. During a subsequent heat stress, mean arterial pressure was significantly lower POST vs. PRE (treatment x time interaction: $P < 0.01$); however, this effect was limited to the first 30 min of the heat exposure. No effect of dietary nitrate supplementation was observed on core temperature, mean skin temperature, heart rate, cutaneous blood flow, cutaneous vascular conductance, forearm blood flow, and forearm vascular conductance throughout heat stress ($P > 0.05$). **CONCLUSION:** Our results indicate that in aged individuals, dietary nitrate supplementation does not attenuate thermal strain, and only transiently reduces cardiovascular strain, during extreme heat stress.

2094 Board #250 May 30 2:00 PM - 3:30 PM
Effects On Skin Temperature of Marathon Running in a Hot Humid Environment

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Participating in marathons in hot and humid weather may lead to fatigue, syncope, injuries or even death. In the diagnosis and monitoring of delayed onset muscle soreness and fatigue status, infrared thermography (IRT) has been used as a non-invasive method for the assessing skin temperature as a response of muscle hyperthermia after exercise.

Purpose: Analyze the effect of running a marathon in a hot and humid environment on skin temperature.

Methods: Seventeen amateur runners (age 35.82 ± 7.03 years, weight 66.79 ± 11.97 kg, height 168.44 ± 10.59 cm, $\dot{V}O_{2peak}$ 52.88 ± 7.09 ml/kg/min) had their lower limb skin temperature measured using trough IRT (FLIR T450) after running a marathon (0-80 m.a.s.l.) in a hot (thermal index 28.34 ± 3.27 °C) and humid environment (~81 %), the measures were taken in a temperature controlled room (23°C). Both dominant (DLL) and non-dominant (NDLL) lower limbs were divided for analysis into fourteen different areas and mean temperature of each area was used for analysis. A one-way ANOVA were used to compared thermal images taken 15 days and before marathon and 24 hours and 6 days after marathon.

Results: We found significant differences in skin temperatures: knee (DLL: $F_{(3,48)}: 5.14, p=0.004$); Vastus lateralis (DLL: $F_{(3,48)}: 7.191, p<0.01$; NDLL: $F_{(3,48)}: 4.883, p=0.005$); Rectus femoris (DLL: $F_{(3,48)}: 5.956, p=0.002$; NDLL: $F_{(3,48)}: 5.521, p=0.002$); Vastus medialis (DLL: $F_{(3,48)}: 5.079, p=0.004$; NDLL: $F_{(3,48)}: 7.214, p<0.001$); Adductor (DLL: $F_{(3,48)}: 4.097, p=0.011$; NDLL: $F_{(3,48)}: 5.702, p=0.002$); biceps femoris (DLL: $F_{(3,48)}: 18.952, p<0.01$; NDLL: $F_{(3,48)}: 15.105, p<0.01$); popliteal fossa (DLL: $F_{(3,48)}: 11.103, p<0.01$; NDLL: $F_{(3,48)}: 11.598, p<0.001$); semitendinosus (DLL: $F_{(3,48)}: 14.382, p<0.01$; NDLL: $F_{(3,48)}: 15.000, p<0.01$); lateral gastrocnemius (DLL: $F_{(3,48)}: 15.007, p<0.01$; NDLL: $F_{(3,48)}: 10.316, p<0.01$); and medial gastrocnemius (DLL: $F_{(3,48)}: 7.567, p<0.01$). Significant differences in all areas mentioned were found between measures: pre 15d < post 24h, pre marathon < post 24h y post 24h > post 6d.

Conclusions: Running a marathon in hot, humid environment leads to significant increases in lower limb skin temperature and the temperature levels returned to baseline values after 6 days of recovery.

D-66 Free Communication/Poster - Endocrinology

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

2095 Board #251 May 30 3:30 PM - 5:00 PM
Myokine Responses To Resistance Exercise In Prader-Willi Syndrome

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Background: Caloric restriction and daily exercise are needed to prevent morbid obesity in individuals with Prader-Willi Syndrome (PWS). Resting and activity energy expenditure are lower in PWS than in BMI-matched controls. Hypotonia, decreased muscle mass, and cognitive impairment make exercise particularly challenging for this population. Myokine responses to RT may have beneficial metabolic effects and promote caloric expenditure.

PURPOSE: Determine if young PWS adults can perform a RT program and evaluate their myokine response compared to age & BMI-matched controls. **METHODS:** Each study group included 11 participants (7 men and 4 women), ages 30.7 ± 4.6 & 30.1 ± 4.3 years, and BMI 28.3 ± 4.3 and 28.2 ± 4.2 kg/m² for PWS & controls respectively (NS). Blood samples for glucose, creatine kinase (CK), lactate, HbA1C, and myokines were obtained before and after performing a program of eight resistance exercises of large muscle groups (3-4 sets of 12 repetitions). Additional blood samples were drawn 30 & 60 minutes after completing the RT. Myokines were assayed using a multiplex myokine panel (Merck). Paired t-test was used for comparing results for PWS vs controls. The unpaired t-test was used for comparing peak laboratory values with basal levels.

RESULTS: Basal levels of glucose, HbA1C, and lactate were similar for PWS & controls but CK was lower in PWS vs controls (62 ± 54 vs 322 ± 333 U/L, $p<0.04$).

Peak lactate was 3.7 ± 2.2 in PWS vs 7.3 ± 2.2 in controls ($p<0.001$). Interleukin-6 (IL-6) increased by 41 ± 52 percent over baseline in PWS ($p<0.03$) and by 35 ± 32 percent in controls ($p<0.007$). Following exercise, peak brain-derived neurotrophic factor (BDNF) levels were 44 ± 47 percent over baseline in control males ($p<0.006$) but did not increase in PWS males or in females. Positive responses of BDNF and irisin were associated with greater exertion compared to non-responders. **CONCLUSIONS:** PWS young adults are capable of performing strength-building exercise. IL-6 responses to exercise were similar in both PWS and controls but BDNF increased only in control males. Further studies of myokine levels in PWS may contribute to understand unique metabolic responses in this population.

2096 Board #252 May 30 3:30 PM - 5:00 PM
Endocrine Responses After Aerobic Exercise Under Inhibition/ Stimulation Of Hpa Axis In Healthy Adult Males.

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Exercise affects the homeostatic mechanisms of the human body, depending on the type, duration, intensity and frequency of exercise. The endocrine responses to acute and excessive exercise are comparable to those related to "stress". **PURPOSE:** Analysis of the hormonal responses under inhibition/stimulation conditions of the Hypothalamo-Pituitary Adrenal (HPA) axis after a selected aerobic protocol was performed in healthy male volunteers. **METHODS:** Eight healthy male volunteers (age: 29.2 ± 3.1 yrs, body mass: 84.5 ± 5.2 kg, height: 1.81 ± 0.03 m) performed a single bout of 30 min aerobic exercise at 70% $\dot{V}O_{2max}$ on a treadmill, on three different conditions [control, HPA axis inhibition (induced by exogenous glucocorticoid administration), HPA axis stimulation (induced by exogenous ACTH administration)], following standard diet. Blood samples were collected before (t0), at the end of the exercise bout (t30), and 30 min later (t60). Serum cortisol (COR), adrenocorticotropin hormone (ACTH) and growth hormone (GH) were measured. Two-way ANOVAs were used for statistics. Data are presented as mean \pm SE. **RESULTS:** COR levels significantly decreased 30 min after exercise ($p<0.05$) (13.2 ± 1.4 ; 10.8 ± 1.5 ; 7.2 ± 1.6 μ g/dl; at t0, t30 and t60, respectively). ACTH significantly decreased 30 min after exercise ($p<0.01$) (25.2 ± 2.9 ; 20 ± 2.9 ; 15.7 ± 2.1 pg/ml; at t0, t30 and t60, respectively). GH significantly increased after exercise ($p<0.05$) (0.1 ± 0.1 ; 5.7 ± 1.2 ; 2.3 ± 1.1 ng/ml; at t0, t30 and t60, respectively). Under HPA axis stimulation conditions, COR significantly increased immediately after exercise ($p<0.001$) and remained increased 30 min after exercise ($p<0.001$) (15.7 ± 1.6 ; 30.8 ± 1.2 ; 32.4 ± 5.4 μ g/dl; at t0, t30 and t60, respectively). GH significantly increased immediately after exercise ($p<0.001$) and decreased 30 min after exercise (0.1 ± 0.1 ; 9.4 ± 3.5 ; 3.2 ± 1.2 ng/ml; at t0, t30 and t60, respectively). This decrease between the end of exercise (t30) and 30 min after exercise (t60) was significant ($p<0.01$). **CONCLUSION:** This exercise regimen does not appear to trigger significant effects on the stress axis other than an HPA axis-independent increase of GH. Prescription of specific training programs should be characterised by stress-induced parameters before recommended for healthy and diseased population groups.

2097 Board #253 May 30 3:30 PM - 5:00 PM
Modeling Growth Hormone Dynamics through Indices of Cardiac Control at Rest and Exercise

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Growth hormone (GH) is released in a pulsatile manner from the anterior pituitary and these secretory dynamics provide important context to the functioning of the hypothalamic-pituitary (HP) axis. Similarly, heart rate variability (HRV) provides important context to cardiac control. These two systems are often investigated separately, however, evidence suggests that they share a common attractor. The **PURPOSE** was to examine how changes in cardiac-dynamics during daytime hours during rest and exercise could be used to predict GH output through machine-learning algorithms. **METHODS:** Seven-healthy males (25.4 ± 2.6 yr, 174.7 ± 7.8 cm) completed two 24hr profiles separated by a minimum of 8-weeks. Participants were randomly assigned to an exercise (5x30s sprints; 3-min of rec) and resting condition [Exercise: 71.2 ± 10.8 kg, 9.8 ± 3.3 %BF, $\dot{V}O_{2max}$ 71.2 ± 11.2 ml/kg/min; Rest: 69.8 ± 12.1 kg, 9.0 ± 2.7 %BF, $\dot{V}O_{2max}$ 67.8 ± 9.0 ml/kg/min]. Serum was collected via intravenous catheter every 10-min and RR-intervals were collected continuously. The 24hr RR-interval was split into 3-min epochs taken every 10-min throughout the 24hr period; providing an index of acute cardiac regulation throughout the 24hr period. The sample entropy of each of these epochs was used to create an additional time-series ($SampEn_{ep}$) that was used to predict changes in GH output. A long-short-term-memory (LSTM) network was

used to model and predict GH output over time. The LSTM was trained on the first 14hr of each of the exercise and resting profiles using lagged GH and SampEn_{EP}. Five iterations of each model were run and the root mean square of the error (RMS) from each of these iterations were compared across conditions. **RESULTS:** The LSTM models trained on the exercise profiles provided significantly better fit compared to the resting condition ($RMS_{EX}=0.28\pm0.29$; $RMS_{REST}=0.41\pm0.26$; $p=0.02$), resulting in more accurate prediction of the nighttime changes in GH than resting profiles. **CONCLUSIONS:** The ability of these models to learn the relationship and accurately predict GH output based on the patterned regulation of cardiac control throughout the day represents a shared hierarchical regulation between the HP and cardiac axes. These methods capture the more rapid time-dependent relationships that are currently missed with common assessment techniques.

2098 Board #254 May 30 3:30 PM - 5:00 PM
The Effects of Acute Ultraviolet Light Exposure on Post-Resistance Exercise Serum Testosterone in Older Men

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(No relevant relationships reported)

Evidence tying ultraviolet (UV) light exposure to endogenous vitamin D synthesis presents a possibility for naturally enhancing serum testosterone via endogenous vitamin D. **PURPOSE:** 1) Determine the effect of an acute bout of UV light exposure on post-resistance exercise serum testosterone in older men and, 2) to investigate whether serum testosterone was influenced by endogenous vitamin D. **METHODS:** Six older adult men (age 62 ± 1.79 yrs., height 179.92 ± 1.12 cm., body mass 83.79 ± 3.12 kg., BMI 25.95 ± 1.15 kg/m²) participated in two identical resistance exercise sessions followed by a 30-minute recovery. Sessions were approximately one week apart and the exercise protocol consisted of 4 sets of 10 repetitions of leg press, chest press, and back row with one minute of rest between sets. After the second exercise session, participants were exposed to an UV light source during the first 10 minutes of recovery. Serum testosterone and vitamin-D were measured pre- and post-resistance exercise in 5-minute increments during the 30-minute recovery. **RESULTS:** Exercise alone did not significantly affect serum testosterone or vitamin D. Exercise combined with acute UV light exposure significantly increased serum testosterone area under the curve ($p<0.05$) but did not significantly alter serum vitamin D. **CONCLUSION:** These findings suggest that acute UV light exposure may positively impact serum testosterone response following a single bout of resistance exercise in older adult men.

2099 Board #255 May 30 3:30 PM - 5:00 PM
Effects Of Exercise On The Expression Changes Of Kiss-1/gpr54 In Testis Of Rats In Growth Phase

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(No relevant relationships reported)

PURPOSE: To investigate the localization and expression level of KISS-1/GPR54 in testis and effects of exercise during the growth period of male rats. **METHODS:** 21D old weanling rats were randomly divided into group C ($n=60$) and group CE ($n=65$). CE group took 5-weeks trained (60-70% vVO_{2max} , 1h/day, 5days/week). The rats of two groups were killed on the 21st D, 35th D, 43rd D, and 56th D old. The localization, mRNA expression and protein expression of KISS-1/GPR54 in the testis of each group were tested. **RESULTS:** From 21st D to 56th D, KISS-1 and GPR54 were expressed firstly in rat testicular Spermatogenic cells, and then they expressed both in Spermatogenic cells and Leydig cells. Following the growth, the expression of testis KISS-1mRNA peaked at 35D, ($p<0.01$), and then decreased without significantly difference. But the protein level of kiss-1 increased continuously and peaked at 56D ($p<0.01$). The expression of GPR54 mRNA and protein peaked at 43D ($p<0.01$), and then decreased without significantly difference. Exercise intervention had no effect on the localization of KISS-1 and GPR54, but induced the decrease of KISS-1 and GPR54 mRNA during the growth period, which were no significant difference compared with group C. After exercise intervention, the expression of KISS-1 protein in rats testis in each time point had the same trend as group C, but the expression level were significantly lower than group C ($p<0.01$). The expression of GPR54 protein in rats testis of group CE were almost unchanged from 21D to 35D and increased significantly from 35D to 43D, then decreased from 43D to 56D. The GPR54 protein of 56th D was significantly lower than that of group C at 56th day ($p<0.01$). **CONCLUSIONS:** During the growth period, the localization of KISS-1 and GPR54 expressed have stage characteristics, and the expression level of KISS-1 and GPR54 increases gradually, with some temporal characteristics. Although exercise will not influence the change trends of KISS-1 and GPR54, it will decrease their level.

2100 Board #256 May 30 3:30 PM - 5:00 PM
Effects Of Exercise On Hypothalamic Kisspeptin/gpr54 Signaling Pathway Of High-fat-diet-feeding Growing Rats

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(No relevant relationships reported)

Hypothalamic Kisspeptin/GPR54 system is the "control switch" for the onset of puberty. Obesity induced by high-fat diet and/or physical inactivity is a leading cause of precocious puberty. **PURPOSE:** To observe the effect of high-fat diet on the hypothalamic expression of KiSS-1, the G-protein coupled receptor (GPR) 54 and GnRH mRNA and explore the modulatory role of moderate-intensity exercise in the high-fat-diet feeding male rats, which are in growth period. **METHODS:** Male weanling rats (21std) were fed high-fat-diet were randomly assigned to chow diet sedentary (CS, $n=24$), chow diet exercise (CE, $n=24$) and high-fat diet sedentary (HS, $n=24$), high-fat diet exercise (HE, $n=24$) groups. SE and FE groups did the 60%-70% $V(\bullet)O_{2max}$ treadmill training (5 days/week, 1 hour/day). The $V(\bullet)O_{2max}$ of exercise groups were remeasured every two weeks. 6 rats of each group were killed on the 35th day, 42nd day and 56th day. The hypothalamic expression of KiSS-1, GPR54 and GnRH mRNA were tested in each group. **RESULTS:** During the growth period, the Kiss-1mRNA of FS group increased continuously, which was opposited with CS group. The GPR54 mRNA of FS group got to the maximum level on 42nd day, which was similar with CS group. Both in CS and FS groups, GnRH mRNA decreased significantly before 56th day, which had the trend of increase. Both in CE and HE groups, the mRNA of KiSS-1 and GPR54 got the maximum levels on 42nd day, which opposited with the lowest level of GnRH mRNA. **CONCLUSIONS:** The changed trend of kisspeptin/GPR54 signaling pathway during the growth period were obvious increase in high-fat diet rats. Exercise could change the trend of kisspeptin/GPR54 signaling pathway induced by high-fat diet especially after puberty.

2101 Board #257 May 30 3:30 PM - 5:00 PM
Salivary and Serum Cortisol Proportion Dynamics Are Impacted by High-Intensity Exercise

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(No relevant relationships reported)

Salivary cortisol (C_{sal}) represents the free cortisol concentration of serum cortisol (C_{ser}). It has been suggested that C_{sal} is approximately 5-10% of total C_{ser} , however, the impact of diurnal variation in C_{sal} and how this pattern affects the proportion of C_{ser} and C_{sal} (C_{prop}), has yet to be explored. **PURPOSE:** Therefore, the purpose of this study was to assess the diurnal changes of C_{prop} , and the extent to which a high-intensity exercise bout may impact this relationship. **METHODS:** Male ($n=7$) college-aged students (26.3 ± 2.8 yrs, 176.5 ± 8.1 cm, 73.6 ± 12.6 kg, 9.9 ± 3.2 BF(%), VO_{2max} : 68.9 ± 9.5 ml.kg⁻¹.min⁻¹) completed two 24-hour (rest and exercise) cortisol profiles. Subjects had a catheter inserted at 0600hr and blood and saliva samples were collected simultaneously every 120 mins. During the exercise condition, subjects performed 5x30s sprinting intervals on the cycle ergometer, at a resistance of 7.5% of body mass. Subjects were permitted 3-min of passive recovery between bouts. C_{sal} and C_{ser} were analyzed via competitive-binding assay. C_{prop} was calculated as proportion of C_{sal} relative to C_{ser} at each time point. Multilevel growth models with varying fixed/random coefficients were tested and compared (AIC). The final cubic growth model controlled for condition and freely estimated the intercept, velocity, and acceleration terms while the initial trajectory of C_{prop} was fixed across all individuals. **RESULTS:** The IQR of C_{prop} was 3.56-6.29%. The greatest C_{prop} values were consistently observed during nighttime sampling with the magnitude of C_{prop} being greatest at 2300hr. The cubic growth models were determined to best-represent 24-hr changes in C_{prop} . The final model showed a significant effect for exercise ($\beta = -1.37$, $p = 0.036$; AIC = 1030.781). **CONCLUSION:** The greatest C_{prop} at 2300hr appears to be driven primarily by elevations in C_{sal} . This shift may be influenced by night time cortisol secretion interactions with binding proteins, alterations in salivary flow rate, or salivary gland enzymatic activity. Exercise appears to influence C_{prop} dynamics, especially during late afternoon and nighttime hours. It is therefore recommended that cortisol profiles be constructed from both total and free C_{ser} for the most accurate monitoring of the HPA-axis, especially within an exercise context.

2102 Board #258 May 30 3:30 PM - 5:00 PM

Effect of the Menopausal Transition on Physical Performance: A Longitudinal Study

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(No relevant relationships reported)

Low muscle strength and decline in the power are associated with low walking speed and with mobility limitations, disabilities and falls among older populations. Whether menopause per se accelerates decline in physical performance in women and in this way contributes to functional limitations in later years remains controversial. **PURPOSE:** The aim of this study was to examine changes in physical performance in women aged 47 to 55 following the menopausal transition. **METHODS:** This longitudinal study is a part of the Estrogenic Regulation of Muscle Apoptosis study. Women aged 47 to 55 were randomly selected from the Finnish National Registry ($n=6878$) and perimenopausal women ($n=228$) were followed until postmenopausal. The baseline menopausal status was defined based on menstrual cycle diary and follicle stimulating hormone (FSH) level. The progression of menopausal transition was followed at three-to-six months' intervals for early perimenopausal and late perimenopausal women, respectively. When FSH >30 IU/l was recorded, the measurement was repeated within two-to-four weeks and if FSH was determined in two consecutive blood samples to be elevated and no bleeding had occurred in past 6 months participant was considered to be postmenopausal. To capture a comprehensive understanding of the physical performance, measures of muscle power (vertical jump), muscle strength (grip and knee extension), aerobic capacity (6min walking distance), and walking speed were carried out. **RESULTS:** A significant decline in hand grip force for -2.9 % (95%CI -4.5, -1.1; $d=0.20$) in knee extension force for -3.1% (95%CI -4.8, -1.3; $d=0.23$) and in vertical jumping height for -3.24 % (95CI -4.6, -1.7; $d=0.28$) was observed following the menopausal transition. Walking distance significantly increased for 1.9 % (95%CI 1.2, 2.7, $d=0.38$) while in walking speed changes were 0.24 % (95%CI -1.1, 1.6; $d=0.02$) non-significant. **CONCLUSIONS:** The menopausal transition influences muscle strength and power, whereas the influence on mobility/ walking was less evident and may follow after. Supported by the funding from the European Union's Horizon 2020 research and innovation Programme under the Marie Skłodowska-Curie grant agreement No675003, and by the Academy of Finland (ERMA study grant agreement 275323).

2103 Board #259 May 30 3:30 PM - 5:00 PM
The Relationship Between Oral Contraceptive Use With Total Hydroxyvitamin D And Its Metabolites In Young Adult Women

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(No relevant relationships reported)

Vitamin D deficiency, defined as total hydroxyvitamin D (25(OH)D) <50 nmol/L, is associated with poor bone health, impaired muscle function and increased risk of some diseases. The biologically active form of vitamin D is dihydroxyvitamin D (1,25(OH)₂D), but there is emerging evidence that the relative proportion of 1,25(OH)₂D to the catabolic metabolite (24,25(OH)₂D) determines biological activity. In women, higher 25(OH)D concentrations have been reported in oral contraceptive pill (OCP) users, but the influence of OCP and other hormonal contraceptives (HC) on vitamin D metabolites and their ratio is unknown. **PURPOSE:** To examine the relationship between vitamin D metabolites, the vitamin D metabolite ratio (VMR) and HC use in young adult women. **METHODS:** 512 female Army recruits, mean (SD) age 23 (3.2) years, height 1.66 (0.06) m, and body mass 64.8 (7.9) kg, volunteered to provide a venous blood sample at the start of basic military training. Samples were analysed for 25(OH)D, 1,25(OH)₂D, 24,25(OH)₂D, intact parathyroid hormone (iPTH), and albumin adjusted calcium (aCa). Participants had passed Army selection including medical screening and physical performance testing. Hormonal contraceptive use was assessed by questionnaire, and later verified from medical records. **RESULTS:** 163 women using vitamin D supplements were excluded from the analysis. Remaining participants were subdivided into groups: no-HC ($n=157$); OCP ($n=95$); progesterone-only pill (POP, $n=25$); injection ($n=13$); and, implant ($n=59$). There were no differences in participant characteristics between groups ($p>0.05$). Compared with no-HC, OCP users had higher 25(OH)D (61 (28) vs 73 (31) nmol/L), 1,25(OH)₂D (159 (38) vs 177 (50) pmol/L), 24,25(OH)₂D (6 (3) vs 7 (4) nmol/L), and lower iPTH (3.64 (1.04) vs 3.22 (1.05) pmol/L) ($p<0.01$). There were no differences in the VMR (25(OH)

D:24,25(OH)₂D and 1,25(OH)₂D:24,25(OH)₂D), or in aCa, between groups ($p>0.05$). iPTH and 25(OH)D:24,25(OH)₂D VMR were lower, and aCa was higher, in POP than in no-HC users ($p<0.05$). **CONCLUSION:** Oral contraceptive pill users have higher 25(OH)D, possibly from the stimulation of vitamin D binding protein and increased bioavailability of 25(OH)D, but the balance between the active and catabolic vitamin D metabolites is not dependent on HC use.

2104 Board #260 May 30 3:30 PM - 5:00 PM
Changes in Salivary Cortisol and IgA Levels are Associated with Fatigue after Acute Endurance Exercise.

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(No relevant relationships reported)

Several studies have investigated markers for exercise-induced fatigue. Physical and mental fatigues induce a secretion of salivary cortisol, and this hormone affects immunosuppression such as reduction of salivary immunoglobulin A (IgA) secretion. However, it is unclear whether the secretions of salivary cortisol and IgA levels in response to different exercise volumes are related to subjective fatigue and exercise performance. **PURPOSE:** The aim of this study was to investigate relationships among salivary cortisol and IgA levels, subjective fatigue, and exercise performance after acute endurance exercise.

METHODS: Nine healthy young males voluntarily participated in this study. All subjects randomly performed the following three sessions: cycling exercise at 70% VO₂max for 20-min (20-min session), cycling exercise at 70% VO₂max until exhaustion (exhaustive session), and resting control for 20-min (resting session). Salivary cortisol and IgA levels, visual analog scale on subjective fatigue, and maximum voluntary contraction (MVC) in knee extensor muscle groups were measured before and immediately, 30, 60, and 120 min and 24 hours after each session.

RESULTS: In the 20-min and exhaustive sessions, subjective fatigue increased at immediately after exercise and decreased 60, 120 min and 24 hours after exercise. However, MVC showed no change throughout the all sessions. In the resting sessions, no significant differences in salivary cortisol levels before and after exercise were observed. In the 20-min and exhaustive sessions, salivary cortisol levels were significantly higher 30 min after exercise as compared with before exercise and after then gradually decreased until 120 min after exercise. ($p<0.05$). No significant differences in salivary IgA levels before and after exercise were observed in all sessions. Additionally, salivary cortisol and IgA levels were positively correlated with the subjective fatigue (cortisol: $r=0.243$, $p<0.05$, IgA: $r=0.167$, $p<0.05$), but were not correlated with the MVC.

CONCLUSIONS: These findings suggest that the changes in salivary cortisol and IgA levels may be related to increase in acute exercise-induced subjective fatigue. Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13059, M. Iemitsu).

D-67 Free Communication/Poster - Genetics

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2105 Board #261 May 30 3:30 PM - 5:00 PM
Body Height Trajectories in Pediatric Competitive Athletes

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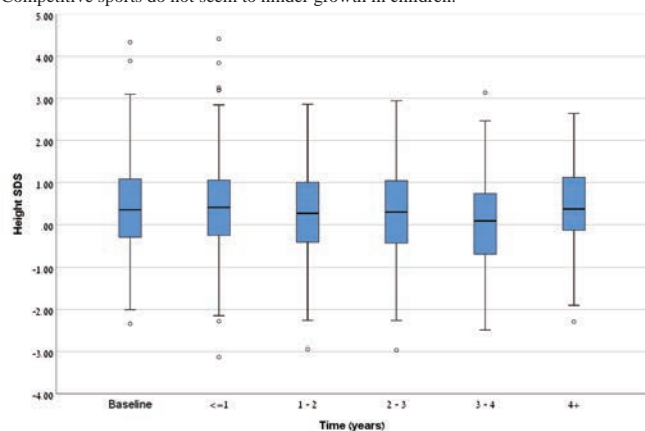
PURPOSE: There is a significant concern that competitive sports in children and adolescents might hinder growth. Currently available data are limited and conflicting. The purpose of this study was to examine the trajectories of body height in competitive pediatric athletes.

METHODS: Data on all child and adolescent athletes that underwent annual pre-participation examinations in a sports medicine center from 2007-2018 were extracted. Data included sport type, age, sex, weight and height. Height was transformed to age-

and sex- specific standard deviation scores (SDS) using the CDC growth charts. In athletes with >1 examination, generalized estimating equations were used for repeated measures analyses of height SDS changes over time.

RESULTS: Data on 2,287 athletes were available, of which 693 had >1 height measurement and formed the study population (70.4% males, mean age 11.5 ± 2.4 years, range 6-18, from 46 sport types). The median duration between the first and last examinations was 1.9 years (IQR 0.99-2.93 years) with a maximum of 9.3 years. Height SDS was not significantly changed throughout the follow-up period in the total cohort (-0.13 per year, 95%CI -0.52-0.03, $p=0.51$), see Figure. In subgroup analyses, no significant change in height SDS was seen among athletes aggregated from classic height-advantageous sports (basketball, volleyball, tennis and swimming, $p=0.73$), basketball players ($p=0.84$) or gymnasts ($p=0.24$). No significant change in height SDS over time was seen when participants were stratified by first measurement age (<9, 9-12, 12+ years) and sex.

CONCLUSIONS: In this large cohort of pediatric athletes with repeated physical examinations, competitive sports were not associated with significant changes in body height relative to age. This finding remained true regardless of age at first measurement and sex, as well as when focusing on sports with typically tall or short statures. Competitive sports do not seem to hinder growth in children.



2106 Board #262 May 30 3:30 PM - 5:00 PM
Effects Of Collagen Gene Polymorphisms On Ligament Injury In Weight-lifting Athletes

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(No relevant relationships reported)

Previous studies have been reported that polymorphism is associated with injury in athlete and general populations. Some studies suggested that COL5A1 polymorphism is one of the risk factors of ligament and tendon injury in professional soccer players and others. **PURPOSE:** To investigate the association between COL1A1, COL5A1, COL11A1 and COL22A1 gene polymorphisms and ligament injury in Japanese weight-lifting athletes.

METHODS: A total of 174 Japanese weight-lifting athletes (Male: $n=111$, Height: 168.4 ± 6.8 , Weight: 81.0 ± 18.8 , Age: 21.3 ± 6.2 , Female: $n=63$, Height: 153.8 ± 20.2 , Weight: 61.9 ± 11.0 , Age: 20.5 ± 3.1) participated in present study. Subjects were divided into 2 groups based on their results of questioners (ligament injury group and no ligament injury group). Genotyping results were analyzed using the TaqMan approach for the COL1A1, COL5A1, COL11A1 and COL22A1 polymorphism.

RESULTS: the genotype frequency of the CC, CT, and TT genotypes in the COL5A1 gene were 0, 29 and 71 % in the no injury group and 5, 28, and 67 % in the injury group. COL5A1 CC genotype frequency was lower tendency in no injury group compared with injury group. However, there was no significant association between COL1A1, COL5A1, COL11A1, COL22A1 polymorphisms and ligament injury.

CONCLUSIONS: Our results suggested that COL5A1 CC genotype has tendency of low risk factor of ligament injury, however, there is no association between Each polymorphisms and ligament injury in Japanese weight-lifting athletes.

2107 Board #263 May 30 3:30 PM - 5:00 PM
The Effect Of FTO rs9969309 Polymorphism On Body Composition in Chinese adults

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The FTO (fat mass and obesity associated) gene, the first common obesity susceptibility gene in a Caucasian population, was reported by GWAS (genome-wide association studies) in 2007. **PURPOSE:** The aim of this study was to explore the effect of genotypes of FTO rs9969309 polymorphism on body composition related traits in Chinese adults. **METHODS:** Forty-three Chinese adults aged from 19 to 55 years old (32 males and 11 females) were recruited from Shenzhen University and a running club of local community. The subjects participated in physical activity at least three times per week with thirty minutes each session. Body composition related traits, including body weight (BW), hip circumference (HC), abdomen circumference (AC), waist-hip ratio (WHR), percentage of body fat (PBF), fat mass (FM), fat free mass (FFM) and body mass index (BMI), were analyzed by bioelectrical impedance analyzer (BH-380 in Beijing Acemeway Company). The genotypes of FTO rs9969309 were analyzed by the Beijing Genomics Institute. One-way ANOVA was used to compare between genotypes and body composition related data. **RESULTS:** There were three genotypes (TT, AT and AA) in rs9969309 polymorphism, in which 24 individuals with TT genotype, 16 individuals with AT genotype and 3 individuals with AA genotype. The body composition related traits, including HC, AC, BMI and FM, were significantly lower in TT genotypes than those in AA genotypes ($p=0.017$, $p=0.004$, $p=0.002$, $p=0.006$, respectively), and were significantly lower in TT genotypes than those in AT genotypes ($p=0.025$, $p=0.023$, $p=0.010$, $p=0.041$, respectively). Also, there was a significant difference only between TT and AA genotypes in WHR ($p=0.015$). No significant differences were found in the three genotypes with BW, PBF and FFM. **CONCLUSION:** The results indicate differences in several body composition parameters regarding the FTO rs9969309 polymorphism in a small sample of Chinese adults.

2108 Board #264 May 30 3:30 PM - 5:00 PM
The Association Between Mct1 T1470a And Ace I/d Polymorphisms And Athletic Status In Climbing Athletes

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(No relevant relationships reported)

Previous studies have shown a relationship between MCT1 T1470A polymorphism and blood lactate concentration during and after high-intensity intermittent exercise. In addition, the I allele seems associated with endurance-orientated events, while the D allele seems like to be the opposite with power- orientated events in the ACE I/D polymorphism. Sports climbing also required muscle power and endurance performance, therefore we hypothesis that MCT1 T1470A and ACE I/D polymorphisms associated with athletic performance in climbing athletes.

PURPOSE: To investigate the effects of the MCT1 T1470A and ACE I/D polymorphisms on athletic achievements (national or regional level) in climbing athletes.

METHODS: Sixty-nine climbers (49 men and 20 women) were genotyped for the MCT1 T1470A genotype (rs1049434) and ACE I/D (rs4341) using the TaqMan@Assay. All climbers were assigned to two groups (35 national level climbers and 34 regional level Climbers) based on their results of competitions.

RESULTS: The genotype frequency of the AA, TA, and TT genotypes in the MCT1 gene were 43%, 49% and 8% in the national level and 44%, 32%, and 24% in regional level. TT genotype frequency was lower tendency in national level athletes (8%) compared with regional level athletes (24%) ($P=0.089$). The genotype frequency of the DD, ID, and II genotypes in the ACE I/D gene were 16%, 38% and 46% in the national level and 3%, 38%, and 59% in regional level. There was no significant differences of frequency of the DD, ID, and II genotypes in the ACE I/D.

CONCLUSIONS: Conclusions: results were suggested that MCT1 T1470A polymorphism may associated with athletic performance in climbing athletes. The MCT1 T1470A and ACE I/D genotypes can provide useful information (e.g., talent selection and genotype-based customization for training) for athletes, especially well-trained men and their strength and conditioning coaches and sports coaches.

2109 Board #265 May 30 3:30 PM - 5:00 PM
Association Between Mitochondrial Dna Sequence, Heteroplasmy, And Indels With Response To Aerobic Exercise Training

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PURPOSE: Aerobic exercise training provides numerous biological and physiological health benefits towards the prevention and treatment of various chronic diseases. However, not all individuals increase cardiorespiratory fitness (CRF) with exposure to a given dose of aerobic training: some individuals are highly trainable and increase CRF, while others respond poorly. Genetic background is known to contribute to interindividual variation in adaptations to aerobic training. Our current understanding of genetics and exercise is limited primarily to the nuclear genome as only a few laboratories have investigated the role of the mitochondrial genome. The purpose of this study was to determine whether mitochondrial DNA (mtDNA) sequence, heteroplasmy, and indels differed among individuals previously characterized as elite endurance athletes, and high- or low-responders to aerobic training.

METHODS: DNA was obtained from whole blood in healthy subjects part of the GENATHLETE (world class endurance athletes; n=15) and HERITAGE (CRF response levels: high responders n=15; low responders n=15) study cohorts. mtDNA was amplified by long-range polymerase chain reaction, then tagged with Nextera libraries and sequenced on a Miseq instrument. Unique mtDNA sequence variants were called when at least two individuals in a group had the variant.

RESULTS: Compared to athletes and high-responders, low-responders had unique mtDNA single nucleotide polymorphisms (SNPs) in D-loop (displacement-loop) hypervariable region (HVR) 2 at positions 72, 152, 185, 188, 228, 295, 462, and 489. Of the HVR2 positions, position 188 was unique only to low-responders. Indels were unique to athletes and high-responders and located in D-loop HVR1 (16179, 16182, 16188, 16192), HVR2 (302), and HVR3 (567) positions. mtDNA Heteroplasmy was not different between groups.

CONCLUSIONS: Our results highlight an area of the mitochondrial genome responsible for DNA replication and transcription that may contribute to an individual's ability to improve CRF with aerobic training. Ongoing work aims to 1) confirm present findings in low responders through increasing sample size from the HERITAGE cohort, and 2) test for interactions between mitochondrial and nuclear genomes associated with response to a given dose of aerobic training.

2110 Board #266 May 30 3:30 PM - 5:00 PM
Circulating DNA As A Monitoring Tool In Professional Soccer

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PURPOSE: Player monitoring in elite sports settings is becoming increasingly important. Questionnaires or biomarkers, such as circulating, cell-free DNA (cfDNA) are possible approaches for load monitoring. cfDNA concentrations were shown to increase dependent on total distance covered in soccer and cfDNA was associated with overtraining in weightlifters. Thus, the purpose of this study was to examine whether cfDNA is feasible as a monitoring tool in elite soccer Players.

METHODS: Capillary blood from 22 elite male soccer players was collected on 40 time points during 4 months of a regular season. Moreover, 2 time points during pre-season were included. Blood samples were drawn on the day before and on days after season games. Players filled in a Visual-Analogue-Scale questionnaire (VAS) including the items "general perceived exertion" and "muscular fatigue". Performance was recorded by a GPS based (training) or a camera based (games) tracking system.

RESULTS: We observed a significant increase in mean cfDNA concentrations from the start of pre-season to the end of pre-season (1.6-fold, p=0.02). Moreover, cfDNA concentrations were significantly elevated in players on the day after regular season games (1.4-fold; p<0.001) in line with the VAS scores. cfDNA showed significantly higher values during weeks that included an additional midweek game (1.3-fold, p<0.001). While cfDNA concentrations correlated with performance data of the training, the VAS scores were correlated with the tracking of the season games. However, cfDNA concentrations and VAS scores did not significantly correlate with each other.

CONCLUSIONS: Here, we show that cfDNA concentrations at rest and VAS scores are influenced by previous load in professional soccer players. Moreover, a higher load

due an additional midweek game led to significantly higher cfDNA concentrations. Future studies will reveal the full potential of cfDNA as a monitoring tool for player load in soccer Players.

2111 Board #267 May 30 3:30 PM - 5:00 PM
A Genome-wide Association Study For Muscle Fiber Composition

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Endurance-oriented athletes have a high proportion of slow-twitch muscle fibers (MF), whereas muscles of sprinters and strength athletes predominantly consist of fast-twitch MF. The heritability of the MF composition was estimated at 45%.

PURPOSE: To perform a genome-wide association study for MF composition and to validate the results in additional studies using sport-related phenotypes. **METHODS:** MF composition of M. vastus lateralis in 168 physically active healthy Russian subjects (55 females, 113 males) was evaluated with immunohistochemistry. The case-control study involved 241 elite Russian athletes (89 sprinters, 49 strength athletes vs 103 endurance athletes). Twenty male wrestlers participated in the Wingate anaerobic test. Micro-array analysis (for detection of 700 K - 1.1 M single nucleotide polymorphisms (SNPs)) or whole-genome sequencing (wrestlers only) was used for genotyping. **RESULTS:** We first identified 929 SNPs that were associated (P<0.05) with the proportion of fast-twitch MF both in males and females. Next, we found that of the 929 SNPs, 37 variants were associated with sprinter athlete status (i.e. alleles associated with increased proportion of fast-twitch MF were over-represented in sprinters compared to endurance athletes). Of those, sprint-related alleles of 4 SNPs (rs7669580, rs1247330, rs2048968, rs2369665) were also over-represented in strength athletes (vs endurance athletes). Only rs7669580 SNP located in the *LDB2* gene (encodes cytoskeletal protein) was found to be associated with the relative peak power in wrestlers. **CONCLUSION:** We have identified the A allele of the *LDB2* rs7669580 SNP that was associated with increased proportion of fast-twitch MF (P=0.00046), ability to become a sprinter (P=0.021) or a strength athlete (P=0.016) and increased peak power of wrestlers (P=0.0187). The study was supported by grant from the Russian Science Foundation (Grant 17-15-01436).

2112 Board #268 May 30 3:30 PM - 5:00 PM
Genetic Modulation of Hypothalamic Pituitary Adrenal Function in Specialized Military Men

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 (No relevant relationships reported)

Hypothalamic-pituitary-adrenal (HPA) hormone profiles are informative mediators of health status. Existing studies link candidate genetic variants in the corticosteroid and serotonin systems to basal cortisol function in diverse populations. Potential connections of such variants to the HPA end-product, dehydroepiandrosterone (DHEA), is essentially unexamined and virtually nothing is known of their effects in military populations. **PURPOSE:** To determine whether candidate genetic variants in the mineralocorticoid receptor (MR [i.e., -2C/G]), glucocorticoid receptor (GR [i.e., BclII]), and serotonin transporter (i.e., 5HTTLPR, triallelic version) modulate daily HPA function (cortisol and DHEA) of specialized military men. **METHODS:** Seventy-three elite military men were studied (mean ± SE age = 33.2±0.7 yrs). Salivary cortisol and DHEA were collected on 2 consecutive weekdays at wake, wake + 30 min, wake + 60 min, 1600, and 2100. TaqMan® genotyping assays were performed for BclII and -2C/G. Variable number tandem repeat analyses were conducted for 5HTTLPR. Unique and combined associations of the genetic variants were assessed with respect to daily patterns of salivary cortisol and DHEA. **RESULTS:** Homozygous GG carriers of -2C/G had higher DHEA concentrations across the day in comparison to C carriers (F(1, 55) = 8.7, p = .005). Homozygous SS carriers of 5HTTLPR had higher DHEA concentrations at wake + 30 and 60 min, followed by convergence with the L carrier profile in the afternoon and evening (interaction effect, F(2.4, 132) = 4.2, p = .011).

Combined effects on DHEA patterns: $-2C/G + 5HTTLPR$ (interaction effect, $F(7.3, 126.3) = 3.7, p < .001$), $-2C/G + BclI$ (group effect, $F(3, 53) = 4.2, p = .01$), and $5HTTLPR + BclI$ (interaction effect, $F(7.8, 134.8) = 3.7, p < .001$). Salivary cortisol profiles were not modulated by candidate variants. **CONCLUSION:** Whereas MR's affinity for cortisol and aldosterone is well researched, the link between $-2C/G$ and DHEA helps to resolve equivocal literature regarding MR's potential compatibility with DHEA. Also, the connection between $5HTTLPR$ and DHEA implies the signaling between serotonergic and HPA systems extrapolates beyond the primary end-product, cortisol. Finally, this study demonstrates that genetic modulation of salivary DHEA profiles is additive, if not synergistic.

2113 Board #269 May 30 3:30 PM - 5:00 PM
Effects of Collagen Gene Polymorphisms on Tendon And Ligament Inflammations in Japanese Male Endurance Athletes.

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(No relevant relationships reported)

In endurance athletes, chronic mechanical stress to tendon and ligament induces local inflammation, leading to tendon and ligament injuries. Type 1, 5 and 12 collagen is the major structural component of tendon and ligament and other component is type 3 and 6 collagen. Several studies were identified the relationship between tendon or ligament injuries and collagen gene polymorphisms such as, rs1800012 in COL1A1, rs12722 and rs3196378 in COL5A1, rs1800255 in COL3A1 and rs35796750 in COL6A1. However, effect of tendon and ligament inflammations on collagen-related gene polymorphisms remains unclear in Japanese endurance athletes. **PURPOSE:** This study aimed to clarify whether single nucleotide polymorphisms (SNPs) within the collagen genes were associated with the incidence of tendon and ligament inflammations in Japanese male endurance athletes.

METHODS: Twenty-four Japanese elite male long-distance runners participated in a cross-sectional study. All subjects were investigated the onset number of tendon and ligament inflammations in the student period of the university by using a questionnaire. SNPs of rs1800012 in COL1A1 gene, rs12722 and rs3196378 in COL5A1 gene, rs1800255 in COL3A1 gene and rs35796750 in COL6A1 gene were determined by real-time PCR with Taqman probe.

RESULTS: All subjects had GG genotype of rs1800012 in COL1A1 gene. The onset number of tendon and ligament inflammations in the student period of the university was significantly higher in CC genotype of rs12722 in COL5A1 gene as compared with CT and TT genotype individuals ($P < 0.05$) and was significantly higher in CC genotype of rs3196378 in COL5A1 gene as compared with CA and AA genotypes individuals ($P < 0.05$). Moreover, the onset number of tendon and ligament inflammations in the AA and AG genotype of rs1800255 in COL3A1 gene was tended to be higher than that in GG genotype individuals ($P = 0.078$). However, the rs35796750 in COL6A1 gene polymorphism had no impact on differences of the onset number of tendon and ligament inflammations.

CONCLUSIONS: These results suggest that SNPs of rs12722 and rs3196378 in COL5A1 gene and rs1800255 in COL3A1 gene may affect incidence of tendon and ligament inflammations in Japanese male endurance athletes. Supported by Grants-in-Aid for Scientific Research (#17H02182 and #16K13059, M. Iemitsu).

2114 Board #270 May 30 3:30 PM - 5:00 PM
KCNA4 Gene Variant is Auxiliary in the Complex Phenotype of Endurance Running Performance Level

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(No relevant relationships reported)

To the best of our knowledge, the pertaining sources of information on the Potassium Voltage-Gated Channel Subfamily A Member 4 (KCNA4) gene do not evidence a single study evaluating the possible association between its genotypic and allelic frequencies with endurance performance. **PURPOSE:** We tested the hypothesis of an association between the prevalence of the genotypic and allelic frequencies distribution of the KCNA4 gene rs1323860 (C/T transition) and endurance performance level in Hispanic male marathon runners (MR). **METHODS:** The present is an observational study following a genetic epidemiology model using a case-control design. The subjects ($n=1876$) were adult Hispanic male MR. Fast-MR (Cases; $n=938$) were finishers in the top 3rd percentile. Slow MR (Controls; $n=938$) were finishers in the lowest 3rd percentile of their respective age. Genomic DNA was purified from a whole blood sample. Polymerase chain reaction was used to amplify a KCNA4 SNP which

consists of a C/T (rs1323860) transition. The observed genotype frequencies, in both Cases and Controls, met Hardy-Weinberg equilibrium (χ^2 , P RESULTS: Genotype and allele frequencies were statistically different ($P < 0.01$) between cases and controls. Odds ratio revealed that the C allele was 1.33 times more likely prevalent in the cases than in the controls (95% CI; 1.17, 1.51; $P < 0.001$). The magnitude of the statistical power for the present study was 0.86. **CONCLUSIONS:** The findings strongly suggest that KCNA4 gene rs1323860 (C/T transition) is auxiliary in the complex phenotype of endurance running performance level in Hispanic male marathon runners.

2115 Board #271 May 30 3:30 PM - 5:00 PM
Association Of Circulating Cell-free Dna Released During Physical Exercise With Extracellular Vesicles
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Introduction Circulating cell-free DNA (cfDNA) has emerged as an important target for liquid biopsies including performance diagnostics. Extracellular vesicles (EVs) are important mediators of cell-to-cell communication and are demonstrated to deliver bioactive material, such as proteins, lipids and nucleic acids, via the circulation. The ability of EVs to transport DNA and, thus, contribute to the pool of cfDNA is controversially discussed. **Purpose** To gain more detailed information of the release mechanisms of cfDNA during physical exercise by estimation of the proportion of cfDNA associated with EVs. **Methods** Platelet-free plasma was collected prior and immediately after an incremental cycling test to exhaustion from a single healthy male athlete. Using size exclusion chromatography (SEC), 2 ml of plasma were separated into 16 fractions of 1 ml. cfDNA concentration in plasma and SEC fractions was measured by direct quantitative real-time PCR of the LIPA2-repeat sequence with or without prior treatment of the fractions with DNaseI. To take pre-analytical considerations into account, the analysis was performed on freshly prepared plasma in a technical duplicate, and frozen SEC fractions. Vesicular fractions 4 to 7 were defined by the presence of the genuine EV markers CD9 and CD63 as well as the platelet-EV marker CD41b in western blot analysis. **Results** Plasma cfDNA concentration increased from 14.05 ng/ml plasma Pre to 157.01 ng/ml Post the cycling test. The amount of DNA, recovered in differently prepared SEC samples (fraction 1-16), was 8.8 ± 0.9 ng in the pre samples and 108.8 ± 22.8 ng post samples. The run of the cfDNA curve in the SEC samples was very similar in the pre and post samples ($r = 0.90$, 95% CI: 0.82-0.94; $p < 0.001$). In the vesicular fractions (SEC 4-7) 23.8 ± 1.9 % of the recovered DNA occurred. DNaseI treatment only slightly decreased the amount of DNA in fractions (4-7) from 2.18 ± 0.15 ng to 1.72 ± 0.52 ng in the Pre samples and from 24.9 ± 7.0 to 20.3 ± 0.4 ng in the Post samples. In the remaining SEC fractions 79.9 \pm 6.4 % of the DNA was digested. **Conclusion** About 24% of the cfDNA in human plasma occurs in the vesicular Sec fractions. The larger amount seems to be independent of EVs and is prone to DNaseI digest. Further experiments are required to clarify if the DNA is inside of EVs or on the outside, protected from DNaseI.

D-68 Free Communication/Poster - Concussion II

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

2116 Board #272 May 30 3:30 PM - 5:00 PM
Athletic Training Educator Concussion Symptomology Prioritization for Clinical Decision-Making Compared to Typical Symptom Presentation

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Athletic training education program directors (PDs) are often tasked with setting the tone of their curriculum and prioritizing items of focus for students. Given the current attention on concussion, it is important to understand PDs' concussion knowledge and strategies for decision making. PDs personal strategies may influence educational content and student practices, implicating clinical practices for new athletic trainers (AT). **PURPOSE:** To determine whether educator-identified prioritized symptoms for removing an athlete from play align with common concussion-related symptoms experienced by athletes. **METHODS:** PDs from 32 professional-level athletic training education programs ($n = 25$ undergraduate; age = 43.8 ± 8.2 ; yrs experience = 21.1 ± 9.2) completed a validated survey examining concussion knowledge and the three symptoms most likely to cause them to remove an athlete from play. Participants responded to questions regarding symptoms and consequences of concussion on the

scale of 1 (definitely not a symptom/consequence) to 4 (definitely is). Total knowledge was summed for a possible range of 25-100. **RESULTS:** PDs' concussion knowledge was moderate (81.1 ± 6.7), primarily due to lack of confidence ("probably" vs. "definitely" is a symptom/consequence) in some items as opposed to being incorrect. The primary symptom reported by PDs as indicating necessary removal from play was headache ($n = 23/32$) followed by a three-way tie ($n = 14/32$ each): 1) amnesia/trouble remembering, 2) trouble understanding/confusion, and 3) visual disturbances. Dizziness was the fifth most common symptom causing removal from play ($n = 11/32$). Previous literature supports headache as the most common symptom experienced by athletes, then dizziness and difficulty concentrating. Although after headache, most common symptoms may vary; however, memory problems, confusion, and visual disturbances are typically reported as some of the most common symptoms. **CONCLUSION:** These data suggest that in general, PDs are prioritizing the most common symptoms experienced for their removal from play decisions. This is encouraging as it suggests that PD's knowledge on key symptoms is appropriate. Future research should further investigate the role AT knowledge and symptom prioritization plays on content in educational programs.

2117 Board #273 May 30 3:30 PM - 5:00 PM
No Effect Of Randomizing Concussion Symptom Presentation On Symptom Number Or Severity Reporting
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Purpose: Concussion symptom evaluations are the most common tool used by clinicians to diagnose an injury. However, the most common post-concussion symptoms reported are also the symptoms that appear first on the Standardized Concussion Assessment Tool (SCAT) symptom list. The purpose of the current study was to evaluate whether SCAT symptom order influenced symptom reporting in healthy young adults with and without a prior concussion.

Methods: Previously concussed and non-concussed young adults completed a survey consisting of demographics, medical history, and SCAT symptoms. Participants were randomized to either complete the original SCAT form or the SCAT with randomized symptom order. Since the individuals were healthy, many participants reported zero symptoms. Thus, logistic regression and zero inflated negative binomial models compared the symptoms scores of the first 5 SCAT symptoms to determine whether presentation order influenced symptom reporting. The first five symptoms evaluated were headache, pressure in the head, dizziness, neck pain, and nausea.

Results: A total of 13 ($n = 6$ Female) participants completed the surveys who had an average age 25.07 ± 4.73 . Participants who completed the randomized SCAT consisted of 2 females (33.3%), 5 males (71.4%), there was no significant effect of sex on likelihood of receiving the randomized SCAT order ($p > 0.05$). Three participants (60.5%) out of five with a concussion completed the randomized SCAT order. There was no significant effect of prior concussion on likelihood of receiving the randomized SCAT order ($p > 0.05$). Logistic regression and zero inflated negative binomial models yielded no significant effect of SCAT order on the likelihood to report symptoms or the severity of symptoms (all p 's > 0.05).

Conclusions: In this small sample size of healthy young adults, SCAT symptom presentation does not appear to influence symptom reporting or severity. Follow up analyses should evaluate for this effect in a larger sample and in acutely concussed individuals.

2118 Board #274 May 30 3:30 PM - 5:00 PM
Adult Perception of a Child's Sport Concussion Risk
 Allyssa K. Memmini¹, Kathryn L. Van Pelt¹, Alissa H. Wicklund², Steven P. Broglio, FACSM¹. *¹University of Michigan, Ann Arbor, MI. ²Orthopaedic and Spine Center of the Rockies, Fort Collins, CO.* (Sponsor: Steve Broglio, FACSM)
 (No relevant relationships reported)

Purpose: With increased media coverage on sport-related concussions (SRC), there has been a growing concern about the risks associated with contact sports. Previous literature reports a decrease in participation numbers stemming from increased perception of concussion risk in contact sports such as football. The purpose of this study was to evaluate the effect of adult profession and perception of their child's concussion risk while participating in contact sports. We hypothesized that adults with a medical background would be more educated about the consequences of SRC, and thus would be less inclined to choose high-contact sports participation for their own children compared to those without medical backgrounds. **Methods:** Data were collected through an anonymous electronic Qualtrics survey administered to faculty and staff at a large midwest university and associated medical center between 2017 to 2018 ($n=5849$, age= 39.519 ± 13.802 years). Respondents indicated their gender, age, highest degree awarded, whether or not they were a medical professional, and

in what sports they would allow their children to participate. Sports were subdivided into four categories (high-contact, partial-contact, non-contact, and all of the above) and analyzed using chi-square tests, followed by a logistic regression to investigate any differences between professional categories and rate of selection of high-contact sports. **Results:** Preliminary chi-square tests indicated no difference between medical (MP) and non-medical professionals (NMP) and the four sport subdivisions ($\chi^2=5.58$, $p=0.23$). Between-group nominal logistic regression was non-significant ($p=0.20$) in examining the effect of profession and selection of sports. More specifically, there was insignificance between professions and likelihood of choosing high-contact sports ($p=0.092$). **Conclusion:** Initial analyses suggest no difference in the choice of sport participation among children with parents in medical and non-medical backgrounds despite an increased attention on concussion in recent years. Future analyses will investigate the specific sports chosen, as well as additional covariates such as parental sport participation and concussion history.

2119 Board #275 May 30 3:30 PM - 5:00 PM
Changes in Fixational Eye Movements following Concussion
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Concussions can affect smooth pursuit, saccadic, and vergence eye movements. Fixational eye movements (FEMs) - the small, involuntary motion of the eye that occurs while focusing on a target - are affected by Alzheimer's, Parkinson's, and mild cognitive impairment. However, little is known about changes in FEMs following concussion.

Purpose:

To compare FEMs in concussed patients to controls using a retinal image-based eye tracking device.

Methods:

Participants included 50 patients with a concussion and 39 age- and gender-matched controls aged 13-27 years. FEMs were measured with a tracking scanning laser ophthalmoscope (TSLO) that tracks retinal image motion at 480 Hz with accuracy of ~ 0.2 arcmin. Eye traces were analyzed offline to compute microsaccadic amplitude, peak velocity, and peak acceleration. Fixational spread, using bivariate contour ellipse area (BCEA), intersaccadic intervals, blink rate, and total blink time were also analyzed. Concussed patients completed the Vestibular Oculomotor Screening (VOMS), Post-concussion Symptom Scale (PCSS), and Immediate Post-Concussion Assessment and Cognitive Test (ImPACT) for comparison with FEMs.

Results:

Microsaccades were larger (amplitude - controls: 0.397° SD 0.32, concussion: 0.597° SD: 0.45; $p < 0.001$) and faster (peak velocity: control: $27.9^\circ/\text{sec}$ SD: 22.2; concussion: $39.7^\circ/\text{sec}$ SD: 30.3; $p < 0.001$; peak acceleration: control: $6.27^\circ/\text{sec}^2$ SD: 9.29; concussion: $9.47^\circ/\text{sec}^2$ SD: 14.1) in concussed participants. Although concussed patients and controls made equal numbers of microsaccades during a 30 sec recording, concussion patients had a greater proportion of larger, faster microsaccades - with 19% more microsaccades at amplitudes greater than 0.75° and 22% more microsaccades $\geq 30^\circ/\text{sec}$. The BCEA was 221% larger in concussed patients (0.56°) compared to controls (0.26°).

Conclusions:

These findings support changes in FEMs following concussion as measured using retinal image-based eye tracking. Microsaccades in concussed patients were larger in amplitude, peak velocity, and peak acceleration compared to controls. Specifically, fixation is less precise, with a larger spread (i.e., increased BCEA). Retinal imaging and eye-tracking of FEMs may be useful in identifying and monitoring recovery following concussion.

2120 Board #276 May 30 3:30 PM - 5:00 PM
Examining Persistent Deficits in Gait Utilizing Inertial Measurement Units
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 (No relevant relationships reported)

Purpose: The effects of concussion on gait have been studied using three-dimensional motion capture technology. However, the equipment expense may not be feasible for all clinicians and researchers. Inertial Measurement Units (IMU) are inexpensive, portable, and have been used to evaluate gait. The purpose of this study is to utilize IMU's to evaluate gait deficits in concussed participants (CON) (time > 1 year since concussion incidence) compared to non-concussed participants (NC). **Methods:**

Fourteen participants ($n=6$ CON 22.87 ± 2.13 years, 3.16 ± 2.14 concussions, 4.49 ± 1.66 years from concussion, $n=8$ NC 26.42 ± 5.25 years) completed the 2-Minute Walk (2Walk), and Timed Up and Go (TUG) gait tasks while equipped with 10 IMU's. Exclusion criteria included no orthopedic injuries in the past year or condition that impedes gait, or the ability to jump. Additionally, control participants were excluded if they presented with any concussion history. Independent t-tests were utilized to examine the relationship between concussion history and motor function utilizing turn velocity, angle and duration, as well as double support gait percentage and TUG duration. For all TUG variables, the results from the participants' three trials were averaged before computation. **Results:** There was a significant difference amongst groups for turn duration ($p<0.01$), turn velocity ($p=0.04$), during the TUG gait task. Additionally, there was a significant difference for percentage of gait cycle in double support for the 2Walk ($p=0.011$). Turn velocity was faster for the concussed participants (mean CON= $238.4^\circ/\text{sec}$, NC= $208.2^\circ/\text{sec}$) while turn duration was shorter (mean CON= $1.66 \pm 0.1\text{sec}$, NC= $1.90 \pm 0.13\text{sec}$) compared to controls. Concussed participants spent approximately 3.5% less of their gait cycle in double support during the 2Walk. However, no significant differences were noted in turn velocity and duration in the 2Walk task. **Conclusion:** Preliminary findings show altered gait and turning strategies among those with a concussion history. These differences may be explained by concussion history. Alternatively, differences in activity levels and sporting experience may also contribute. Future analyses will reassess these changes in addition to other kinematic metrics as sample size increases.

2121 Board #277 May 30 3:30 PM - 5:00 PM
Interrater And Intrarater Reliability Of The Standard Assessment Of Tackling Technique (SATT) On Secondary School Football Athletes

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BACKGROUND: Eighteen years after Guskiewicz et al. (2000) began studying sport related concussion in college and high school football players, head and spine injuries remain a very serious concern for the sport. An upward trend in serious catastrophic brain and spinal cord injuries still exists (Meehan and Landry, 2015), despite greater awareness of signs and symptoms, improved injury evaluation, more accurate symptom assessment, cautious return to play decisions, better helmet technology, new tackling styles, updated coach education, and rule changes limiting contact in practice (Yang et al., 2017). A consistent, cost effective method to evaluate and screen unsafe tackling behaviors has yet to be established. The Standard Assessment of Tackling Technique (SATT) is an observational tool designed to score movement proficiency on five critical elements of an American football tackle. Each element is rated on a four step, ordinal scale from zero - did not occur to three - performed with proficiency. **PURPOSE:** of this study was to evaluate interrater and intrarater reliability of the SATT.

METHODS: Fifteen healthy subjects were videotaped while performing a tackle proficiency assessment (TPA) drill on a square blocking dummy. Twelve players ($n=12$) completed all three TPA sessions spaced 7 days apart, three players did not complete all trials and their data was removed. A total of 36 videos were independently scored by two, trained raters. Training required completion of a forty-five-minute session with explanation of the scoring rubric and scoring sample videos until 80% scoring agreement was obtained.

RESULTS: Interrater reliability was good for sessions 1 (ICC = 0.801; 95% confidence interval [CI]: 0.446-0.938) and 2 (ICC = 0.856; 95% CI: 0.575-0.956) and moderate for session 3 (ICC = 0.602; 95% CI: 0.076-0.867). The individual SATT components showed Arm Rip was the least reliable component (ICC = 0.40; 95% CI: 0.31-0.51) and leg drive was the most reliable component (ICC = 0.95; 95% CI: 0.92-0.97). Intrarater reliability was moderate to good for both raters (ICC = 0.57 - 0.79).

CONCLUSIONS: The results showed that the SATT can be independently scored by two raters, following a 45 minute training session and more experienced raters demonstrate increased intrarater reliability.

2122 Board #278 May 30 3:30 PM - 5:00 PM
Effects Of 3D Multiple Object Tracking On Head Impacts During A Collegiate Ice Hockey Season

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Player-to-player contact is the most frequent head impact mechanism in collegiate ice hockey. Training with three-dimensional multiple object tracking (3D-MOT) could potentially reduce the quantity and severity of head impacts by enhancing player

anticipation of these impacts. **PURPOSE:** The purpose of this study was to utilize 3D-MOT training as a tool to reduce the quantity and severity of head impacts in NCAA Division III men's and women's ice hockey players.

METHODS: Collegiate men's and women's ice hockey players ($N = 33$; men = 17, women = 16) were randomly assigned to a 3D-MOT group (3D-MOT = 17) or control group ($C = 16$). 3D-MOT training occurred twice per week for 12 weeks throughout one regular season. Quantity, location, linear acceleration, and rotational velocity of head impacts were measured in practices and games. Independent samples t-tests compared peak linear acceleration and peak rotational velocity between groups. Pearson chi square analysis compared the quantity of impacts between groups. Independent groups ANOVAs compared peak linear acceleration and peak rotational velocity of impacts between player positions and peak linear acceleration and peak rotational velocity at five different helmet locations between groups. **RESULTS:** 3D-MOT forwards sustained head impacts with greater mean peak linear acceleration (3D-MOT = $41.33 \pm 28.54g$; $C = 38.03 \pm 24.30g$) and mean peak rotational velocity (3D-MOT = $13.59 \pm 8.18 \text{ rad.sec}^{-1}$; $C = 12.47 \pm 7.69 \text{ rad.sec}^{-1}$) in games, and greater mean peak rotational velocity in practices versus control forwards (3D-MOT = $11.96 \pm 6.77 \text{ rad.sec}^{-1}$; $C = 10.22 \pm 6.95 \text{ rad.sec}^{-1}$). Conversely, 3D-MOT defensemen sustained fewer in-game head impacts (3D-MOT = 181 head impacts; $C = 282$ head impacts) and head impacts with a mean peak rotational velocity less than control defensemen (3D-MOT = $11.54 \pm 6.76 \text{ rad.sec}^{-1}$; $C = 13.65 \pm 8.43 \text{ rad.sec}^{-1}$). There was no significant difference for all other parameters analyzed between 3D-MOT and control groups. **CONCLUSION:** 3D-MOT training reduced the quantity and severity of head impacts for defensemen in games, but not for forwards. Player position may play an important role in future interventions to reduce quantity and severity of head impacts in collegiate ice hockey.

2123 Board #279 May 30 3:30 PM - 5:00 PM
Concurrent Validity and Reliability of the XLNTbrain Balance Test with the Balance Error Scoring System

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 (No relevant relationships reported)

Background: The Balance Error Scoring System (BESS) is a commonly used balance assessment, because it is cost-effective and requires minimal equipment. The XLNTbrain Balance Test, was recently developed and uses smartphone accelerometer technology to provide clinicians with a more objective measure. While the objective nature of the test is promising, the validity and reliability of the XLNTbrain Balance Test is unclear.

Purpose: To determine the concurrent validity and reliability of the XLNTbrain Balance Test compared to the BESS.

Methods: Thirty-seven physically active participants (15 males, 22 females, 20.73 ± 2.02 yrs, 169.60 ± 10.28 cm, 70.12 ± 14.15 kg) completed the BESS and XLNTbrain Balance Test in a counterbalanced order. A subset of the sample ($n=33$) repeated the tests one week later. Concurrent validity was established through correlation analysis examining the relationship between scores on the BESS and XLNTbrain Balance Test. Reliability was established using paired-samples t-tests and Intraclass Correlation Coefficients (ICC_{3,1}) computed for the BESS and XLNTbrain Balance Test.

Results: A significant moderate relationship was found between the total scores of the BESS and XLNTbrain Balance Test ($r_s=0.43$, $p=0.008$), and between the firm tandem stance condition of the BESS and the eyes closed tandem stance condition of the XLNTbrain Balance Test ($r_s=0.41$, $p=0.013$). There were no statistically significant differences in scores between testing sessions for the BESS total score (Time 1: 16.44 ± 8.01 , Time 2: 14.64 ± 6.38 , $t_{32}=1.64$, $p=0.11$), or the XLNTbrain total score (Time 1: 12.85 ± 5.89 , Time 2: 14.77 ± 10.30 , $t_{32}=-1.02$, $p=0.31$). There was a moderate reliability score for the BESS total score (ICC_{3,1}=0.54, $p<0.005$) and a low reliability score for the XLNTbrain Balance Test (ICC_{3,1}=0.17, $p=0.17$).

Conclusions: Although the XLNTbrain Balance Test appears to demonstrate moderate concurrent validity against the BESS, it did not demonstrate improved reliability. Future research should determine if the XLNTbrain Balance Test demonstrates validity against force plates. Additionally, the sensitivity of the BESS and XLNTbrain Balance Test to the effects of concussion should be explored.

2124 Board #280 May 30 3:30 PM - 5:00 PM
Balance And Cognitive Recovery Following Concussion Injury Is Associated With Initial Symptom Severity

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Introduction: Symptoms remain a primary way to monitor recovery from concussion injury. However, the association between subjective symptoms and objective measures of balance and cognition is not entirely understood.

Purpose: To examine the association between objective and subjective measures during recovery from concussion injury. The primary hypothesis is to describe changes in cognition, balance, and symptom severity over a one month timeframe following concussion injury. A secondary hypothesis is that symptom severity at time of injury will be associated with objective measures during the recovery period.

Methods: Fifty-one young adults (18.01±5.96 years old) who recently sustained a concussion completed a battery of four cognitive tests, eight balance tests, and a 22 item symptom report using a commercially available assessment tool (ClearEdge, Quadrant Biosciences Inc; Syracuse, NY). All subjects completed test 1, on average, 5.45 ± 3.53 days after injury, and test 2, 23.06 ± 10.92 days following test 1. Group comparisons (repeated measures ANOVA or T-Test) and effect sizes (Cohen's d) were used to compare recovery across time. To address the secondary hypothesis, those within the group reporting low symptom severity (symptoms <10; n=18) and high symptom severity (symptoms > 40; n=14) were compared.

Results: Across the sample, symptom severity at initial testing ranged from 0-89. Statistically significant differences between test 1 and 2 were seen for all cognitive tests (p<0.001) and 1 of the 8 balance tests (p=0.028). When comparing symptom severity groups, significant differences (p<0.05) at the first testing session were seen on 3 cognitive tests and 2 balance tests. No differences were seen between groups at test 2. The low symptom severity group had no changes in cognitive or balance scores between test 1 and 2. The high symptom group had large effects sizes towards improvement on Tandem Stance Eyes Closed (d=1.16), and Simple Reaction Time 2 (d=1.36).

Conclusion: Symptom severity is associated with objective measures of balance and cognition during the recovery period. The low symptom group appears to have reached full recovery prior to initial testing. The high symptom group showed signs of injury at initial testing with large changes in cognitive and balance performance at re-test.

2125 Board #281 May 30 3:30 PM - 5:00 PM
Reliability of the Stability Evaluation Test Over Consecutive Annual Baseline Assessments

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PURPOSE: It is recommended athletes receive annual concussion baseline testing that includes an assessment of postural control. Research has found concussion history does not correlate to baseline Balance Error Scoring System (BESS) scores. However, the BESS is not as sensitive in detecting postural control changes when compared to force plate measurements. The Stability Evaluation Test (SET) on the VSR Sport™ by NeuroCom® is an instrumented BESS and measures sway velocity. The purpose of this study was to determine the reliability of baseline sway velocity measurements taken during consecutive annual baseline screenings in Division I lacrosse players.

METHODS: 44 healthy Division I Lacrosse Players (14 females, 30 males; age = 20.57 ± 0.99; height = 69.59" ± 3.38"; weight = 169.73lbs ± 31.24) from one university participated in the study. All players were medically cleared for full participation and did not have a history of a concussion in the last 12 months. At the start of each season, players performed the standard 3 stances of the BESS test (double leg, single-leg, tandem) on two surfaces, firm and foam, while standing on the VSR Sport™ force plate.

RESULTS: A Pearson correlation analysis of the 2017 and 2018 sway velocities during each stance of the Stability Evaluation Test, found that none of the stance trials met the a priori threshold of $r \geq 0.70$ to indicate good test-retest reliability.

CONCLUSIONS: There is not a strong correlation between baseline balance measurements taken at the start of consecutive seasons. To ensure the reliability of measurements, it is recommended annual baseline measurements be taken even in the absence of a concussion. An individualized approach is ideal in the management of a concussion injury, and baseline accuracy should be considered a critical component.

Mean Sway Velocity Scores & Stance Correlations							
	Double Leg, Firm	Single Leg, Firm	Tandem, Firm	Double Leg, Foam	Single Leg, Foam	Tandem, Foam	Composite Score
2017 Mean Sway Velocity	.69	2.19	1.31	1.75	4.88	5.40	2.69
2018 Mean Sway Velocity	.63	2.18	1.38	1.58	3.60	3.61	2.17
Correlation (r)	.49	.40	-.01	.41	.18	.30	.34

2126 Board #282 May 30 3:30 PM - 5:00 PM
Relationship Of Vestibular/ocular Motor Symptoms And Impairment On State Anxiety In Athletes With Sport-related Concussion

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 (No relevant relationships reported)

PURPOSE: This study 1) compared state anxiety scores between concussed athletes with and without vestibular/ocular motor symptoms/impairment, 2) documented changes in state anxiety throughout SRC recovery, and 3) examined the role that state anxiety has on SRC recovery in athletes with vestibular/ocular symptoms/impairment.

METHODS: Thirty-nine concussed athletes (17.23 ± 2.30 yrs, 62%-F) with vestibular/ocular motor symptoms/impairment (total symptoms ≥2 on any component) (VESTIB) and 40 concussed athletes (16.48 ± 1.15 yrs, 30%-F) without vestibular/ocular motor symptoms/impairment (NO VESTIB) completed the Vestibular/Ocular Motor Screening within 30 days of SRC. The State-Trait Anxiety Inventory (STAI) was administered at initial and clearance visits. Analysis of covariance (ANCOVA), controlling for symptoms, was used to examine state anxiety scores between groups, and a paired samples t-test was used to examine changes across time. Chi-square analyses with odds ratios (ORs) assessed the association of vestibular/ocular motor symptoms/impairment on clinical levels of state anxiety (STAI score ≥40) and prolonged SRC recovery (≥21 days). **RESULTS:** The VESTIB group reported higher state anxiety scores (38.95±11.15) than the NO VESTIB group (30.60±9.98) ($F [1,79] = 5.58, p = .02, \eta^2 = .07$). State anxiety scores improved from the initial (35.11±11.83) to clearance visit (26.01±8.15)($t (73) = 6.30, p < .001$). The VESTIB group was 3.64 times more likely to exhibit clinical levels of state anxiety at the initial visit ($\chi^2 [1, 79] = 6.35, p = .01, 95\% \text{ CI} = 1.30 - 10.29$). Athletes in the VESTIB group with clinical levels of anxiety were 4.24 times more likely to have prolonged recovery than without ($\chi^2 [1, 38] = 3.75, p = .05, 95\% \text{ CI} = .94 - 19.26$). **CONCLUSIONS:** Athletes with vestibular/ocular motor symptoms/impairment may experience higher anxiety following SRC, which may influence recovery. Clinicians should assess vestibular/ocular motor and anxiety domains following SRC.

D-69 Free Communication/Poster - Exercise Testing II

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

2127 Board #283 May 30 3:30 PM - 5:00 PM
Comparison of Whole and Regional Body Composition Testing Devices

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Obesity has increased exponentially within the last three decades and is now widely recognized as one of the leading health threats due to its association with such as type 2 diabetes, cardiovascular disease, and hypertension. In recent years, there have been advances in technology such as bioelectrical impedance analysis (BIA), dual-energy X-ray absorptiometry (DEXA), and air-displacement plethysmography that has been used to categorize individuals into percent fat categories. However, there are still concerns with the validity of these devices. **PURPOSE:** The purpose of this study was to analyze the validity of an 8-point electrode BIA, DEXA, and air-displacement plethysmography methods compared to hydrostatic weighing. **METHODS:** 32 male (mean age ± SD = 22.4 ± 2.5 years) and 30 female subjects (mean age ± SD = 21.9 ± 2.3 years) performed body composition testing using BIA, DEXA, air-displacement plethysmography, and hydrostatic weighing. All tests were conducted in one continuous two-hour session for each subject. Subjects were instructed prior to testing to refrain from eating for a minimum of five hours but no more than ten, to avoid consuming alcohol within twelve hours of testing, to avoid caffeine within three hours of testing, to avoid large amounts of liquid within four hours of testing, and to refrain from exercising within 8 hours of testing. **RESULTS:** The one-way ANOVA with repeated measures and follow-up paired samples t-tests indicated that percent body fat estimated from DEXA (mean ± SD = 31.0 ± 8.9%) resulted in significantly greater values than hydrostatic weighing (23.3 ± 9.2%), air-displacement plethysmography (23.3 ± 10.8%), and BIA (23.6 ± 10.5%). In addition, the constant error (CE) and total error (TE) values of predicting hydrostatic weighing percent body fat from DEXA (CE = -7.7%, TE = 8.2%) was significantly greater than those associated with

air-displacement plethysmography (CE = 0.1%, TE = 3.2%) and BIA (CE = -0.3%, TE = 8.2%). **CONCLUSION:** These findings indicated that the air-displacement plethysmography and BIA methods provided acceptable estimates of body composition when compared to hydrostatic weighing. The DEXA method, however, displayed large CE and TE values and thus was not an accurate measure of percent body fat.

- 2128** Board #284 May 30 3:30 PM - 5:00 PM
Relationship Between Cardiorespiratory Fitness and Arterial Stiffness in Healthy Adults
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(No relevant relationships reported)

Aortic stiffness and cardiorespiratory fitness (CRF) are independent predictors of cardiovascular disease (CVD), cardiovascular (CV) events, and early mortality. However, the relationship between arterial stiffness and CRF is largely unknown. **PURPOSE:** To examine the relationship between arterial stiffness and CRF in apparently healthy adults. **METHODS:** Two hundred three subjects—97 men (aged 50±21 years) and 106 women (aged 47±20 years)—visited the Human Performance Lab to complete one round of testing. Each performed a maximal cardiopulmonary exercise test to determine CRF (i.e., $\dot{V}O_{2max}$). Aortic stiffness was measured via carotid-femoral pulse wave velocity (cfPWV). Data were checked for normality, and Pearson-product moment correlations were performed to determine the association between CRF and arterial stiffness. **RESULTS:** $\dot{V}O_{2max}$ for the entire cohort was 32.8±12.0 ml/kg/min (range 11.4–66.4). The entire cohort had a cfPWV (m/s) of 7.3±1.6 (range 4.8–12.2). cfPWV was moderately associated with CRF ($r = -0.585$, $p < 0.001$). **CONCLUSION:** Arterial stiffness is inversely related to CRF. These data suggest that the beneficial effects of CRF on cardiovascular-related outcomes may be mediated, at least partially, through arterial stiffening.

- 2129** Board #285 May 30 3:30 PM - 5:00 PM
Relationships Among Muscle Function, Skeletal Muscle Mass, and Arterial Stiffness
 Olivia E. Jones, Daniel E. Elston, Bradley S. Fleenor, Matthew P. Harber, FACSM. *Ball State University, Muncie, IN.* (Sponsor: Matthew P. Harber, FACSM)
(No relevant relationships reported)

Skeletal muscle function (MF), skeletal muscle mass (SMM) and arterial stiffness are independent risk factors for all-cause mortality and cardiovascular events. Decreases in SMM are negatively associated with arterial stiffness, however, the relationship between MF and arterial stiffness remains unclear. **PURPOSE:** To examine the relationship between MF and SMM with arterial stiffness. **METHODS:** Participants (N=203, 97 males/106 females) were apparently healthy adults (Age 48.3 ± 20.2 years, BMI 26.8 ± 4.9 kg/m², $\dot{V}O_{2max}$ 32.8 ± 12.0 ml/kg/min). Arterial stiffness was assessed through carotid-femoral pulse wave velocity (cfPWV). SMM was assessed through dual-energy X-ray absorptiometry (DXA), while handgrip strength was measured with a hand dynamometer. Relationships for the entire cohort were analyzed using Pearson correlations between cfPWV, SMM, and MF. **RESULTS:** Inverse associations for the entire cohort were observed with MF and cfPWV ($r = -0.343$, $p = 0.001$) while SMM was not associated with cfPWV ($r = -0.007$, $p = 0.911$). All associations remained significant when divided into groups based on sex ($p < 0.05$). **CONCLUSIONS:** These data suggest that muscle function, specifically handgrip strength, but not SMM are associated with arterial stiffness irrespective of sex. Interventions to improve arterial health should target measures of muscle function instead of skeletal muscle mass.

- 2130** Board #286 May 30 3:30 PM - 5:00 PM
Effect Of Exercise On Reserve Of Repolarization And Blood Stress Markers
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Reserve of repolarization of the heart (RoR) is a non-invasive method to monitor the heart's response to stress. RoR assess stability of cardiac membranes and when excitation becomes unstable. Previous studies reported RoR as a useful tool to determine cardiac risk in cardiac patients. In this study we compared two cohort groups, posttraumatic stress disorder (PTSD) which has a strong association with CVD and a group of apparently healthy subjects (AH). **Purpose:** To determine if RoR and blood stress markers in AH and PTSD cohorts are different at rest and in response to a graded exercise test to 85% HRmax. **Methods:** Ten young women with documented PTSD (23.2 ± 1.4 yrs.) and 8 AH individuals (24.1 ± 1.7 yrs) with normal BP arrived after overnight fast (7-9 am) and rested for 20 minutes. ECG's (12 lead)

were monitored before, during and after exercise to obtain RoR. Blood was taken at rest and after exercise. Plasma samples were analyzed for stress proteins. **Results:** Resting HR's were statistically higher in the PTSD group compared to AH group (77.2 ± 3.1; 67.7 ± 2.6 bpm, $P < 0.0001$). Resting RoR between groups was not significantly different (AH = 81 ± 7%, PTSD = 78 ± 5%, $P > 0.2$). RoR at the final exercise stage in AH group had significantly greater reserve (RoR = 40.4% compared to PTSD = 32.6%, $P = 0.02$) despite greater workload. Brain natriuretic peptide (BNP) increased in PTSD (pre = 139.8 ± 27.8, post = 232.8 ± 47.8 pg/ml, $P = 0.02$) whereas AH showed no change (pre = 123.9 ± 30.2, post = 138 ± 44.2 pg/ml). Plasma TnI was not different between groups at rest ($P > 0.3$) but increased significantly ($P = 0.03$) only in PTSD group with no changes in blood creatine kinase between groups and across time. **Conclusions:** These data suggest that PTSD individuals have less RoR in response to graded exercise compared to AH individuals. In addition, PTSD group had increased plasma BNP, and TNI suggesting an increased risk of having a cardiac event. It is suggested that this procedure may be useful as a screening process to help identify individuals with a risk of a coronary event.

- 2131** Board #287 May 30 3:30 PM - 5:00 PM
Poor Cardiorespiratory Fitness is Associated with Higher Risk of Infectious Events in Kidney Transplant Recipients
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Kidney Transplant Recipients (KTRs) have a reduced cardiorespiratory fitness, which is a well-known independent predictor of overall mortality in the general population and in patients with different chronic diseases. Although it is known that infections are one of the main cause of death in these patients, the possible correlation between cardiorespiratory fitness and the incidence of infectious events remains unexplored. **PURPOSE:** To investigate parameters of cardiorespiratory fitness as possible prognostic markers for infectious events in KTRs. **METHODS:** KTRs were evaluated at our outpatient clinic with an incremental, maximal CardioPulmonary Exercise Test (CPET), 3-12 months after transplantation. Cardiorespiratory fitness was analyzed with peak oxygen consumption ($\dot{V}O_{2peak}$) and the oxygen uptake efficiency slope (OUES). Laboratory data, drug therapy and history of infectious events were collected. The results of the study analysis were obtained with multivariate regression models. **RESULTS:** 157 KTRs (age 51 ± 13 years, 64% men) were included in this study, with a mean BMI of 24.2 ± 3.3 kg/m², Glomerular Filtration Rate of 57 ± 19 mL/min/1.73m², and hemoglobin concentration of 123.5 ± 16.7 g/L. During a mean follow-up period of 33 months after the CPET, at least one infectious event occurred in 72 subjects (46%). The mean $\dot{V}O_{2peak}$ of the entire population was 25.6 ± 6.9 mL/Kg/min, corresponding to 81.3 ± 21.6% of the $\dot{V}O_{2peak}$ predicted for age and gender. 14.7% (n=22) of our patients had a $\dot{V}O_{2peak}$ below the 5th percentile of a matched healthy population based on the FRIEND study results. This subgroup demonstrated an increased risk of infectious events with a Hazard Ratio of 2.11 (CI 95%, 1.19-2.73, $p = 0.01$), which was independent of age, hemoglobin and immunosuppressive regimen. **CONCLUSION:** To our knowledge, this is the first clinical study associating a poor cardiorespiratory fitness with a higher risk of infectious events in KTRs. It can be speculated that an increased cardiorespiratory fitness, obtained by specific aerobic exercise training, may thus reduce infectious events and improve prognosis in this specific population.

- 2132** Board #288 May 30 3:30 PM - 5:00 PM
<Effect Of Menstrual Cycle On Resting, Exercise And Post-exercise Heart Rate In Healthy Women>
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Spontaneous heart rate (HR) is an important physiological measurement in the clinical and exercise contexts, however, it is not totally clear whether spontaneous HR could be influenced by menstrual cycle. **PURPOSE:** Our objective was to investigate the effect of menstrual cycle (Follicular and Luteal phases) on the HR at rest, during the maximal treadmill exercise (MTE) and post-exercise recovery in a clinically healthy woman. **METHODS:** We evaluated 11 healthy women (24.1 ± 4.4 years, BMI 22.5 ± 0.6 kg/m²) with menstrual cycle lasting 28 ± 1.1 days. At rest, the HR was recorded in the supine and orthostatic positions. During the MTE, we recorded the chronotropic reserve with Maximum Heart Rate and Heart rate at the beginning of the test ($HR_{max} - HR_{initial}$) and in the post-exercise recovery we recorded the HR recovery (HRR) at the 1st, 3th, and 5th min following MTE. The HR recovery coefficient refers to equation ($HR_{max} - HRR_{min} / HR_{max} - HRI$) x 100; HR_{max} : higher values on the stress test; HRR_{min} : Heart Rate Values at each minute of recovery and HRI: initial test heart rate.

The evaluations were performed in the follicular phase between the 9th and 11th day and in the luteal phase between the 19th and 21st day after the beginning of the menstrual cycle. Statistical analysis employed parametric tests with two-tailed *p* value set at 5%. **RESULTS:** At rest, HR was [supine: 64 ± 2.8 bpm - 64.7 ± 1.9 bpm, ($p > 0.05$)] and [orthostatic: 82.6 ± 3.4 - 82.1 ± 3.4 bpm ($p > 0.05$)] in during the follicular and luteal phases, respectively. Chronotropic reserve was not different ($p > 0.05$) during Follicular (86.4 ± 2.2 bpm) and Luteal (86.9 ± 3.8 bpm) phases. Also, absolute HRR, $\Delta\%$ HRR and HRR Coefficient did not show any difference between both phases of menstrual cycle ($p > 0.05$).

Variables	Follicular		Lutea	<i>p</i>			
HR _{INITIAL} (bpm)	96	±	3,3	95,18	±	4,4	0,84
HR _{MAX} (bpm)	182,5	±	3,2	182,1	±	2,9	0,93
C.R. (bpm)	86,4	±	2,2	86,9	±	3,8	0,91

CONCLUSIONS: We concluded that HR responses during rest, maximal treadmill exercise and 5 minutes post-exercise were not affected by the menstrual cycles, even with all physiological changes that occur during Follicular and Luteal phases.

2133 Board #289 May 30 3:30 PM - 5:00 PM

A Pilot Observational Study Investigating The Impact Of Glycogen Storage Disease III On Aerobic Capacity

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Glycogen storage disease 3 (GSDIII) is a rare inherited metabolic disorder caused by glycogen debranching enzyme (GDE) deficiency which primarily affects the liver, skeletal muscle and heart and results in muscle weakness and profound exercise limitation. Despite exercise intolerance being a major complication associated with the disease, the influence of GSDIII on aerobic capacity is largely unstudied. **PURPOSE:** To preliminary describe the impact of GSDIII on aerobic capacity and investigate potential mechanisms responsible for any impairment. **METHODS:** In this descriptive study 5 patients (3 female) (39 ± 11 years) with GSDIIIa underwent an incremental cycle exercise test to volitional exhaustion. During exercise breath-by-breath gas analysis took place to determine oxygen utilisation (VO_2), carbon dioxide production (VCO_2), and minute ventilation (VE) and heart rate (HR) was measured continuously. The study received institutional and NHS ethics approval. **RESULTS:** Peak VO_2 was lower in the GSDIII patients than predicted based on their demographic data (16.9 ± 8.4 ml/kg/min, $52 \pm 23\%$ of predicted), as was peak work rate (WR) (86 ± 59 watts, $52 \pm 30\%$ predicted), peak HR (139 ± 26 bpm, $77 \pm 11\%$ predicted), and VE peak (30 ± 19 L/min, $36 \pm 13\%$ predicted). Peak RER was low for a test completed to maximal exertion (0.90 ± 0.07). **CONCLUSION:** $\text{VO}_{2\text{peak}}$ is lower in patients with GSDIII than would be expected for their age, height, mass and sex. The mechanisms responsible for this impairment are yet to be fully determined, but the small data set presented here indicate a reserve in respiratory and central cardiovascular function. Previous literature has identified energy deficiency as a primary cause of exercise intolerance in GSDIII due to impaired glycogen breakdown, and these results are supported here by the low RER values at peak exercise.

2134 Board #290 May 30 3:30 PM - 5:00 PM

Inflammation and Muscle Oxygen Saturation are Associated with Exercise Pressor Response in Peripheral Artery Disease

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(No relevant relationships reported)

Purpose: To determine whether calf muscle oxygen saturation (StO_2) and vascular biomarkers of inflammation and oxidative stress were associated with an exercise pressor response during treadmill walking in patients with symptomatic peripheral artery disease (PAD). **Methods:** A total of 179 patients were characterized on demographic variables, comorbid conditions, cardiovascular risk factors, ankle/brachial index, peak walking time (PWT), claudication onset time (COT), and calf muscle oxygen saturation (StO_2) during a graded maximal treadmill test. The exercise pressor response was measured as the change in blood pressure from rest to the end of the first 2-minute treadmill exercise work stage (2 mph, 0% grade). Patients were further characterized on endothelial effects of circulating factors present in the sera using a cell culture-based bioassay on primary human arterial endothelial cells, and on circulating inflammatory and vascular biomarkers. **Results:** During the maximal

treadmill test, patients experienced COT at 197 ± 164 seconds (mean \pm SD) and PWT at 395 ± 254 seconds. There was a wide range in the change in systolic blood pressure (-46 to 50 mm Hg) and in diastolic blood pressure (-23 to 38 mm Hg), with mean increases of 4.3 mm Hg and 1.4 mm Hg, respectively. In multiple regression analyses, significant predictors of systolic blood pressure included glucose ($p < 0.001$) and insulin ($p = 0.039$). The significant predictors of diastolic blood pressure included cultured endothelial cell apoptosis ($p = 0.019$), the percentage drop in exercise calf muscle StO_2 ($p = 0.023$), high sensitivity C-reactive protein ($p = 0.032$), and glucose ($p = 0.033$). **Conclusion:** Higher levels in pro-inflammatory vascular biomarkers, impaired calf muscle StO_2 during exercise, and elevated blood glucose were independently associated with greater exercise pressor response in patients with symptomatic PAD. The clinical implication is that exercise and nutritional interventions designed to improve inflammation, microcirculation, and glucose metabolism may ameliorate the exercise pressor response in patients with symptomatic PAD.

2135 Board #291 May 30 3:30 PM - 5:00 PM

Effects of Combined Exercise on Vascular Inflammatory Markers and Arterial Stiffness in Elderly Women

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(No relevant relationships reported)

Women become more likely to develop chronic diseases as their metabolic function decreases after menopause. Vascular disease is a major problem for elderly women. The problem of these elderly women is due to a decline in health status due to lack of physical activity.

Purpose: The purpose of this study was to analyze the effects of a combined exercise training regimen on vascular inflammatory markers (WBC, CRP, fibrinogen) and arterial stiffness (blood pressure, pulse wave analysis and velocity) in elderly women.

Methods: Forty-five healthy elderly female volunteers, aged 75.44 ± 5.30 years, were randomly assigned to combined exercise group (EX; $n = 24$) trained for 12-week or to a "non-exercise" control (CON; $n = 21$) group. The variables of vascular inflammatory markers, BP, PWA and PWV were measured in all the subjects before and after the 12-week combined exercise training. The 60 minute combined exercise program (aquatic exercise 1 time, strength exercise 2 times/week) was performed 3 times per week for 12 weeks, and the intensity was progressively increased every four weeks (1-4 weeks: RPE 12 to 13, 5-8 weeks: RPE 13 to 14, 9-12 weeks: RPE 14 to 15).

Results: The vascular inflammatory markers were as follows; All variables showed interaction effects and there was a significant difference in delta values between the two groups. WBC and CRP levels significantly decreased in the EX ($p < .05$). But control group CRP ($p < .05$) and fibrinogen ($p < .01$) levels significantly increased in the CON. SBP showed interaction effect and significant difference in delta-value. CON had significantly increased. However, there was no significant difference between PWA and PWV. **Conclusion:** Our findings indicate that regular aquatic and resistance exercise were effective in improving the serum vascular inflammatory markers and blood pressure of the elderly women with lower cardiovascular disease risk, which are all due to the decreased physical activities. Therefore, if senior citizens continuously improve their efficiency of exercise, they can get the benefit of improving anti-inflammation and delaying the aging process with aging so that they can improve their level of healthy life in the old age.

D-70 Basic Science World Congress/Poster - Circadian Rhythms in Health and Performance

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2136 Board #292 May 30 3:30 PM - 5:00 PM **Olympic Distance Amateur Triathlete Chronotype Profile**

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It seems that the athletes tend to select and pursue sports that suited their chronotype. Elite triathletes show to comprise high proportions of morning-types (MTs), differently from general population. Possibly the early morning training sections, characteristics in

this sport modality, favors athletes presenting morning types profile. There are no data about amateur triathletes chronotype, but probably there are also a high percentage of morning type, mainly because the training sessions occur even earlier, once amateurs need to work after the training. As the training sessions occur early in the morning, it is possible for morning-type athletes are able to develop higher intensity trainings and thus having better physiological adaptations. However, there are no data about chronotypes and physiological profile.

PURPOSE: Characterize the chronotype profile in a group of triathlon amateur competitors who participate in the Olympic distance triathlon race. Verify if there are association between chronotype profile and physical fitness in amateur triathletes.

METHODS: Thirty-nine men and six women who had subscribed to compete in the sixth stage of the 26th Brazil Triathlon Trophy (26^o Troféu Brasil de Triathlon) in the Olympic distance participated in this cross-sectional observational study. Participants were evaluated for anthropometric characteristics (body mass, height, and body composition through [DXA]), aerobic physical fitness (maximum oxygen consumption [V O₂max], anaerobic threshold and respiratory compensation point, maximum aerobic velocity [MAV] and running economy [RE]). Chronotype profile was evaluated using Horne-Ostberg morning-eveningness questionnaire.

RESULTS: According to the chronotype questionnaire 66.7% of the volunteers (69.2% men and 50.0% women) were classified as morning profiles (22.2% definite morning and 44.4% as moderate morning) and only 6.7% were classified as evening profiles. There were no significant correlations between chronotype profiles and the physical fitness variables.

CONCLUSIONS: Amateur triathletes show to comprise high proportions of morning-types, but the physiological profile is similar between the different existing chronotypes.

2137 Board #293 May 30 3:30 PM - 5:00 PM

The Effect Of Time Of Day On Jump Potentiation In Distance Runners

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The Effect of Time of Day on Jump Potentiation in Distance Runners.

Time of day is a key factor that influences athletic performance. No study has specifically investigated the effect of early morning vs. late afternoon training on jump potentiation in distance runners. This is important because circadian rhythms and alterations in sleep patterns can affect training adaptations and athletic performance.

PURPOSE: To determine whether the time of day influence jump potentiation in distance runners. **METHODS:** We recruited 18 male runners that were divided into two groups: novice runners (NOV) with ≤ 3 years of racing experience ($n=6$; age 34.7 ± 6.4), and experienced runners (EXP) with ≥ 3 years of experience ($n=12$; age 34.5 ± 5.1). Chronotypes were identified using the Horne-Ostberg's Morningness-Eveningness questionnaire and sleep quality was assessed with the Pittsburgh Sleep Quality Index. Counter movement jump (CMJ) was determined with the My Jump App. CMJ height was measured after 5 min warm-up and after 30 min test (70% HRR) of running on a treadmill at 8:00 am and 8:00 pm. Following the 30 min test treadmill CMJ height was measured at 0, 3, 6 and 9 minutes of recovery. **RESULTS:** The overall sleep quality of the athletes were poor (5.4 ± 3.8 , $n=18$). The NOV group were poor sleepers (6.5 ± 3.6 , $n=6$) whereas the EXP group were at the limit score to become poor sleepers (4.8 ± 3.9 , $n=12$). The majority (77.3%, $n=14$) of the runners were morning types and 22.2% ($n=4$) were intermediate types. CMJ height in the EXP group was increased at 0 min of recovery and was decreased to warm-up levels at 3, 6 and 9 min ($p < 0.01$) during morning test. Interestingly, jump potentiation only occurred in the morning while no significant increases were observed in the evening in the EXP group ($p=0.6$). The NOV group had no changes in jump potentiation in both morning and evening tests. **CONCLUSION:** We conclude that jump potentiation could be only observed during morning in experienced distance runners probably because of their chronotypes.

2138 Board #294 May 30 3:30 PM - 5:00 PM

Effects Of Time Restricted Feeding On Metabolism Depression And Circadian Rhythms

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(No relevant relationships reported)

Time restricted feeding (TRF) is a form of intermittent fasting limiting the time to intake calories throughout the day. TRF has been shown to affect substrate

concentration and utilization at rest and exercise. Changing patterns in substrate availability and utilization can have effects on metabolism, cognitive functioning and circadian rhythms. **Purpose:** The purpose of this study was to evaluate the effects of TRF on overall physiological functioning, specifically sleep, resting energy expenditure (REE), resting respiratory quotient (RQ), and likelihood of depression.

Methods: A longitudinal design was used to examine physiological changes associated with four weeks of TRF among 34 healthy adults between the ages of 18-60 years. Sleep was evaluated via self-report logs given to participants at testing sessions. REE and RQ were measured using a metabolic cart while subjects were in a fasted state. The Brief Anxiety and Depression Survey was administered, and each subject was given a score indicating their likelihood of depression at each testing session. Variable differences within subjects were determined using a repeated measures ANOVA or a paired samples T-test. **Results:** A significant decrease in total sleep ($p = 0.034$) and BADS scores ($p=.046$) occurred between non-TRF and TRF. Analysis revealed that resting RQ values experienced a significant increase ($p=.002$) between testing non-TRF and TRF testing periods ($p=.034$) and pre-test and TRF testing sessions ($p=.008$). Direct correlations were found between BADS, total sleep and resting RQ.

Conclusion: TRF may influence glucose utilization during rest. Past studies have shown that different forms of intermittent fasting, such as TRF, enable an organism to create more regulated circadian rhythms, allowing less reliance on glucose, resulting in benefits in prevention and treatment of various diseases. The results of the present study are in opposition of previous literature and may provide insight into how glucose utilization affects other physiological processes. Increased glucose utilization may have been a factor in the decrease in total sleep and depression in the patients in the study. Future research is needed to verify if increased utilization of carbohydrates at rest influences changes of circadian rhythms and depression occurrence.

2139 Board #295 May 30 3:30 PM - 5:00 PM

Circadian Phase Is Associated With Self-reported Chronotype In Young, Sedentary Adults

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(No relevant relationships reported)

Chronotype, which is an individual's preferred timing of sleep and activity across the 24-hour day, is regulated by genetics, environmental exposure, and age. Chronotype is measured by subjective questionnaires that query the timing of daily behaviors. Late chronotype has been previously associated with lower level of physical activity, higher body mass index (BMI), and increased risk of type 2 diabetes and the metabolic syndrome. A well-established measure of an individual's circadian timing, or phase, is the onset of melatonin secretion measured in dim light conditions (dim light melatonin onset; DLMO). Despite previous investigations, the associations between DLMO and chronotype, as well as body composition, have not been fully elucidated in young, sedentary adults. **PURPOSE:** To examine the association between DLMO and chronotype; and the association between DLMO and body composition measures in young, sedentary adults. **METHODS:** Fifty-two adults (19 male, 25.8 ± 6.0 yrs; BMI 26.1 ± 5.4 kg/m²; %Fat $34.2 \pm 8.8\%$) participated in this study. All subjects were sedentary (< 2 hrs weekly structured exercise), non-smokers, and did not use medication. Circadian phase was measured by DLMO (time of day when saliva melatonin ≥ 4 pg/ml). Chronotype was measured as the midpoint of sleep on free days (free of vocational responsibilities, corrected for sleep debt; MSFsc) calculated from the Munich Chronotype Questionnaire (MCTQ) and a composite score calculated from the Morningness-Eveningness Questionnaire (MEQ; range: 16-86). Percentage body fat (%Fat) was determined by total body DXA scanning. Pearson's correlation analysis was used to determine if significant ($p < 0.05$) associations were observed between DLMO and MSFsc, MEQ, BMI, and %Fat. **RESULTS:** DLMO ($21:42 \pm 01:31$) was significantly associated with MSFsc ($04:34 \pm 01:11$; $r = 0.66$; $p < 0.001$) and MEQ (50.0 ± 9.0 ; $r = -0.52$; $p < 0.001$). No significant associations were observed between DLMO and BMI ($r = -0.13$) or %Fat ($r = 0.04$). **CONCLUSION:** An objective measure of circadian phase was associated with subjective measures of chronotype. However, neither BMI nor %Fat was associated with DLMO in young sedentary adults. Supported by the University of Kentucky Pediatric Exercise Physiology Laboratory Endowment, the University of Kentucky, and the NIH TL1TR001997 and UL1TR001998.

2140 Board #296 May 30 3:30 PM - 5:00 PM

Social Jetlag Is Associated With Higher Eveningness Index

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(No relevant relationships reported)

Currently, the social demands imposed by work, school and academic activities prevent youth and adults from maintaining an ideal sleep routine. This situation causes

sleep restriction, reducing sleeping hours per night and leading to numerous health damages. This phenomenon has been conceptualized as social JetLag (SJL). **Purpose:** Investigate the association between chronotype and mood profile in presence of SJL of young adults. **Methods:** Participated in this study 68 male subjects (mean age 25.43±6.64 years, and BMI 24.59±4.25) and physically active. In a transversal study approved by our institutional ethics committee (n° 2.263.382), the subjects answered a sleep questionnaires battery composed by Pittsburgh Sleep Quality Index (PSQI), Morningness-Eveningness Questionnaire (MEQ), Munich Chronotype Questionnaire (MCTQ), Epworth sleepiness scale (ESS) and Brunel Mood Scale to determinate a mood profile (subscales: anger, confusion, depression, fatigue, vigor, tension). The SJL was categorized in accord to MCTQ results in 3 groups: a) No SJL (≤ 30 min), b) SJL until 1 h (31- 60 min), c) SJL more than 1h (>61 min). **Results:** The groups were compared, and no differences were found between all subscales of Brunel. Moreover, we didn't find any differences regard the sleep quality and diurnal excessive sleepiness. On the other hand, the groups were different on sleep duration and chronotype. Longer SJL is associated to higher Eveningness index ($F(2,65)=7.48$; $p=0.001$). **Conclusions:** Our finds suggest that the presence of SJL didn't impact the volunteer's humor profile and longer SJL is associated to higher eveningness index.

2141 Board #297 May 30 3:30 PM - 5:00 PM
Effects of Aerobic Physical Exercise Performed Under Hypoxic Conditions on Melatonin

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Melatonin is a hormone which controls sleep, inflammation, and oxidative stress. Aerobic physical exercise can influence melatonin in normoxia. However, there is controversy about the effects of exercise on the melatonin level in hypoxia, which is characterized by impaired sleep. **PURPOSE:** This work evaluated the effects of aerobic physical exercise on melatonin under hypoxic conditions. **METHODS:** Forty healthy men were randomized into 4 groups: Normoxia (N) - (22.1 ± 3.1 y, 69.1 ± 1.1 kg); Hypoxia (H) - (23.2 ± 2.1 y, 67.2 ± 4.1 kg); Exercise under Normoxia (EN) - (26.1 ± 3.2 y, 71.1 ± 3.2 kg); and Exercise under Hypoxia (EH) - (24.1 ± 3.1 y, 72.3 ± 2.1 kg). The observation period for all groups was 36 hrs, beginning with a first night devoid of any intervention. The normobaric hypoxia condition was conducted in a room equipped for altitude simulation that can reach up to 4,500 m (normobaric chamber, CAT - Colorado Altitude Training™ / 12 CAT-Air Unit, USA). Aerobic exercise was performed by the EN and EH groups on a treadmill at 50% of $\dot{V}O_{2\text{peak}}$ for 60 minutes. Venous blood samples for the melatonin measurement were obtained on the 1st and 2nd days at 7:30 AM as well as on the 1st and 2nd nights at 10:30 PM. Data are reported as mean ± standard deviation. A repeated measures and one-way analysis of variance (ANOVA) followed by the Tukey's post hoc test were used to detect significant differences between groups. The accepted significance level was $p \leq 0.05$. **RESULTS:** On the 2nd night, melatonin was higher in the H group compared to the N group (48.3 ± 2.2 vs. 26.1 ± 1.1, $p < 0.05$); low in the N group compared to the EH group (26.1 ± 1.1 vs. 59.2 ± 2.1, $p < 0.05$); low in the H group compared to the EH group (48.3 ± 2.2 vs. 59.2 ± 2.1, $p < 0.05$); and low in the EN group compared to the EH group (37.2 ± 1.0 vs. 59.2 ± 2.1, $p < 0.05$). On the 2nd day, melatonin was higher in the H group compared to the N group (39.1 ± 3.1 vs. 28.1 ± 2.1, $p < 0.05$); low in the N group compared to the EH group (28.1 ± 2.1 vs. 46.2 ± 2.0, $p < 0.05$); and high in the EH group compared to the H group (46.2 ± 2.0 vs. 39.1 ± 3.1, $p < 0.05$). **CONCLUSIONS:** Hypoxia acutely increases melatonin. Diurnal remission of the nocturnal increase in melatonin seems to be delayed by hypoxia and to an even greater extent if acting together with exercise.

D-71 Basic Science World Congress/Poster - Muscle, Movement and Sleep

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

2142 Board #298 May 30 3:30 PM - 5:00 PM
Investigations of Sleep Quality Disturbances and Its Associations with Respiratory Functions and Depression Level among Young Adults with Down's Syndrome

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 (No relevant relationships reported)

Individuals with Down Syndrome (DS) have a broad range of respiratory problems. These problems are important cause of morbidity, mortality and may increase tendency to sleep disturbances. Also depression has been frequently reported in individuals with DS.

PURPOSE: To investigate of sleep quality disturbances and its associations with respiratory parameters and depression levels in young adults with DS. **METHODS:** 50 individuals with DS (28 male, 22 female; 21.5±3.39 year) were included in the study. Sleep quality components (subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medications, and daytime dysfunction) evaluated with Pittsburgh Sleep Quality Index (PSQI). According to PSQI guidelines, good sleep quality is indicated by a composite score of < 5 (possible total=21), and poor sleep quality by a score of > 5 . Forced vital capacity (FVC), forced expiratory volume in one second (FEV1) and peak expiratory flow (PEF) values were recorded using with spirometry. Pearson correlation was used to relate variables.

RESULTS: Sleep quality parameters, respiratory values and depression scores of participants showed in Table 1. A total of % 52 (n=26) of participants have poor sleep quality. % 10 of participants (n=5) in severely depressed status. We found significant correlations of sleep quality parameters (habitual sleep efficiency; sleep disturbances, total PSQI) to depression level ($r=0.68$, $r=0.75$; $r=0.72$, $p<0.05$). Significant correlations were found between PEF values and total PSQI scores; habitual sleep efficiency ($r=0.86$; $r=0.69$ $p<0.05$).

CONCLUSIONS: Our study suggest that sleep quality has a important effects on depression level. Also suggest that sleep quality and respiratory parameters are correlated, especially with PEF. All of this three parameters may affect each other. Further studies with bigger populations and controls needed for better results.

Table 1. Values of Sleep Quality, Respiratory Functions and Depression Scale	
Pittsburgh Sleep Quality Parameters	Values(mean±standart deviation)
Sleep duration	0.47±0.28
Sleep latency	1.22±0.40
Subjective sleep quality	0.92±0.31
Habitual sleep efficiency	1.45±0.73
Sleep disturbances	0.97±0.6
Daytime sleep dyssfunction	0.52±0.25
Use of sleep medications	0.1±.23
Total	6.72±2.23
Respiratory Parameters	%
Forced Expiratory Volume in 1 Second (FEV1)	64.83±20.11
Forced Vital Capacity (FVC)	69.33±16.93
Peak Expiratory Flow (PEF)	42.66±24.67
Self-Depression Scale	Score
	60±28.75

- 2143** Board #299 May 30 3:30 PM - 5:00 PM
Elastic Band Resistance Training Effects on Strength and Sleep of Shift Workers
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 (No relevant relationships reported)

PURPOSE: To determine the effect of elastic band resistance training in strength, muscle mass and sleep of shift workers. **METHODS:** Twelve sedentary workers with weekly work schedule of 12 hours of work for 36 hours of rest (Age: 42.3 ± 8.8 years, Body Mass Index: 27.6 ± 3.7 Kg), performed 16 elastic band training sessions (2 sets until failed; 3 times by week, for 16 weeks). The initial training load was determined by color and/or number of elastic band test to 10RM (shoulder abduction and biceps curl) and 20RM to seated low row exercise. The push up exercise no used elastic band. In following training sessions, the participants were instructed to perform the four exercises in the maximal number of repetition possible each new session. The estimated arm muscle area, exercises repetition number and sleep (sleep duration, sleep latency, sleep efficiency and weak after sleep onset) were assessment pre and post-training. The sleep variables were determined by actigraphy technique for during seven days. The pre and post-test comparisons were made using paired t test. **RESULTS:** The arm muscle area, was improved after training (7015.5 ± 1859.3 vs. 7571.179 ± 1723.625 , $p < 0.05$) as well as exercises repetition number (shoulder abduction: 10.3 ± 0.6 vs. 22.3 ± 4.7 ; push up: 11.2 ± 3.2 vs. 19.8 ± 6.7 ; seated low row: 20.2 ± 1.0 vs. 37.1 ± 8.4 ; biceps curl: 10.2 ± 0.6 vs. 23.7 ± 7.7 , $p < 0.001$). There is no change in sleep variables after training (Sleep Duration: 386.3 ± 36.7 vs. 384.6 ± 43.8 min; Sleep Latency: 28.5 ± 32.7 vs. 14.0 ± 15.0 min; Sleep Efficiency: 86.7 ± 7.7 vs. $86.5 \pm 7.5\%$; Weak after sleep onset: 34.4 ± 22.2 vs. 38.3 ± 23.7 min, $p > 0.05$). **CONCLUSIONS:** Elastic band resistance training improved the strength and muscle mass of shift work without to change their sleep quality of shift workers. Supported by UFMG, FAPEMIG, MAFRE Foundation, CAPES and CNPQ.

- 2144** Board #300 May 30 3:30 PM - 5:00 PM
Impact Of Sleep Deprivation On Flexibility Performance
 Fernanda Veruska Narciso, Beatriz M. Pereira, Addressa Silva, Mauro H. Chagas, Matheus M. Reis, Carlos Amaral Costa, Valdenio M. Brant, Lucas A. Facundo, Aline A. Cruz, Marco Tulio de Mello. *Universidade Federal de Minas Gerais, Belo Horizonte, Brazil.*
 (No relevant relationships reported)

PURPOSE: The purpose of this study was to verify the impact of sleep deprivation in flexibility of young adults. **METHODS:** Ten sedentary male young adults (Mean age: 24.3 ± 3.8 years old, body mass index: 24.8 ± 2.5 kg/m²) wore wrist actigraph before and during the 36-h of sleep deprivation to measure sleep-wake cycle, and Passive Maximal Range of Motion (PROM_{max}) was evaluated by the modified knee extension test with a fleximeter in 4 different moments: at onset of sleep deprivation (8:00am, day 1 = baseline), and after 12h (8:00pm, day 1), 24h (8:00am, day 2) and 36h (8:00pm, day 2) of sleep deprivation. Volunteers lay back with the hip flexed at 90°, and the initial knee ROM (0°) was considered as 90° right knee flexion. PROM_{max} was measured 06 times, and mean values at the 03 lasts was analysed. Analyses of Paired-Samples Variance were used to compare the variables in four moments, and statistical significance set at $p < 0.05$. **RESULTS:** PROM_{max} values showed significative difference ($F_{1,38} = 51.148$, $p < 0.001$) after 12h ($71.7 \pm 0.27^\circ$; $CI_{95\%} = 66.2-77.2$), 24h ($71.0 \pm 2.6^\circ$; $CI_{95\%} = 65.8-76.3$) and 36h ($69.8 \pm 2.6^\circ$; $CI_{95\%} = 64.5-75.1$) of sleep deprivation compared with baseline (73.0 ± 2.7 ; $CI_{95\%} = 67.6-78.4$). Moreover, there was decrease of PROM_{max} ($F_{1,38} = 17.951$, $p < 0.001$) from 12 h to 36 h and from 24 h to 36 h of sleep deprivation. **CONCLUSION:** Our findings suggest that sleep deprivation may have a negative impact on PROM_{max}. Furthermore, 12 h and 36 h after baseline moment showed reduction of the PROM_{max}, even as the time of maximal circadian rhythm values (acrophase) have generally observed between 4:00pm and 8:00pm. The duration of sleep deprivation and the circadian time are important in determining the impairment in passive flexibility performance. Acknowledgment: CAPES, CNPQ, FAPEMIG, CEMSA, CEPE.

- 2145** Board #301 May 30 3:30 PM - 5:00 PM
Effects Of Sleep Deprivation On Histopathological Changes And Oxidative Damage In Different Type Muscle Fibers
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Previous studies has shown that sleep deprivation (SD) induces muscle atrophy and histopathological changes, however, these effects may be different considering the type muscle fiber. **PURPOSE:** to analyze histopathological changes and oxidative damage after SD in different types of muscle fibers (oxidative and glycolytic) of rats. **METHODS:** 20 Wistar male rats (3 months, 300-350 g) were distributed in two groups, control group (CTL, n=10) and SD by 96 h group (SD96, n=10). The SD96 group was sleep deprived on consecutive 96 h, while the CTL group remained in the housing box. At the end of SD, the soleus and plantar muscles were analyzed for lipid peroxidation by concentrations of malondialdehyde (MDA), oxidative damage to DNA by nuclear labeling of 8-OHdG and histopathological changes. **RESULTS:** it was observed increased MDA concentrations in the soleus of SD96 compared to CTL (0.0134 ± 0.0009 vs 0.0121 ± 0.0009 mmol/mg, $P = 0.01$). Comparison between muscles revealed that the soleus had higher concentrations of MDA than plantar to both groups ($P < 0.001$ for both). Regarding 8-OHdG, there was increased nuclear labeling to the plantar muscle in the SD96 compared to CTL (25.4 ± 3.6 vs 7.2 ± 1.9 positive cells, $P < 0.001$). In the soleus, greater nuclear labeling was observed in SD96 compared to CTL (60 ± 13.6 vs 9.6 ± 3.6 positive cells, $P < 0.001$), already the comparison between the muscles revealed a greater nuclear labeling of 8-OHdG in the soleus muscle compared to plantar in the SD96 group ($P < 0.001$). The histopathological evaluation of the soleus revealed the presence of interstitial edema in SD96 compared to CTL ($19.5 \pm 4.2\%$ vs 0% , $P < 0.001$), associated with intense cellular infiltration, alterations in the arrangement of muscle fibers, as well as areas of tissue degeneration and reduction of muscle parenchyma (72.7 ± 2.7 vs $92.4 \pm 1.6\%$, $P < 0.01$). In the plantar muscle, the changes were more subtle, with slight increase in cellularity in the SD96 and fibers presenting smaller cross-sectional area in SD96 group. **CONCLUSIONS:** SD induces degenerative process and oxidative damage in the skeletal muscle, being more intense in type I fibers.

- 2146** Board #302 May 30 3:30 PM - 5:00 PM
The Effect of Acute Sleep Restriction on Running Mechanics during an Exhaustive Run
 Reiley T. Bergin, Nicholas R. Heebner, Cheyenne DeRaymond, Amanda C. Glueck, John Abt, FACSM, Stuart Best. *University of Kentucky, Lexington, KY.* (Sponsor: John Abt, FACSM)
 (No relevant relationships reported)

Purpose: Inadequate sleep is a known risk factor for injury, but the mechanisms by which sleep restriction increases injury risk remain unknown. The purpose of this study was to determine if running mechanics during an exhaustive run, including average peak impact accelerations between the tibia and the forehead, would be altered following one night of sleep restriction. **Methods:** Two male and seven female subjects (21 ± 3 yrs, 55 ± 10 kg) completed an exhaustive treadmill run following either 8 hours (well-rested, WR) or 3 hours of sleep (sleep-restricted, SR) in a randomized crossover design, separated by at least one week. The exhaustive treadmill run was performed at an intensity equal to the subject's ventilatory threshold until volitional fatigue. Wireless inertial measurement units (IMUs) were placed on the right tibia and forehead. Average right tibia peak impact accelerations (RtPk), average head peak impact accelerations (HdPk), and shock attenuation (ratio of RtPk to HdPk) were measured for 3 minutes during the first 2-5 minutes and final 3 minutes. Paired t-tests were used to compare each dependent variable (shock attenuation, RtPk, HdPk) between conditions (WR vs SR). **Results:** Time to exhaustion during the exhaustive treadmill test was not significantly different between the WR and SR conditions respectively (38.5 ± 15.3 minutes, 40.0 ± 14.7 minutes, $p = 0.69$). There were no significant differences in shock attenuation between conditions during the first 2-5 minutes (WR: 58.96 ± 7.09 , SR: 57.72 ± 7.33 , $p = 0.55$) and final 3 minutes (WR: 58.00 ± 8.73 , SR: 57.53 ± 7.58 , $p = 0.84$). No significant differences were found between conditions for RtPk (WR: 5.19 ± 0.73 g, SR: 5.07 ± 0.92 g, $p = 0.49$, WR: 5.38 ± 0.87 g, SR: 5.29 ± 0.96 g, $p = 0.64$) and HdPk (WR: 2.12 ± 0.44 g, SR: 2.11 ± 0.37 g, $p = 0.79$, WR: 2.22 ± 0.45 g, SR: 2.20 ± 0.36 g, $p = 0.76$) during the first 2-5 minutes and final 3 minutes respectively. **Conclusion:** Running mechanics were not altered following one night of sleep restriction. These data suggest that one night of inadequate sleep is not sufficient to alter running mechanics, however more research is needed to understand the possible effects of chronic sleep restriction and its potential influence on injury risk during running.

2147 Board #303 May 30 3:30 PM - 5:00 PM

Landing Mechanics And Muscular Strength Are Not Altered Following Acute Sleep Restriction

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(No relevant relationships reported)

PURPOSE: Inadequate sleep is associated with an increased risk of injury, however it is unknown what physical risk factors for injury are altered by inadequate sleep. We hypothesized that one night of sleep restriction would affect reaction times and landing mechanics but not leg strength. **METHODS:** Ten healthy subjects (5 males, 5 females, 21 ± 3 yrs, 1.67 ± 0.11 m, 59.8 ± 11.8 kg) completed cognitive testing, strength testing and a series of jump assessments following 8 hours (well-rested, WR) or 3 hours sleep (sleep-restricted, SR) in a randomized crossover design. Subjects woke at the same time for each assessment and testing was conducted at the same time of day, in the same order, and separated by at least one week. Reaction time was assessed using the computerized Automated Neuropsychological Assessment Metrics (ANAM) assessment. Strength testing (isokinetic dynamometer-60°/s) included maximal knee extension (KE) and flexion (KF) strength for each leg. Subjects completed 5 trials of a double leg drop-landing task, as well as 5 trials on each leg of a single leg stop-jump task. Peak knee flexion angles (PkkF) were captured using 3D motion capture. Vertical ground reaction forces (VGRF) for each leg were captured with two flush mounted force plates. **RESULTS:** There were no significant differences between conditions for reaction time ($p=0.894$), or KE ($p=0.882$, $p=0.568$) and KF ($p=0.295$, $p=0.156$) in the left or right legs respectively. VGRF was not significantly different between the WR and SR conditions during the drop-landing task (Left: $p=0.216$, Right: $p=0.082$). Although not significant, a trend of greater PkkF was found (Right WR: $68.7 \pm 32.7^\circ$, SR: $49.5 \pm 34.4^\circ$, $p=0.068$) (Left WR: $68.8 \pm 32.1^\circ$, SR: $51.1 \pm 34.2^\circ$, $p=0.097$), when comparing the WR to the SR condition during the drop-landing task. The difference in VGRF during the single leg stop-jump task approached significance for the left leg (WR: 2.52 ± 0.41 , SR: 2.72 ± 0.44 , $p=0.052$). No other significant differences in VGRF or PkkF were observed during the single-leg stop-jump task (all $p>0.362$). **CONCLUSIONS:** No significant differences in strength and landing mechanics were observed following one night of sleep restriction. Knee flexion angle data trends suggest additional nights or chronic sleep restriction may be required to significantly alter movement mechanics.

D-71b Free Communication/Poster - Sports Medicine Fellow Research Abstracts

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2148 Board #304 May. 30 3:30 PM - 5:00 PM

Parameters Associated with Abnormal Cardiac Conditions in Adolescent Athletes: Analysis using Simon's Heart Heartbytes Registry

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(No relationships reported)

PURPOSE: To determine clinical parameters that are related to abnormal cardiac conditions in the physically active youth.

METHODS: We used the Simon's Heart Heartbytes National Youth Cardiac Registry to collect cardiac related data from middle and high school athletes in southeastern Pennsylvania. We collected age, race/ethnicity, symptoms suggestive of abnormal cardiac conditions, past medical history, medication use, caffeine intake and family history. We also obtained height, weight, blood pressure, and cardiac murmur findings, as well as an ECG in all individuals. Binary logistic regression analysis was performed to identify an independent association between abnormal cardiac symptoms and potential indicators (all collected variables). The odds ratio (OR), 95% confidence interval (95% CI), and p-values were used as critical statistical values. **RESULTS:** There were a total of 887 athletes (543 males and 344 females, age= 16.9 ± 2.1 , height= 166.9 ± 11.4 , weight= 62.0 ± 16.0). There was an independent association between abnormal symptoms and presence of significant past medical history (OR: 4.75, 95% CI: 3.17, 7.10, $p=0.001$) and prescribed medication use (OR: 1.71, 95% CI: 1.04, 2.79, $p=0.034$). Although the association between the presence of abnormal symptoms and African-American race (OR:2.01, 95% CI: 0.95, 4.28, $p=0.069$) and average daily

consumption of at least 2 types of caffeine drinks (soda, energy drinks, tea, and coffee) (OR:2.11, 95% CI: 0.87, 5.07, $p=0.097$) were not significant, there was a trend to reach the a priori significance level.

CONCLUSIONS: The current study identified several clinical parameters that are associated with symptoms suggestive of abnormal cardiac conditions. Further research needs to be done on a larger scale to better sort out the clinical history that may contribute to false positives in an effort to reduce false positives at heart screenings.

2149 Board #305 May. 30 3:30 PM - 5:00 PM

Evaluation of Shoulder Health of Collegiate Wheelchair Basketball Athletes

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(No relationships reported)

Shoulder pain is the most commonly reported musculoskeletal complaint among manual wheelchair users. Wheelchair basketball athletes may be at a higher risk of shoulder injury given the additional demands of their sport, but there is little research on the prevalence of shoulder injuries in this population. Shoulder injuries affect both sport participation and ability to perform activities of daily living for manual wheelchair users. Identifying shoulder injuries in wheelchair basketball athletes is important to provide better context in injury treatment and prevention. **PURPOSE:** Determine the prevalence of shoulder injuries using questionnaires, physical exams, and ultrasound evaluations in collegiate wheelchair basketball athletes. **METHODS:** Observational cross-sectional study of collegiate wheelchair basketball athletes at a single institution. Inclusion criteria were participation on a collegiate wheelchair basketball team and use of a manual wheelchair for $\geq 50\%$ of mobility. Each athlete completed a baseline questionnaire that included a Visual Analog Scale (VAS) for shoulder pain in the last month, the American Shoulder and Elbow Surgeons Score (ASES), the Wheelchair User's Shoulder Pain Index (WUSPI) and then underwent a physical exam and musculoskeletal ultrasound evaluation of both shoulders. The Ultrasound Shoulder Pathology Rating Scale (USPRS) was used to grade pathological ultrasound findings. 2-tailed t-tests were used to compare shooting arms to non-shooting arms. **RESULTS:** Seven males and eight females completed the study. Ten of the fifteen athletes had experienced shoulder pain or an injury during the time they had used a wheelchair. Mean VAS in the shooting arm was $2.78 (\pm 2.24)$ and non-shooting arm was $1.50 (\pm 1.89)$ ($p=.11$). Mean ASES score was $89.92 (\pm 11.28)$. Mean WUSPI was $7.12 (\pm 9.46)$. There were nineteen positive physical exam findings in the shooting arms, compared to eight in the non-shooting arms ($p=.05$). Mean USPRS for the shooting arm was $2.13 (\pm 1.73)$ and non-shooting arm was also $2.13 (\pm 1.25)$ ($p>.99$). **CONCLUSIONS:** Shoulder injury and pain are prevalent in wheelchair basketball athletes based on questionnaires, physical exams and ultrasound findings. Supported by the Craig Neilsen Foundation.

2150 Board #306 May. 30 3:30 PM - 5:00 PM

Descriptive Analysis of Youth American Football Quarterback Injuries: A 15-years of Retrospective Data Study

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(No relationships reported)

PURPOSE: To describe the common injuries of youth American football (FB) quarterbacks (QBs) within the last 15 years. **METHODS:** A retrospective chart review of all patients cared for in a sports medicine clinic of an academic pediatric medical center between 01/01/2003 - 10/01/2018. Patients were identified using the search engine *HoundDog* to search the term "quarterback." Records were then reviewed to identify all QBs ≤ 18 years of age. Injuries that were not associated with FB participation were excluded. Main outcome variables were injured anatomic locations, injury types, surgical status, and settings in which the injury was sustained. Descriptive statistics were used to analyze the outcome variables. **RESULTS:** A total of 374 male QBs (mean age: 14.6 ± 2.1) sustained a total of 423 injuries. The top 5 injured anatomic locations (Figure 1) were shoulder (22.2%), knee (15.5%) head/neck (14.5%), elbow (13.6%), and wrist/hand/lower arm (11.3%). The injuries consisted of 64.3% in acute mechanism and 35.7% chronic in nature. The acute injuries occurred during game competition (55.5%), practice (14.3%), and off-season (6.7%); for the remaining 23.5% there was not sufficient documentation in the medical record to determine the setting. Of the chronic injuries, 47.0% occurred during off-season and 34.4% occurred in-season; for 15.2% of the chronic injuries there was not sufficient documentation in the medical record to determine the setting. Among all injuries, 22.9% were surgical cases, and the top 3 anatomic locations of surgery were knee (35.0%), shoulder (20.7%), and elbow (18.7%). **CONCLUSIONS:** The shoulder is the most commonly injured body part among young QBs seeking care in a specialty sports medicine clinic,

although the knee is the most commonly injured body part that requires surgery. Quarterback injuries are primarily acute in mechanism, and the majority of these acute injuries occur during game competition.

2151 Board #307 May. 30 3:30 PM - 5:00 PM
Spine Injuries and Concussions among Figure Skaters

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(No relationships reported)

PURPOSE: To determine the prevalence and mechanism of spine injuries and concussions among a sample population of figure skaters. To assess for potential risk factors for these injuries.

METHODS: This is a cross-sectional analysis of spine injuries and concussions reported by figure skaters. Data was obtained through an anonymous, confidential online questionnaire distributed to members of participating figure skating clubs. The main outcomes included diagnoses, mechanism and source of medical care. Simple descriptive statistics were used; Fisher's exact test was used to assess for statistical differences in categorical variables between groups. SPSS was used for all analyses.

RESULTS: Thus far, 88 participants have completed questionnaires (recruitment ongoing). The mean age of participants is 25.2 years (SD 17.1). Most (79%) respondents are female. Most (85%) practice figure skating year-round; 85% participate in competitions. Some skaters participate in more than one discipline including singles (n=68), pairs (n=3), ice dance (n=21), synchronized skating (n=29), theatre on ice (n=17). More than a quarter (27%; n=24) of participants reported spine injuries/back pain. The most common diagnosis was muscular back pain. Treatment was primarily guided by primary care (n=10), sports medicine (n=13), physical therapists (n=14) and athletic trainers (n=10). Almost half of those who reported back pain did not present to a health care provider (HCP) (45%; n/N=11/24). All injuries occurred in practice. More than a quarter of participants (27%; n=24) sustained at least one concussion; 7 sustained two concussions. Several (42%; n/N=10/24) skaters did not present to a HCP for evaluation of their first concussion. All concussions occurred during practice and most (92%; n/N=22/24) were during on-ice activities. The most common mechanism of injury was a fall (62%; n/N=15/24). The sex of the skater was not associated with either mechanism of spine injury or history of concussion.

CONCLUSIONS: Nearly a third of skaters sustained a concussion or spine injury, yet nearly half did not report their injuries to a HCP. Our findings warrant further investigation into the reasons for such a low reporting rate among figure skaters and the potential effect on injury outcomes.

2152 Board #308 May. 30 3:30 PM - 5:00 PM
Development and Evaluation of an Electronic Preparticipation Physical Evaluation System: A Pilot Feasibility Study

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The preparticipation physical evaluation (PPE) is important for athlete health and safety, and is required for participation in collegiate sports and the majority of US high schools. The vast majority of PPEs are completed using a paper PPE form. Previous work had developed an ePPE system and found it was efficient and yielded good athlete compliance and high physician satisfaction. Another study showed ePPE's value for collecting and analyzing college athlete injury and illness data, suggesting strong potential for the ePPE to improve injury analysis as well as efficiency of the PPE. Despite these reports, use of electronic PPE forms has not become widespread. **PURPOSE:** 1) to develop and implement an ePPE system for collegiate athletes that simultaneously serves as a relational database for research purposes, 2) to assess perceptions of providers on the ePPE system compared to paper PPE forms, and 3) to demonstrate the research potential of an ePPE system by conducting a sample epidemiologic analysis using electronically collected data.

METHODS: In this pilot feasibility study, researchers developed an ePPE system using REDCap, a HIPAA-compliant web application designed for academic research purposes. The ePPE form had the identical contents and questions as the paper PPE form already in use at the NCAA Division I institution. Athletes on three teams at were randomized to use the ePPE (n = 22) or the paper PPE (n = 21) form. Providers and athletes were later surveyed regarding their perceptions of the two systems. A sample epidemiologic analysis using ePPE data was conducted.

RESULTS: The ePPE system was successfully developed and implemented. All athletic trainers and physicians preferred the ePPE over the paper PPE, and felt that the ePPE was more efficient. Data were easily extracted for analysis from the ePPE system. A sample epidemiologic analysis established concerns about concussions

sustained by athletes (27.3% of athletes) and some behavioral and psychological symptoms reported by athletes (trouble sleeping, depression, and anxiety; 13.6-22.7% of athletes).

CONCLUSIONS: While this was only a pilot feasibility study involving relatively small teams, we show that development and implementation of an ePPE system is technically feasible, is preferred by users, and facilitates sports research.

2153 Board #309 May. 30 3:30 PM - 5:00 PM
Psychological Factors Related to Return to Sport After ACL Reconstruction in Adolescents

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(No relationships reported)

PURPOSE: The present study aimed to assess the relationship between psychological factors, including perceived social support and pre-operative expectations, and return to sport after ACL reconstruction in adolescents.

METHODS: 56 participants completed the Hospital for Special Surgery Pediatric Functional Activity Brief Scale (HSS Pedi-FABS), the Psychovitality (PV) questionnaire, and the Multidimensional Scale of Perceived Social Support (MSPSS) prior to undergoing ACL reconstruction. We performed a multiple linear regression to assess if MSPSS score was associated with confidence in returning to sport (total PV score). Additionally, we divided participants into competitive and non-competitive groups based on their response to the HSS Pedi-FABS. Outcome variables obtained from the PV questionnaire addressing pre-operative expectations of returning to sport following surgery were compared between the competitive and non-competitive groups using a series of Chi-square analyses.

RESULTS: Among all participants, 86% (n=48) reported that they expected to return to sport within less than six months of surgery. A higher proportion of competitive athletes (81%) expected to return to sport within six months post-operatively compared to the non-competitive athletes (63%; p=0.18). In addition, a significantly lower proportion of competitive athletes (14%) compared to non-competitive athletes (39%) reported that they would be content returning to an activity level that was less than their pre-injury activity level (p=0.037) and would be willing to settle for a less strenuous sport than their pre-injury sport (16% vs 42%; p=0.034). There was no significant association between MSPSS total score (mean= 6.22±0.375, range= 4-7) and PV total score (mean= 13.8±3.0, range= 8-18; β coefficient= -0.63, 95% CI= -1.77, 0.52, p = 0.28).

CONCLUSIONS: The majority of all participants reported the expectation of returning to sport within six months of surgery. A significantly lower proportion of competitive athletes compared to non-competitive athletes reported that they would be content returning to a lesser activity level or less strenuous sport. There was no significant association between perceived social support and confidence in returning to sport.

2154 Board #310 May. 30 3:30 PM - 5:00 PM
A Review of the Injury Pattern of the 2018 Chicago Marathon

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(No relationships reported)

Marathon racing is increasingly popular and it is estimated that 25 out of every 1000 finishers will seek medical help during their race. Some studies have shown that the most common injuries are musculoskeletal and the volume of runners seeking medical care increases as the race progresses. However, there is a lack of information that illustrates a specific injury pattern along a race course.

PURPOSE: To measure the volume and types of injuries sustained by 2018 Chicago Marathon runners at the various medical stations to determine the impact that distance has on injury pattern.

METHODS: In this retrospective chart review of records collected at the 2018 Chicago Marathon (N=1016), the diagnoses of runners seeking medical care was taken at 21 course medical tents and 2 finish line tents and categorized as either musculoskeletal, medical, wound care, or other. The data was divided into quartiles: miles 0-10, 10-18, 18-26.2, and finish line. The rate of each diagnosis was then compared between the quartiles using a chi-square analysis.

RESULTS: 3.8% of the runners visited the medical tents. Visit volumes had a bimodal distribution in the 2nd and 4th quartiles. 41.6% of runners seeking medical help did so at the finish line compared to 8.6%, 32.8%, and 17.0% in the first three quartiles respectively. 50.6% of all complaints were musculoskeletal, followed by 15.2% medical, 7.9% wound care, and 15.1% other. The percentage runners with musculoskeletal complaints were 24%, 75%, 16%, and 51% in the first, second, third, and fourth quartile respectively. Conversely, the percentage of medical complaints peaked in the 4th quartile with percentages of 1.1%, 5.8%, 1.7%, and 31.0%

respectively. When comparing the diagnosis of musculoskeletal, medical, wound care, and other complaints, there was a statistically significant difference in incidence with $p < 0.001$.

CONCLUSIONS: The most common presenting complaints were musculoskeletal, followed by medical, other, and then wound care. The largest number of runners seeking medical care were at the finish line and halfway point of the race and so the majority of resources should be focused at these locations. While there was a larger proportion of musculoskeletal complaints near the halfway point of the course, the higher percentage of medical complaints was at the finish line.

2155 Board #311 May. 30 3:30 PM - 5:00 PM
Iron and Vitamin D Deficiency in D1 Female Track & Field Athletes

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 (No relationships reported)

PURPOSE: To identify the prevalence of Iron and Vitamin D deficiency in D1 female track and field (T&F) athletes

METHODS: In a retrospective review of medical records at a single institution, laboratory data were reviewed for female T&F athletes [BT1] from 2013 to 2019. Labs were acquired as part of the entrance pre-participation physical (PPE) including ferritin, hemoglobin, and Vitamin D. Iron deficiency was defined as serum ferritin below 30 ng/mL with severe deficiency below 13 ng/mL. Vitamin D was classified as; below 15 ng/mL - deficient, 16-29 ng/mL insufficient, and above 30 ng/mL sufficient. Anemia was defined as hemoglobin (Hgb) < 11.1 g/dL.

RESULTS: Seventy-seven student-athletes were screened, 48% were iron deficient, and a further 13% had severe iron deficiency. Of those with iron deficiency (ferritin < 30 , $n = 37$), four had anemia ($n = 3$). For Vitamin D, 7% were deficient, 24% were insufficient, and 69% were sufficient. **CONCLUSIONS:** When compared to the prevalence of iron deficiency in the general US female population ages 16-49 (11%), there was an increased prevalence in our sample (48%). Interestingly, we noted a similar prevalence of iron deficiency anemia (3-5% general population vs. 4.3% in our sample). Furthermore, our results showed a 24% prevalence for Vitamin D Insufficiency consistent with the general US female population of similar age at 24-26%. The prevalence of Vitamin D deficiency was higher in the US population at 10-11% when compared to our study at 7%. The effects and benefits of screening, intervention, and performance outcomes are a topic of ongoing investigation.

2156 Board #312 May. 30 3:30 PM - 5:00 PM
The Impact of Clinical Factors in Physician and ATC Decision Making for Concussion Return to Play: Insight from a Policy Capturing Study

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 (No relationships reported)

PURPOSE: To scrutinize the role of several clinical factors in physician and clinical athletic trainer (ATC) return-to-play (RTP) decision making in high school athletes who sustained a concussion.

METHODS: Sports Medicine physicians and ATCs completed a policy capturing survey of 50 clinical scenarios and rated how likely they were to clear the athlete for RTP. Nine factors were randomly varied within the scenarios: age, gender, sport, prior concussion, initial symptom score, symptom duration, and ImPACT performance. Participants then ranked how important each variable was in their decision making process.

RESULTS: 16 physicians (87.5% CAQSM, 12.5% Fellows, mean 9.2 concussions managed per month) and 29 ATCs (mean 4.8 concussions managed per month) participated. ImPACT testing was the most significant contributor in RTP decisions. Physicians and ATCs weighed ImPACT changed from baseline (β 0.42 ± 0.23 and 1.28 ± 1.18 respectively) and ImPACT compared to normative values (0.39 ± 0.24 and 1.38 ± 0.90 respectively) most heavily. Respondents self-ranked prior concussion and age as most influential in their RTP decision making. There was no correlation between participants self-ranking of importance and the observed contribution of a variable to decision making.

CONCLUSIONS: Respondents displayed poor insight to the role of various clinical factors in their management of concussion RTP. ImPACT testing has a greater influence on RTP decisions than physicians and ATCs realize. Despite having low self-ranked importance, variables related to ImPACT results were among the most influential. Self-ranking importance of clinical variables is similar between physicians and ATCs; however, symptom duration is less important to ATCs compared to physicians. Although age was considered important in self-ranking it was not a significant contributor to RTP decision making.

2157 Board #313 May. 30 3:30 PM - 5:00 PM
Evaluating Patient Reported Outcomes in a Pediatric Sports Medicine Practice: A Look at the FAAM

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Purpose: Foot and ankle injuries account for up to 30% of all pediatric sports medicine visits. Self-reported outcome measures can be utilized to capture the patient's perspectives on their injury and monitor recovery, however, this has not been well studied in youth athletics. The objective of this study is to examine the relationship between patient injury characteristics and FAAM scores. **Methods:** A retrospective cross-sectional pilot study was conducted on patients that completed the Foot and Ankle Ability Measure (FAAM) survey as standard of care for either their first clinic or physical therapy visit. Factors of interest include age, sex, diagnosis and type of rehabilitation program. Descriptive statistics and multiple linear regression models were performed. **Results:** In this pilot study, 457 individuals were identified as having completed the FAAM over the 3 year review period. A sample of 36 patients with 42 distinctive injuries were reviewed. The average age of the sample was 16.38 years, 53% were female. Only 8 athletes (22%) identified as participating in multiple sports. Soft tissue injury was the most common diagnosis (65% of encounters) and more than half of the patients were referred to physical therapy. The average time from injury to presentation was 63 days (RNG: 1-694 days). The average initial FAAM score was 0.52 (SD \pm 0.28, RNG: 0.03-0.96). Multiple linear regression models showed no significant predictors. Only time from injury to initial FAAM score approached a p-value of 0.10. **Conclusions:** The use of the FAAM may provide insight into patient perception of function and recovery from a musculoskeletal injury. Our study unveils characteristics of one cohort of adolescents from a pediatric sports medicine clinic with foot and ankle injuries. Time to presentation was significantly longer than expected but perceived level of dysfunction was higher. The multiple linear regression models showed no strong predictors of FAAM scores, however, this pilot study was underpowered. Future efforts will focus on further evaluation of this entire cohort and the interaction between injury characteristics, management recommendations, and FAAM scores.

2158 Board #314 May. 30 3:30 PM - 5:00 PM
Application of Quantitative Balance Testing to Office Based Concussion Care: A Feasibility Study

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 (No relationships reported)

PURPOSE

Assessment of concussion in the office should be multimodal, including a clinical interview, neurocognitive and balance assessment. Access to baseline, pre-injury measures have been identified as having greater clinical utility than single assessments. Our institution offers baseline ImPACT neurocognitive assessment to pediatric contact sport athletes. The goal of this study was to determine the feasibility of quantitative balance testing of individuals to improve quality of our concussion care.

METHODS

Following Institutional Review Board (IRB) approval, patients were offered objective balance assessment using a modified Balance Error Scoring System (mBESS) conducted using a combination motion analysis video/force plate of postural stability (Equilibrate; Balance Engineering LLC, Henrietta, NY). Baseline balance testing obtained was compared to published normative data (Howell & Meehan, J Pediatr Orthop, 2016); results were segmented by age and gender using unpaired Student-t test with significance set at $p < 0.05$.

RESULTS

80 patients (December 2014-present) conducted a balance assessment: (43 Female/ 37 Male); age (14.5 ± 4.1 yrs); Body Mass Index (21.7 ± 5.6 Kg m^{-2}), previous concussion 7/80 (9%) and history of lower extremity musculoskeletal injury 15/80 (19%). 18 patients over the age of 18 years were excluded from comparative analysis to published pediatric normative data, leaving 62 patients. Two stances were directly compared and analyzed: double leg stance and tandem stance (non-dominant behind) with eyes closed. There were significantly better performances in our study groups in tandem stance for 16-18 yrs females, 8-12 yrs males and females compared to the normative data (Table. 1).

CONCLUSION

Quantitative baseline balance testing was deliverable in our office and our results indicate better performance for some populations than previously published normative data.

2159 Board #315 May. 30 3:30 PM - 5:00 PM
Specific Dietary Practices In Female Athletes And Their Association With Disordered Eating

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(No relationships reported)

PURPOSE: Health and weight management benefits may influence athletes' decisions regarding specific dietary practices. Eating disorders/disordered eating (ED/DE) are highly prevalent in the athletic population. The purpose of this study was to determine if following specific diets correlated with a greater likelihood of responding positively to ED/DE screening tools compared to not adhering to a diet. **METHODS:** 1000 female athletes (15-30 yrs) were asked to complete a comprehensive health and wellness survey. Athletes were asked to specify their diet and completed 3 ED/DE screening tools: the Brief Eating Disorder in Athletes Questionnaire, the Eating Disorder Screen for Primary Care, and self-reported current or past history of ED/DE. We hypothesized that athletes adhering to specific diets were more likely to score positively on ED/DE screening tools than those not following a diet. The most common diets were included in the analyses: vegan, vegetarian, pescatarian, gluten free, low carbohydrate, low dairy, and ≥ 2 diets. Athletes following diets for health issues (e.g. Celiac disease) were excluded. Descriptive statistics were calculated for all study measures and Chi-square testing was performed to assess relationships between athletes' dietary practices and their responses to ED/DE screening tools. **RESULTS:** 234 of 1000 female athletes reported adherence to specific diets; 766 reported no diet adherence. 69 of the 234 athletes were excluded due to medically-related dietary practices or vague dietary descriptions. 133 athletes reported following 1 of the diets and 32 athletes reported following ≥ 2 diets. Of the diet-adherent athletes, 67.9% responded positively to ≥ 1 of the 3 ED/DE screening tools. Athletes practicing vegetarian, vegan, low carbohydrate, low dairy, or ≥ 2 diets were more likely to respond positively to ≥ 1 ED/DE screening tool vs. athletes without dietary restrictions (70.0%, 77.8%, 79.5%, 60.0%, and 65.6%, respectively vs. 41.8%; $p \leq 0.048$). **CONCLUSION:** Specific diet adherence in female athletes is associated with greater likelihood of positive screening for ED/DE using survey self-report. Health practitioners should consider further ED/DE questioning of athletes reporting specific diet adherence in order to enhance nutritional knowledge and help treat and prevent ED/DE.

2160 Board #316 May. 30 3:30 PM - 5:00 PM
Concussion Symptom Reporting Across Age Levels

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Purpose: To evaluate differences in concussion symptom reporting across age levels **Methods:** Between 2008-2018 post-concussion symptoms were reported by Middle School (MS), High School (HS) and Collegiate athletes (CA) utilizing the post-concussion symptom scale after a concussive injury. Repeat evaluations and initial evaluations with a symptom score of zero were excluded. ANOVA was performed assessing total symptom scores and number of symptoms reported by age group and gender.

Results: 1,748 athletes (65.2% male, 22 sports) were included: Middle School (6.3%, n=110), High School (86.4%, n=1511) and Collegiate (7.3%, n=127). Significant differences were found in total symptom scores ($p=0.006$) and number of symptoms reported ($p=0.00003$). Symptom scores were highest in High School athletes (23.37, SD 20.2) compared to MS (mean 17.78, SD 18.5) and CA (20.13, SD 21.3). Total number of symptoms reported was also highest in High School athletes (9.73, SD 6.1) compared to MS (7.55, SD 5.4) and CA (8.02, SD 5.9). High School females report significantly higher symptom scores (27.5+/-22.5 vs 21.6+/-18.9, $p<0.0001$) and number of symptoms (10.7+/-6.1 vs 9.4+/-6.1, $p=0.0002$) relative to male peers.

Conclusion:

In student athletes who have suffered a concussion, the post injury symptom scores and total number of symptoms and individual symptoms reported varied significantly across age levels, with significantly less symptoms being reported in the middle school athletes.

2161 Board #317 May. 30 3:30 PM - 5:00 PM
The Role of Resistance Training Dosing on Pain and Quality of Life in Individuals with Knee Osteoarthritis: A Systematic Review

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(No relationships reported)

Purpose: To determine whether resistance training effects pain and quality of life in individuals with knee osteoarthritis (OA), and whether or not a dose-response relationship exists. Secondly, we will investigate if the effects of resistance training are influenced by KL grade or location of OA (tibiofemoral and/or patellofemoral).

Methods: A systematic literature search of three electronic databases (PubMed, CINAHL, and EMBase) was performed for English studies to identify RTCs comparing resistance interventions with no intervention or education in knee OA and reporting changes in pain and physical function. Articles meeting inclusion criteria were assessed independently by two reviewers for methodological quality using the CONSORT 2010 scale and bias assessed by the Cochrane Collaboration's tool for assessing risk of bias.

Results: Four hundred and sixty-nine studies were found in the initial search. Fourteen were included for analysis after screening. Thirteen trials were rated with high methodological quality based on the CONSORT scoring system. One study was excluded due to poor CONSORT score (9). Thirteen eligible trials with 1,521 participants were therefore included in the subsequent analysis. The average CONSORT quality score was 20.3 (range 17 to 24.5). Evidence from eleven studies revealed resistance training significantly improved pain and/or quality of life. No trends were identified with maximum strength, and frequency of exercise sets or repetitions, and thus trends between strength training outcomes and location or KL grade of knee OA were unable to be evaluated.

Conclusion: This systematic review suggests that resistance training improves pain and quality of life for patients with knee OA, but specific optimal dosing strategies remain unknown. Further high quality prospective studies with homogenous populations and interventions aimed to investigate precise dosing parameters are needed.

2162 Board #318 May. 30 3:30 PM - 5:00 PM
Distribution of Sonographically Guided Injections of the Subgluteus Minimus and Medius Bursae in Cadaveric Model

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(No relationships reported)

PURPOSE: The primary purpose of this investigation was to describe and validate sonographically guided techniques for injecting the subgluteus minimus bursa (SGMinB) and subgluteus medius bursa (SGMedB) in a cadaveric model.

METHODS: A single experienced operator completed all injections under ultrasound guidance in 12 unembalmed cadaveric specimens. SGMinB injections (N=12) placed 3mL of diluted blue latex into the bursa using an in-plane, anterior-inferior to posterior-superior approach in short axis (SAX) to the gluteus minimus (GMin) tendon. SGMedB injections (N=12) placed 3 mL of diluted yellow latex into the bursa using an in-plane, anterior to posterior approach in SAX to the gluteus medius (GMed) tendon. For comparison with more commonly performed injections, the same operator completed sonographically guided injections into the subgluteus maximus bursa (SGMaxB, N=12) and sonographically guided intraarticular hip injections (N=2) in the same 12 specimens. 10 specimens were subsequently dissected and 2 specimens were frozen and cut into cross sections.

RESULTS: All 12 SGMinB injections accurately placed latex deep to the GMin tendon without intraarticular communication. All 12 SGMedB injections accurately placed latex deep to the GMed tendon. In 3/12 specimens some latex communicated between SGMinB and SGMedB, 2 of which occurred in the setting of pre-injection documented tendinosis. No injections communicated with the SGMaxB or intraarticular space.

CONCLUSIONS: Sonographically guided SGMinB and SGMedB injections can accurately target specific locations of tendon-bursa pathology in patients with greater trochanteric pain syndrome. In the presence of tendon pathology, communication between SGMinB and SGMedB may occur.

D-71c Free Communication/Poster - Sports Medicine Fellow Clinical Cases

Thursday, May 30, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

2163 Board #319 May. 30 3:30 PM - 5:00 PM

Field Of View: A Football Player With Acute Visual Changes

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(No relationships reported)

HPI

A 23 year old professional football player self-reported abnormal vision during a game. He had two episodes of blurriness in the superior visual field of the right eye lasting 15-20 minutes each and separated by 15 minutes. He had no eye pain or headache. No identified head trauma preceding symptoms. He was not removed from play.

Exam

At halftime: Blood pressure 130/83. Normal appearing conjunctiva and clear corneas. Pupils equal, round, and reactive to light. Normal extra-ocular movements. Visual fields full to confrontation. Decreased visual acuity in right eye. Undilated fundoscopic exam revealed crisp vessels and normal optic discs. Neurologic exam normal. Post-game: Normal visual acuity and remainder of exam normal.

Differential Diagnosis

1. Retinal detachment
2. Retinal vessel occlusion
3. Acephalgic migraine
4. Concussion
5. Optic nerve lesion

Tests and Results

Athlete referred to ophthalmology for full eye exam the day following the game. Ophthalmology Findings:

- normal intraocular pressure
- bilateral AV nicking consistent with hypertensive retinopathy
- right retinal venous engorgement with few dot blot hemorrhages consistent with central retinal vein occlusion
- no retinal detachment

Carotid artery ultrasound and transthoracic echocardiogram were unremarkable. Laboratory tests for coagulopathy and systemic inflammatory disease were negative. Sleep study was notable for severe supine obstructive sleep apnea with associated episodic hypoxia and severe sleep fragmentation.

Final/Working Diagnosis

Central retinal vein occlusion and hypertensive retinopathy, likely associated with obstructive sleep apnea, an association described in the literature, with no other identified etiology.

Treatment and Outcomes

- Athlete did not miss any football practices or games
- Vision remained normal and follow up retina exam was unchanged
- Blood pressure monitored frequently without any documented daytime hypertension
- Began to use CPAP at night
- Reported improved sleep quality and reduced daytime fatigue

2164 Board #320 May. 30 3:30 PM - 5:00 PM

It's More Than A Headache

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HISTORY:

15yo male high school soccer player with headache and dizziness following injury 1 month prior. Event was soccer ball striking right temporal area with fall to the ground without secondary head trauma or loss of consciousness. On rising, patient was knocked down by the opponent. He removed himself from the game due to symptoms of headache, balance problems, dizziness, sensitivity to light and noise, irritability, feeling slowed down, feeling mentally foggy, difficulty concentrating, and having visual problems. He had associated neck pain, numbness and tingling in the left upper extremity and left lower extremity after the injury. No weakness in the upper or lower extremities. No retrograde or anterograde amnesia reported. He continued to play the game. Reported his symptoms to the coach and licensed athletic trainer (LAT) when the game finished.

History of congenital C2-C3 autofusion, concussion 4 years prior with loss of consciousness, and posterior tension-like headaches with coughing and laughing. **PHYSICAL EXAM:**

NECK: Neck supple without rigidity. **FROM** without tenderness on movement or palpation

NEURO: alert, oriented, normal speech. Normal neurological exam of arms.

Normal DTRs, motor, sensory exam.

No focal findings or movement disorder noted.

Finger to nose testing normal.

Cranial nerves II-XII intact.

Motor and sensory grossly normal bilaterally, normal muscle tone, no tremors, strength 5/5

GAIT: normal

Post Concussion Symptom Scale: 46

DIFFERENTIAL DIAGNOSIS:

1. Post-concussion syndrome
2. Cervical Spinal Stenosis
3. Cerebral Herniation

TEST & RESULTS:

MRI of brain & C-spine: Chiari 1 malformation with cerebellar tonsils extending 2 cm below the foramen magnum. Dens angled posteriorly, increasing the degree of crowding at and below the foramen magnum. There is associated slight indentation of the ventral aspect of the upper cervical spinal cord. Congenital partial fusion of C2 and C3. The posterior arch of C1 appears incomplete. No spondylolisthesis.

FINAL WORKING DIAGNOSIS

Chiari Type 1 malformation

TREATMENT & OUTCOMES

1. Avoid athletic activities and referred to neurosurgery for treatment.
2. Neurosurgery performed posterior fossa decompression and duraplasty procedure successfully.
3. Discharged from hospital to home after 3 days with full resolution of headaches and symptoms.

2165 Board #321 May. 30 3:30 PM - 5:00 PM

When Leg Pain In A Runner Does Not Mean Stress Fracture Or Shin Splints

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HISTORY: A 17-year-old male participating in high school middle-distance running presented with a 6-week history of lower left leg pain and limp. The pain was getting worse with increased training. He was running an average of 12-15 miles per day five days a week. This was evenly split on streets and cross-country roads. Although he had taken analgesics, the pain did not improve. He had no pain at rest but had noted some occasional pain at night. There was no history of antecedent trauma and the remaining history did not reveal any significant abnormalities.

PHYSICAL EXAMINATION: Local examination revealed diffuse tenderness over the anterior aspect of the lower left leg. There was no bruising or palpable swelling noted. The musculature and strength was normal. The range of motion of the left knee and ankle joints was normal and there was no neurovascular deficit noted. General physical examination did not reveal any significant abnormalities.

DIFFERENTIAL DIAGNOSIS: 1-Shin Splint 2-Stress Fracture 3-Brodie Abscess 4-Osteoid Osteoma

TEST AND RESULTS: Plain radiographs revealed cortical thickening in the middle 3rd of medial cortex of Tibia(Figure-1). The central nidus and the surrounding sclerosis of the bony lesion was apparent on the CT scan (Figure-2).

FINAL/WORKING DIAGNOSIS: Osteoid Osteoma

TREATMENT AND OUTCOMES: The patient underwent surgical en bloc excision as an outpatient procedure. A shark bite excision of cortical lesions along with the surrounding sclerotic bone was performed under image guidance. The specimens were sent for histopathological examination which was consistent with Osteoid Osteoma. He was kept partial weight bearing for 6 weeks, followed by gradual progression to full weight bearing. Three months post-surgery, the patient was completely asymptomatic. Follow-up radiographs revealed a well-healed excision site and no evidence of recurrence. He returned to his running without problems.

2166 Board #322 May. 30 3:30 PM - 5:00 PM

Doc, My Leg Is Numb.

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(No relationships reported)

HISTORY: An 18 year old, high school, football kicker suffers a leg injury during his last regular season game. He kicked his last PAT of the game when he reported tightness in his anterior leg. During the following kick off, he felt a pop in his right upper thigh as he kicked the ball. He reported immediate pain and difficulty walking. He was able to independently limp off the field. That night he elevated and iced his leg. He reported that he fell asleep with his leg elevated with ice on the area. Upon waking the next morning he felt numbness in the outside of his right thigh. He continued experiencing the soreness in the anterior portion of his thigh, but reported it was no worse than the day before. He denied any back pain, prior back injury, or history of trauma to his back. **PHYSICAL EXAMINATION:** General: NAD, crutch assisted ambulation, athletic build CV: 2+ dorsalis pedis pulses bilaterally, warm extremities Pulm: no dyspnea GI: abdomen soft, non-tender Skin: no bruising Neuro: decreased sensation subjectively along the outer right thigh from hip to knee MSK: Pain to palpation along proximal hip flexors and AIIS, no defect in muscle palpated, full AROM, PROM of hips. 4/5 strength of right hip flexion secondary to pain, 5/5 on left. 5/5 strength bilaterally with hip extension, adduction, abduction, as well as knee flexion and extension. No spinous process or SIJ tenderness to palpation, no step offs appreciated. **DIFFERENTIAL DIAGNOSIS:** 1. Avulsion fracture of AIIS with associated nerve injury 2. Hip flexor strain with meralgia paresthetica 3. hip flexor strain with direct nerve injury from ice 4. FAI with acute hip labral tear 5. Lumbar disc herniation **TEST AND RESULTS:** Pelvis XR: Normal radiographic examination of the hips and the remainder of the pelvis **FINAL/WORKING DIAGNOSIS:** Hip flexor strain with associated meralgia paresthetica **TREATMENT AND OUTCOMES:** 1. Rest from kicking over the following 10 days. 2. Active recovery with ATC at school 3. Numbness resolved at time of follow up in clinic, strength was returning without pain with hip flexion 4. Released to increase kicking distance from PAT to less than 30 yards with plans to increase as tolerated, recommended no kick offs for the remainder of playoffs 5. Athlete had complete resolution of symptoms and was back to full kicking duties approximately 4 weeks after initial injury

2167 Board #323 May. 30 3:30 PM - 5:00 PM
"Not Just Another Ankle Sprain"-an Interesting Case Of Chronic Ankle Pain

Cole C. Budinsky. *Nationwide Children's Hospital, Columbus, OH.*

(No relationships reported)

HISTORY: 22-year-old female presented with progressively worsening ankle pain, swelling, catching, and locking over a five year period. She denied recent or prior trauma. Her limitation was inability to stand throughout a full work day. Past medical history was significant for morbid obesity s/p sleeve gastrectomy 4 years ago. She was seen in the past and told it was "just another ankle sprain" or "from her weight". The pain has worsened despite claims it would improve "once she lost weight".

PHYSICAL EXAMINATION: Mild circumferential swelling with moderate pes planus noted. Tenderness: talar dome, post.-tib. tendon, posterior talar processes. Full ROM, with 4/5 strength appreciated in all planes. Able to walk on heels and toes, with a limp. Unable to hop. Anterior Drawer: positive w/excessive laxity and crepitus. Talar Tilt: positive. Anterior impingement and impaired proprioception noted. Sensation and pulses intact.

DIFFERENTIAL DIAGNOSIS:

1. Talar Stress Fracture
2. Tarsal Coalition
3. Os Trigonum

TEST AND RESULTS:

Radiographs: 3-view Left Ankle

-Degenerative changes of the tibiotalar joint.

-Osteochondral lesions of the medial talar dome and medial shoulder of the tibial plafond.

-Hypertrophic changes concerning for enthesitis about the tendinous insertions.

MRI: Left Ankle:

-Chronic OCD lesion to medial talar dome with large subchondral cysts, measuring 16mm x 8mm.

-Talar Dome collapse with Outerbridge Grade 3/4 articular cartilage loss of the overlying tibial plafond and talar dome.

-Enthesophytes of the dorsal and plantar calcaneus.

FINAL/WORKING DIAGNOSIS:

Large medial talar dome OCD lesion with subchondral cysts (Grade 5 Hepple MRI Staging) and evidence of enthesitis and degenerative talonavicular changes concerning for longstanding inflammatory arthritic condition.

TREATMENT AND OUTCOMES:

1. Tall walking boot and ice therapy, with work modifications to limit weight bearing status
2. Ortho Foot and Ankle referral to address operative management in process.
3. Referral to Rheumatology after case discussion given concern for inflammatory arthritis.
4. Final Outcome pending; patient has yet to consult with either of the above.

2168 Board #324 May. 30 3:30 PM - 5:00 PM

Tumbling Triceps in Gymnastics

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(No relationships reported)

HISTORY: 21 year old female, D-1 gymnast, with 2 weeks of tight and achy right triceps pain. Athlete noted pain after practice, denies specific injury. Her pain is worse with resisted elbow extension. She is treating conservatively, rehabbing with ATC with strengthening both shoulder and arm, and is now tolerating forward tumbling, but soreness remains with backward tumbling. She feels she has plateaued in progress. **PE:** Grossly unremarkable, no ecchymosis or swelling. She has tenderness to triceps muscle belly without palpable muscle defect. ROM and strength are intact at her shoulder and elbow. She is neurologically intact distally. **DDX:** Triceps tear, triceps tendinopathy, shoulder pathology **TEST & RESULTS:** MSK US-proximal, mid belly of long head of triceps muscle fiber disruption with 2 cm fiber gap and hematoma. Extensive hyperemia in zone of injury and 8 cm of fascial thickening. Active contraction demonstrates fiber gap without contraction at zone of injury and abnormal contraction of surrounding fibers. **FINAL/WORKING DX:** Acute tear of right triceps, long head, grade 2b **TREATMENT & OUTCOMES:** Platelet-rich plasma injection into triceps tear followed by compression and 2 days rest. Progressive, sport-specific, pain-free strengthening with ATC guidance. Athlete avoided weight bearing on hands and stretching of triceps. She tolerated dance and trampoline work without issue. Upon reaching 80% speed/power without pain or functional limitation, 2 weeks after diagnosis, we performed serial US exams to evaluate tissue healing and guide progressive muscle loading. 2 week US demonstrated decreased fascial thickening, 2 cm fiber gap w/hyperemia persisted. Absent contraction at site of injury remained, abnormal contraction of surrounding fibers was improved. Continued rehab, did not progress beyond 80% at this time regardless of pain-free status. 4 week US revealed resolution of hematoma and fascial edema. Mild hyperemia remained at zone of injury. Some abnormal contraction at site of injury present, and normalized contraction of surrounding fibers. Athlete was released to gradually RTP under ATC guidance. Athlete progressed overhead loading, reached 100% power/speed and was advanced to forward and eventually backward tumbling. She tolerated full RTP 8 weeks after initial US. Athlete remains without re-injury.

2169 Board #325 May. 30 3:30 PM - 5:00 PM

Knee Pain in a 7th Grade Runningback

Michael Bradburn¹, E. Ray Stewart¹, E. Lyle Cain². ¹The University of Alabama, Tuscaloosa, AL. ²Andrews Sports Medicine and Orthopaedic Center, Birmingham, AL.

(No relationships reported)

Authors: Michael J. Bradburn, E. Ray Stewart, E. Lyle Cain

Affiliation: The University of Alabama, Tuscaloosa, AL, Andrews Sports Medicine and Orthopaedic Center, Birmingham, AL

Title: Knee pain in a 7th Grade Runningback

Case History: Patient is a 13-year-old male 7th grade runningback who sustained a left knee injury at practice. He reported running the football and dragging a defender who was holding onto the patients left leg. He felt a pop in his knee and reported immediate swelling. He was evaluated later that night at the Varsity football game and was referred to the sports medicine office in Tuscaloosa for evaluation.

Physical Exam

Inspection: non-weight bearing left lower extremity, assistance with crutches
Mild ecchymosis, severe effusion, maximal tenderness: lateral joint line, medial patellar, moderate swelling

Tests: left knee: negative Lachman's, guarded medial and lateral McMurray's.

Negative valgus and varus stress, negative anterior and posterior drawer
Range of motion left knee: painful active and passive range of motion, 45 degrees of flexion active and passive, 0 degrees extension active and passive

Positive patellar apprehension on left

Lower extremity strength is normal

Lower extremity neurovascular exam is normal

Differential Diagnosis

#1: patellar subluxation

#2: femoral condyle fracture

#3: lateral collateral ligament sprain

#4: lateral meniscus tear

#5: femoral / tibial bone contusion

Tests and Results

X-ray Knee 4 views Left: avulsion fracture of lateral femoral condyle – minimally displaced
MRI Left knee without contrast: popliteus tendon rupture with retraction. Edema surrounding ACL

Final/Working Diagnosis

Left popliteus tendon femoral avulsion

Discussion

Isolated popliteus tendon rupture is a rarely reported finding in the literature. The vast majority of popliteus tendon ruptures occur in combination with other ligamentous injuries specifically in the posterolateral structures of the knee. Generally, reported cases are treated non-operatively with a high rate of return to play at previous level.

Outcome

Patient was evaluated by an orthopedic surgeon at Andrews Sports Medicine and Orthopaedic Center in Birmingham, AL and underwent arthroscopic left popliteus tendon repair

Return to Activity and Follow Up

After surgery the patient followed an ACL rehabilitation protocol, weight bearing as tolerated in a controlled motion brace, locked in extension for two weeks and began physical therapy after his initial post-operative appointment two weeks after surgery. At his 2-week post-operative appointment he could wean off crutches and weight bear as tolerated with his knee brace locked in extension. Physical therapy following ACL rehab protocol was initiated for the next 4 weeks, allowing for range of motion exercises out of the brace. After six weeks total he was released to return to full activities.

2170 Board #326 May. 30 3:30 PM - 5:00 PM **Hurting Humeri in a Teenage Fencer**

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(No relationships reported)

HISTORY: Patient is a 13-year-old right-hand-dominant male fencing athlete who presented with one year of intermittent right upper arm pain without a specific injury. The pain was diffuse throughout the entire upper arm. The dull, aching pain rated 5/10 and last weeks at a time. The pain was worse at night, causing him to cry. Advil and BenGay helped with the pain. PT did not seem to help. He had seen by two other physicians previously and had a working diagnosis of referred pain from the shoulder. He had shoulder x-rays that were reportedly normal. After initial evaluation and imaging, the patient rested from fencing and restarted upper extremity PT. At 2 month follow-up, he endorsed similar symptoms on his left upper extremity, despite not using the arm for any strenuous activities apart from PT **PHYSICAL EXAMINATION:** Normal cervical ROM. Normal posture. Bilateral upper extremities: No scapular dyskinesia. No pain with palpation over clavicle, SC joint, AC joint, biceps tendon, humerus, elbow. Full ROM of both shoulders and elbows. Negative rotator cuff, AC, labrum provocative tests. Nerves intact. **DIFFERENTIAL DIAGNOSIS:** Biceps/Triceps strain, Humeral stress injury, Cervical spine radiculopathy, Thoracic Outlet Syndrome, Leukemia

TEST AND RESULTS: Right humerus xray: Cortical thickening of the right mid humeral shaft, with subtle periosteal reaction. Mottled cortical thickening which could represent an atypical stress reaction location. Left humerus xray: Unremarkable. Right humerus MRI: Diffuse, primarily diaphyseal marrow and periosteal edema of the right humerus. Findings could be consistent with chronic stress injury. Left humerus MRI: Diffuse bone marrow edema of the left humerus, with adjacent periosteal and mild muscular edema, consistent with left humeral stress reaction with no fracture line. Labs: BMP, Mg, TSH, Free T4, PTH, Vit D, Celiac panel are normal. Phos mildly elevated. **FINAL/WORKING DIAGNOSIS:** Bilateral humeral stress reactions **TREATMENT AND OUTCOMES:** PT to work on upper extremity strengthening. Rest from fencing for 3 months. Recommended formal evaluation by bone specialist but family declined. Patient returned to full fencing activity 5 months after his initial right arm stress injury diagnosis without any return of symptoms

2171 Board #327 May. 30 3:30 PM - 5:00 PM **Different Strokes for Different Folks**

Shannon Carroll. *Edward Via College of Osteopathic Medicine at Auburn University, Auburn, AL.*

(No relationships reported)

HISTORY: A 21 year-old right-hand dominant Division I women's golfer presented with gradual onset right wrist pain starting July 2018 without change in equipment, technique, grip or shaft, but did increase tournament play over the summer. She was initially diagnosed with radiocarpal impingement and treated with posterior interosseous nerve injection at the fourth dorsal compartment. Shortly after she began to have right medial elbow pain with associated fourth and fifth digit numbness and tingling. She had an injection of the cubital tunnel as well with immediate pain relief, though the pain returned shortly after injection and continued to worsen. Particularly noted pain was worsened with full extension mid-swing. She had minimal playing time

through the fall season (unable to chip and putt secondary to pain) and has been unable to participate in spring practice for more than 10 minutes at a time without pain. At this time she is also having resting pain.

PHYSICAL EXAMINATION: Right Wrist/Hand: No muscular atrophy, full range of motion active and passively, non-tender to palpation, ligamentously stable Right Elbow: No soft tissue swelling, bruising, or muscle atrophy, tender to palpation over the flexor pronator mass, medial epicondyle, and sublime tubercle with resisted digital and wrist flexion as well as pronation, stable in varus and valgus at 0 and 30 degrees, positive Tinel's test and elbow flexion test, negative subluxable ulnar nerve, negative moving valgus test, negative Milking maneuver, decreased sensation in the distribution of the ulnar nerve, negative Froment sign, negative Scott Earl test, negative Wartenberg syndrome. **DIFFERENTIAL DIAGNOSIS:** 1. Medial Epicondylitis 2. Cubital Tunnel Syndrome 3. Flexor Pronator Syndrome **TEST AND RESULTS:** 1/2/19 MRI Right Elbow - minimal tendinopathy of the common flexor tendon without tear, small spurring at the sublime tubercle with subtle marrow edema, possibly reflecting low-grade stress reaction, intact UCL, anconeus epitrochlearis identified T2-weighted axial images 11-12 1/10/19 Right Upper Extremity EMG/NCV - no evidence of right cervical radiculopathy or ulnar neuropathy 2/19 Right Upper Extremity Dynamic EMG/NCV - no significant change in activity, recruitment or motor unit seen pre- or post-exertion of right upper extremity; parenthetically despite normal studies, significant tenderness palpated in the area of the anconeus/flexor carpi ulnaris origin on the median elbow region **FINAL/WORKING DIAGNOSIS:** Dynamic Compression of Ulnar Nerve secondary to Anconeus Epitrochlearis with Medial Epicondylitis **TREATMENT AND OUTCOMES:** Surgical cubital tunnel release with anterior subcutaneous nerve transposition with a nerve protection wrap, neurolysis of the posterior medial antebrachial cutaneous nerve and excision of the Flexor Carpi Ulnaris. Post-operatively she will be in a long arm splint for two weeks followed by a removable long arm splint with 30 degrees extension at the wrist and 90 degrees flexion at the elbow. Continue progression at 4 weeks post-operatively to full active range of motion, then 6 weeks full passive range of motion if indicated. At 8 weeks patient can begin sport-specific activity with full return to play after 12 weeks of post-operative recovery.

2172 Board #328 May. 30 3:30 PM - 5:00 PM **An Unusual Presentation of an Increasingly Common Infection**

Erica Martin. *The University of Michigan, Ann Arbor, MI.*

(Sponsor: Keri Denay, FACSM)

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(No relationships reported)

HISTORY: 20-year-old female collegiate basketball player with no medical history presented to training room for 1 day history of epigastric abdominal pain. Pain initially generalized but then localized to epigastric region with nausea and non-bloody diarrhea but no emesis or urinary symptoms. Patient's last menstrual period ended 2 days prior to presentation, was normal. She is sexually active but uses condoms inconsistently. No vaginal complaints. She tried ibuprofen for pain which helped somewhat. No history of GERD, but given location of her symptoms and benign examination, treated with Tums with follow up in 1-2 days. She presented to the emergency department that evening as pain acutely increased.

PHYSICAL EXAMINATION: (in emergency department)

General: fatigued, moderate distress

HEENT: dry mucus membranes

Gastrointestinal: tender in the bilateral upper quadrants, normal bowel sounds, no rebound or guarding.

Psychiatric: appropriate affect

DIFFERENTIAL DIAGNOSIS:

1. Gastroesophageal reflux

2. Viral gastroenteritis

3. Anxiety

TESTS AND RESULTS:

1. Negative labs: comprehensive metabolic panel, lactate, blood cultures (eventually)

2. Abnormal labs: complete blood count (CBC) (high white blood cell count)

3. Imaging studies: abdominal ultrasound unremarkable, CT of abdomen and pelvis negative.

FINAL/WORKING DIAGNOSIS:

Gonorrhea

TREATMENT AND OUTCOMES:

Two days after initial emergency room (ER) visit, patient returned and was feeling a bit better, but was still having abdominal pain in the right upper and bilateral lower quadrants. Examination reassuring, but repeat CBC obtained given leukocytosis in ER and sexually transmitted infection (STI) testing ordered. White blood cell count decreased. Prior to STI testing resulting, patient's abdominal pain increased and she was directed again to the ER. There, she had pelvic examination which revealed yellow cervical discharge. STI testing done, in addition to urine pregnancy testing. Transvaginal ultrasound was negative. At the time of discharge from the ER, STI test results pending. Treated empirically in ER for STI with azithromycin and ceftriaxone.

Both STI tests (from training room and ER) positive for gonorrhea after discharge from ER. In follow up with patient, she is feeling better and has returned to normal activities.

2173 Board #329 May. 30 3:30 PM - 5:00 PM

A Narrow Wrestling Decision

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(No relationships reported)

HISTORY: A 25 year-old male college wrestler presented to the training room the day after a wrestling match complaining of neck soreness. He had unintentionally fallen backwards on the mat and sustained a hyperextension injury of his neck. Immediately after the trauma, he felt an "electrical sensation" traveling down both of his arms into his hands, which resolved within 24-48 hours. At the time of evaluation, he denied any weakness, bowel or bladder retention or incontinence, or numbness or tingling. His only complaint was residual neck pain which was previously treated with oral prednisone and NSAIDs.

PHYSICAL EXAMINATION: A young healthy male in no distress. Normal ambulation. Neck range of motion demonstrated full flexion, but 50% in extension, right and left rotation and lateral tilting. Pain reproduced with neck extension. There was left and right cervical paraspinal tenderness to palpation with no step-off or crepitus noted. Bilateral upper and lower extremity strength, sensation, and reflex testing were normal. No clonus and negative Babinski, Spurling's, and Hoffman's signs.

DIFFERENTIAL DIAGNOSIS:

1. Cervical paraspinal muscle strain
2. Cervical Cord Neurapraxia
3. Fracture of cervical vertebrae
4. Congenital Cervical Stenosis

TEST AND RESULTS:

Cervical Spine AP and Lateral Radiographs: Seven cervical vertebrae seen in AP view. Pedicle shadows intact. Lateral view shows loss of cervical lordosis. Intervertebral disc spaces are well maintained.

CT Cervical Spine WO Contrast: No evidence of fracture or subluxation. Mild congenital cervical canal stenosis.

MRI Cervical Spine WO Contrast: No evidence of acute injury. Multilevel cervical spondylosis with congenital stenosis with the diameter of the spinal canal measuring 6-7 mm. No significant CSF surrounding the spinal cord.

Torg ratio measured on all imaging had values of 0.7 or less.

FINAL/WORKING DIAGNOSIS:

Congenital Cervical Stenosis with associated Cervical Cord Neurapraxia and Cervical strain

TREATMENT AND OUTCOMES:

Based off of imaging and Torg ratio of 0.7 or less, the athlete was not cleared to return to participation. Although he had wrestled for 20 years without issues, he did sustain a transient spinal cord injury necessitating a visit to the ER. He was referred for a second opinion to a neurosurgeon regarding clearance for return to play.

2174 Board #330 May. 30 3:30 PM - 5:00 PM

A Jaw Crushing Line Drive in a Baseball Pitcher

Joshua I. Wilner, Michael Fong. Kaiser Permanente, Los Angeles, CA. (Sponsor: Aaron Rubin, FACSM)
(No relationships reported)

Title: A Jaw Crushing Line Drive in a Baseball Pitcher

Authors: Joshua Wilner, MD, Michael Fong, MD (Sponsor: Aaron Rubin, FACSM)
Institutions: Kaiser Permanente Los Angeles

History: A 23 year old collegiate baseball pitcher sustained a line drive off the right body of his mandible. The patient had a few seconds in which he reported loss of consciousness. After regaining consciousness, he found the baseball at his feet and threw to first in time for the out. At initial medical evaluation, patient complained of pain and bleeding at the right body of his mandible where the baseball made struck him. However, the site of maximal pain was the left superior mandible, where there was no direct trauma. The patient also had concussion symptoms, including headache, confusion, and photophobia.

Physical Examination: Examination on the field indicated a superficial laceration over the right body of the mandible. There was tenderness and swelling at the right body and left subcondylar aspect of the mandible. He had trismus, but no dysphagia or malocclusion. Patient had a positive concussion evaluation. There was no dental or oral trauma. There was no airway compromise or cervical spine abnormalities. There were no neurological deficits. The patient was sent to the emergency room for further evaluation and imaging.

Differential Diagnosis:

1. Mandible fracture
2. Mandible contusion

3. Mandible dislocation

Test and Results:

CT Scan Head and Mandible:

1. Non-displaced left subcondylar mandible fracture
2. No fracture of right body of mandible
3. No acute intracranial hemorrhage or pathology

Final Diagnoses:

Non-displaced, closed left subcondylar mandible fracture

Concussion

Facial laceration

Treatment and Outcomes:

1. Mandible fracture was treated with observation and soft diet for 4 weeks.
2. All concussion symptoms resolved within 4 days, and the patient graduated return to play protocol.
3. The laceration was treated with simple interrupted suture repair for 7 days. There were no wound complications.
4. The patient returned to full baseball activities 4 weeks after date of initial injury.

2175 Board #331 May. 30 3:30 PM - 5:00 PM

A Real Pain in the Neck: A Football Player with Atypical Post-Traumatic Neck Pain

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(No relationships reported)

HISTORY:

18 yo M football player presented to college training room clinic with painful right-sided neck swelling after blunt neck trauma from another player's shoulder pad 2 weeks prior. He had presented to ER 2 days after the incident with acute neck pain and limited ROM, headaches, and difficulty concentrating. CT head & cervical spine were unremarkable. Diagnosed with concussion and SCM strain. He started concussion and muscle strain rehab. Concussion symptoms improved over the next two weeks, but his cervical pain and ROM didn't, and his neck became more swollen. He denied recent illness, cough, rash, fever, chills, dyspnea, dysphagia. POCUS was performed before referral to ER. **PHYSICAL EXAMINATION:** VS: Normal; Gen: No acute distress HEENT: tender 5 x 3 cm subcutaneous mass on the antero-lateral neck, no bruits appreciable; MSK (Neck): tenderness to palpation along the entire right SCM, no spinous process tenderness, decreased lateral flexion and rotation towards the contralateral side; Card: Regular rate and rhythm, no murmurs; Resp: Clear bilaterally **DIFFERENTIAL DIAGNOSIS:** Occult cervical spine fracture, Intramuscular infection, Ruptured sternocleidomastoid, Internal jugular thrombosis, Arterial pseudoaneurysm

TEST AND RESULTS: POCUS: diffuse heterogenous regions throughout the SCM musculature, increased vascularity; ED Labs: WBC: 15.40; ED CT Neck with Contrast: diffuse inflammation of the right SCM muscle with multiple intramuscular abscesses collections in the deep aspect, largest measuring 2.1 x 2.4 x 6.0 cm with associated narrowing of the right internal jugular vein. **FINAL/WORKING DIAGNOSIS:** Traumatic SCM myositis with intra-muscular abscesses

TREATMENT AND OUTCOMES:

Hospitalized and started on IV Unasyn and Decadron. Ultrasound guided needle aspiration collected 2 cc purulent fluid that grew 2+ strep pyogenes. Symptoms didn't improve, so sent to OR for I&D where purulent fluid was drained from cavities superficial to and within the SCM. Neck swelling, pain, and range of motion improved. Repeat neck CT confirmed resolution of infection. Discharged on oral Augmentin. Over several weeks rehabbed to full strength and range of motion in the neck. Given the duration of time away from sport, patient decided to red-shirt the rest of his football season.

2176 Board #332 May. 30 3:30 PM - 5:00 PM

Atypical Shortness of Breath in Division 1 Athlete

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(No relationships reported)

HISTORY: This patient a 20-year-old NCAA Division 1 Field Hockey player who presented with shortness of breath, early fatigue, weakness, and achiness with aerobic training for the past several years. She had symptoms almost immediately with aerobic conditioning that would progress as she continued to exercise. Our athlete reported a trial of pre-exercise albuterol which did not improve her symptoms or exercise tolerance.

PHYSICAL EXAMINATION: Lungs were clear to auscultation bilaterally, with appropriate inspiratory and expiratory effort and normal lung sounds. The patient was able to speak in full sentences without hoarseness. Pulse oximetry 99% and resting

heart rate was 64. There was no cyanosis or clubbing of the nails, with normal capillary refill. Cardiac exam revealed regular rate and rhythm without murmurs, rubs, gallops. PMI was not displaced.

DIFFERENTIAL DIAGNOSIS:

1. Reactive Airway Disease 2. Exercise Induced Bronchospasm 3. Valvular Heart Disease 4. Vocal Cord Dysfunction **TEST AND RESULTS:**

Chest X-rays —no focal consolidation, trachea is midline, no masses, no pneumothorax, full inspiratory effort. EKG —within normal limits. Echocardiogram —within normal limits, preserved ejection fraction and without significant stenosis or regurgitation Spirometry —Pre albuterol administration - FVC 3.33L, FEV1 3.01L, FEV1% 90.5% —Post albuterol administration - FVC 3.4L, FEV1 3.00L, FEV1% 88.9% —Normal lung volumes Flexible Laryngoscopy —appropriate vocal cord movement with respiration and phonation. **FINAL/WORKING DIAGNOSIS:**

Exercise-Induced Laryngeal Obstruction, Vocal Cord Dysfunction

TREATMENT AND OUTCOMES:

1. Referred to Otolaryngologist for diagnosis and treatment; diagnosed with Exercise-Induced Laryngeal Obstruction as diagnosis of exclusion 2. Treated with botox to the bilateral thyro-arytenoid muscles on 3 separate occasions separated by 4 months with positive clinical response. 3. Regular behavioral voice/speech therapy with Speech Language Pathologist tolerated well. 4. Sport psychology counseling was utilized and subjectively helpful to address the underlying anxiety associated with her dyspnea. 5. Patient with improved exercise tolerance, although continues to have symptoms and was unable to return to NCAA Division 1 competition level.

2177 Board #333 May. 30 3:30 PM - 5:00 PM

Eosinophilic Fasciitis Presenting as Benign Subcutaneous Emphysema

Karim Elghawy, Aditya Mehta, Karen Bovid, Robert Baker, FACS. *Western Michigan University, Homer Stryker MD School of Medicine, Kalamazoo, MI.* (Sponsor: Robert J. Baker, FACS)

(No relationships reported)

HISTORY: A previously healthy 12 year old female presented with left forearm pain and subcutaneous crepitus of one week duration. She sustained a minor fall 6 weeks ago where she scratched her forearm against a wooden deck. No bruising, cut wounds or penetrating injury. Few days later she developed dull aching pain and subcutaneous crepitus at the front of her left forearm. No redness, warmth, swelling or limitation of movement. X-rays showed air under the skin. She was started on oral antibiotic without improvement. Ten days later, she was admitted to the hospital and started on IV antibiotics with partial improvement. After 2 days she was discharged on oral antibiotics. Symptoms resolved within 10 days of discharge. A week from finishing antibiotics, she presented with similar symptoms without new injuries. No fever, malaise, weight loss or joint pains. She has family history of JIA in a 19 year old brother and Psoriasis in a 15 year old sister.

PHYSICAL EXAM: She looked non-ill and non-toxic with normal vital signs. There was a mildly tender palpable crepitus over the antero-lateral aspect of her left forearm. No localized swelling, erythema or fluctuation. Normal active range of motion at shoulder, elbow, forearm and wrist. Intact sensation to light touch. Intact radial pulse and brisk cap refill.

DIFFERENTIAL DIAGNOSIS:

1. Necrotizing fasciitis
2. Benign subcutaneous emphysema
3. Autoimmune disease

TESTS AND RESULTS:

Forearm AP and lateral radiographs:

-Moderate subcutaneous gas in the left volar forearm

MRI left forearm:

-Subcutaneous, muscle as well as superficial and deep fascial edema suggestive of cellulitis, myositis and fasciitis. Multiple foci of gas within the subcutaneous tissues and deep fascia-No osteomyelitis or abscess

CBC, CRP and ESR:

-Normal

Tissue biopsy and cultures:

-Severe eosinophilic inflammation, no bacterial growth

FINAL/WORKING DIAGNOSIS:

Eosinophilic fasciitis

TREATMENT AND OUTCOMES:

1. Surgical I&D. No fluid or gross tissue abnormality was noted
2. No antibiotics post-operatively, only one prophylactic dose intra-operatively after cultures were collected
3. Her symptoms resolved and she remained symptom free for 2 months
4. Symptoms recurred without new injury
5. She was referred to pediatric rheumatology for further management
6. Symptoms resolved spontaneously within 2-3 weeks

2178 Board #334 May. 30 3:30 PM - 5:00 PM

Tunneling Away Lateral Ankle Pain

Geoffrey Dreher, David Webner, Kevin DuPrey. *Crozer-Keystone Health Newtownrk, Springfield, PA.* (Sponsor: Thomas Kaminski, FACS)

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(No relationships reported)

TITLE: Tunneling Away Lateral Ankle Pain

AUTHORS: Geoffrey M. Dreher, DO; David Webner, MD; Kevin DuPrey, DO
ACSM Sponsor (if you accept): Thomas Kaminski, PhD, ATC (kaminski@udel.edu)

HISTORY:

60-year-old boilermaker presented with 2-month insidious onset left lateral ankle pain, localized to the lateral malleolus, described as achy and throbbing, 7/10, worse with walking, stairs and climbing ladders. No relief with Acetaminophen or NSAIDs.

PHYSICAL EXAMINATION:

Left ankle: no edema or ecchymosis, full range of motion with pain in active dorsiflexion and plantarflexion. Strength 5/5, gross sensation intact and 2+ dorsalis pedis and posterior tibial pulses. Tenderness to palpation along the lateral malleolus extending distally approximately 5 cm along lateral ankle.

DIFFERENTIAL DIAGNOSIS:

1. Chronic lateral ankle instability
2. Peroneal tendinosis with subluxation
3. Lateral malleolar stress fracture
4. Ankle osteoarthritis
5. Talar osteochondral lesion

TEST AND RESULTS:

- Left ankle 3 view x-ray: Normal.
- Left ankle MRI: Anatomic variant involving conjoined peroneus brevis and longus tendons, located along the anterolateral aspect of distal fibula. Deficient/absent peroneal groove along posterior fibula, which also suggests congenital abnormality. Mild conjoined tendinosis, without surrounding edema.
- Left lateral ankle ultrasound: Intact peroneal tendon overlying the lateral maleolus with trace fluid in sheath. The peroneal tendons split just before brevis insertion onto base of 5th metatarsal.

FINAL/WORKING DIAGNOSIS:

1. Conjoined left peroneal tendon subluxation with tenosynovitis and absence of fibular groove.

TREATMENT AND OUTCOMES:

1. Physical therapy for 6 weeks led to improved balance and walking mechanics, but no change in pain.
2. Immobilization in CAM boot for 6 weeks caused no improvement in pain or swelling out of boot.
3. Corticosteroid injection to peroneal tendons at level of lateral malleolus lead to no improvement.
4. Podiatry referral and surgery including tubularization of peroneal tendons, creation of 6mm fibular groove and repair of peroneal retinaculum. 3 months post-operatively, the patient was full weight bearing pain free with daily activities in lace-up ankle brace.

2179 Board #335 May. 30 3:30 PM - 5:00 PM

Shoulder Pain in a Weightlifter

Kelly Joy Valignota, Terry Nicola, FACS, Melody Hrubes. *UIC Sports Medicine, Chicago, IL.* (Sponsor: Dr. Terry Nicola, FACS)

Email: kj.valignota@gmail.com

(No relationships reported)

HISTORY: A 20-year-old male weightlifter presented as a new patient to a sports medicine clinic with left shoulder pain. Pain began five months prior while the patient was performing overhead presses with a 205 lb barbell. While pushing up into his 5th repetition, he felt a "shift" in his left shoulder. He did not have a significant amount of pain at the time. In the following weeks, he began to have more pain in the left shoulder and decreased his weight during overhead presses and chest presses due to pain and weakness. He tried taking two weeks off from lifting, but when he resumed

he was unable to complete any overhead or chest work due to pain. The pain is focal over the anterior-lateral shoulder with no radiation. No numbness or tingling. He is unsure if his weakness is due to pain or a separate issue.

PHYSICAL EXAMINATION: There was no bony abnormality or muscle atrophy. Patient had full active range of motion of the left shoulder in forward flexion and abduction, with mild pain at end range. Passively, he had 85 degrees of external rotation and 85 degrees of internal rotation with arm abducted to 90 degrees. There was tenderness to palpation along the distal clavicle and acromion, as well as over the supraspinatus, infraspinatus, teres minor/major, biceps, and anterior deltoid. Jobe's test positive for pain and weakness. Positive cross-arm test. Negative Hawkin's, Neer's, O'Brien's, Speed's, and Yergason's. Pain with resisted external rotation and shoulder abduction. Strength was 5/5 at bilateral deltoid, biceps, triceps, wrist extensors, finger flexors, and finger abductors, but 4/5 during resisted left glenohumeral external rotation due to pain.

DIFFERENTIAL DIAGNOSIS: 1) Glenohumeral subluxation 2) Rotator cuff tear 3) Labral tear 4) AJ joint sprain/separation 5) Clavicle fracture
TESTS AND RESULTS: 1) XR Chest from ER visit for unrelated incident: Visualized left clavicle normal, shoulder not visualized. 2) MRI left shoulder without contrast: Nondisplaced fracture of the distal clavicle with associated bony edema of the clavicle and acromion at the AC joint with mild surrounding soft tissue edema. Low grade tendinosis of the infraspinatus and supraspinatus with suspicion for a tiny undersurface tear without retraction.

3) XR Clavicle: Clavicle is intact and negative for fracture.

FINAL/WORKING DIAGNOSIS: Nondisplaced fracture of distal clavicle

TREATMENT AND OUTCOMES:

1. Given no signs of fracture healing after 5 months, ordered laboratory work which revealed Vitamin D deficiency. Patient started on Vitamin D 1200mg and Calcium 800mg daily.

2. Activity modified to abstain from weight bearing exercises through the left upper extremity until next follow up visit.

2180 Board #336 May. 30 3:30 PM - 5:00 PM

Is it Friction? A Rare cause of Medial Knee Pain

Wade Johnson, Jeffrey Payne. *Mayo Clinic, Minneapolis, MN.*
(Sponsor: Jonathan Finnoff, FACSM)

(No relationships reported)

HISTORY: A 22-year-old male with no significant past medical history presents with reports of two weeks of progressive medial knee pain, after beginning training for a sprint triathlon. Prior to starting his training, he primarily lifted weights and ran only sporadically. He increased his running significantly up to 3 to 4 miles 4 to 5 times per week. Pain was initially only present while running, but became present with any activity including swimming, especially with a frog-leg kick, after cycling, and finally with day-to-day walking. He notes mild swelling in the medial knee. He denies any catching, locking, buckling, or give-way of the knee. He denies any paresthesias in the right lower extremity.

PHYSICAL EXAMINATION: Pain in the right medial knee with single leg squat on the right. No knee effusion, however, there is mild swelling located just below the medial joint line over the proximal medial tibia on the right. Knee range of motion is full bilaterally. Ligamentous exam stable. Pain with valgus stress testing at 30 degrees on the right without laxity. No tenderness over the medial or lateral joint lines. Tenderness to palpation over the proximal medial tibia a few centimeters distal to the joint line and over the MCL in this region. No tenderness to palpation over the proximal MCL or pes anserine bursa. **DIFFERENTIAL DIAGNOSIS:** 1. Medial tibial plateau stress reaction 2. Distal MCL sprain 3. Pes anserine bursitis

TEST AND RESULTS: Plain radiographs: — No acute osseous abnormality. MRI right knee: — focal subcortical marrow edema within the medial aspect of the tibia 2.5cm below the joint line at the site of a bony protuberance compatible with prominent medial tibial crest — No fracture line, or soft tissue mass

FINAL/WORKING DIAGNOSIS: Medial tibial crest friction syndrome

TREATMENT AND OUTCOMES:

1. Voltaren gel and activity modification with cessation of cycling, and reduction in training volume, with reported improvement. 2. Patient wanted to return to training for a triathlon and ultrasound-guided corticosteroid injection, deep to the MCL over the tibial protuberance, was performed. 3. Patient reported complete resolution of pain immediately after injection that was maintained at 2 weeks. 4. Patient completed his sprint triathlon without development of pain and he was instructed to follow-up should his symptoms recur.

2181 Board #337 May. 30 3:30 PM - 5:00 PM

Osteitis Pubis: A Career Ending Diagnosis?

Stephen Sanker, Amanda Goodale. *TriHealth, Cincinnati, OH.*
(Sponsor: Henry Stiene, FACSM)

(No relationships reported)

HISTORY:

A 19-year-old Division III collegiate basketball player presents with gradual onset of right groin pain during training. There is no known acute injury. He notes increasing pain during basketball workouts which occurs with running, squatting, and standing from a seated position. There are no radicular symptoms. No numbness, tingling. No genital pain or bulges in the groin. Of note, patient had similar symptoms in high school which reportedly never fully subsided. Treatment has included occasional NSAIDs and intermittent rest.

PHYSICAL EXAMINATION:

Skin intact. No warmth, erythema, or swelling

Full active and passive range of motion of bilateral hips, pain at extremes of external rotation

Tender anteriorly at bilateral groin and over pubic symphysis. Mildly tender proximal adductor tendons.

Pain with FADIR and FABER testing, resisted straight leg raise, and abdominal crunch 5/5 strength of major muscle groups of the lower extremity

NVI

DDX:

1. Hip flexor strain / tear
2. Adductor strain
3. Femoroacetabular impingement syndrome
4. Osteitis pubis

5. Athletic pubalgia

TESTING:

AP and lateral Xrays of right hip:

- No acute osseous abnormalities. No signs of degenerative changes
MRI of the pelvis:

- Symmetric stress edema on either side of pubic symphysis consistent with osteitis pubis.

FINAL/WORKING DIAGNOSIS:

Osteitis pubis

TREATMENT AND OUTCOMES:

1. Several weeks of rest and oral NSAIDs with mild improvement in symptoms, followed by athletic trainer supervised therapy focused on core and pelvic strengthening.
2. Corticosteroid injection of pubic symphysis two months after initial presentation with modest improvement in symptoms, though short-lived.
3. Patient continues to have significant pain with any increased levels of activity.
4. Recently prescribed topical NSAID.
5. Consult with local surgeon recommended against surgical intervention at this time. Discussed further work-up and treatment options with patient including: protected weight-bearing with crutches, repeat MRI with athletic pubalgia protocol, diagnostic femoroacetabular injection, MRI arthrogram of hips evaluating for labral pathology, platelet rich plasma injections, pubic symphysis excision. Patient has recently been only exercising in limited fashion, and is not currently participating in collegiate athletic due to pain.

2182 Board #338 May. 30 3:30 PM - 5:00 PM

Left Knee Pain In A 9-year-old Female

Branden Turner. *Kaiser Los Angeles Sports Medicine, Los Angeles, CA.* (Sponsor: Aaron Rubin, FACSM)

Email: branden.turner@kp.org

(No relationships reported)

HISTORY: 9yo female presents with 2 years of recurring left knee pain. Patient is unable to extend the knee and has pain with ambulation. History of a fall, 1 year ago and worsening pain at the lateral patella. Patient worked with PT after initial fall with resolution of symptoms. Subsequently, the patient had multiple episodes of acute pain and decreased extension of knee with no acute trauma. Patient was referred to Sports Medicine for further evaluation. There is a 2-year history of symptoms since onset. Patient with 2/10 left lateral knee pain with sensation of pressure and inability

to completely extend knee. Denies acute trauma. Pain is improved with massage and stretching. Occasionally taken NSAIDs for pain management. Denies numbness, tingling, weakness, swelling, redness, fever, or chills XR and US performed in clinic. Subsequently, MRI of left knee was ordered.

PHYSICAL EXAMINATION: LEFT KNEE Symmetric, no quadriceps atrophy No effusion No TTP over quadriceps tendon, patella, patella tendon, medial joint line, MCL or LCL Left: Active ROM: 5-135, PROM 0-135 Right: Active ROM: -3-135 Clark Inhibition: neg Bounce test: neg Patella grind: neg Varus stress 0 and 30: neg Valgus stress 0 and 30: neg Lachman: neg Anterior drawer: neg Posterior drawer: neg Mc Murray: + palpable lateral knee click without pain Thessaly/Apley: neg Ober: very flexible at level of hip Short and hypertonic hamstrings on left, w/o tenderness to palpation No tenderness along IT band Thomas: positive Strength 5/5: hip and knee flexion and extension Sensation intact to light touch

DIFFERENTIAL DIAGNOSIS: Hamstring hypertonicity, Mass/tumor, Reactive arthropathy, Enteropathic arthropathy, Meniscus tear

TEST AND RESULTS: X-ray left knee, standing: flattening of the lateral tibial plateau and tibial spines, no acute fracture, no joint disease, open physis US left knee: normal hamstring tendon and muscle no fluid appreciated along tendon sheath, no pes anserine bursitis, no IT band bursitis, no effusion, meniscus not visualized

MRI Left knee: discoid lateral meniscus with horizontal tear

FINAL/WORKING DIAGNOSIS: Discoid meniscus with tear

TREATMENT AND OUTCOMES: Left discoid meniscus saucerization and Physical therapy for rehabilitation. Patient doing well after surgery, with return to full activity without pain or other symptoms

D-75 Clinical Poster/Reception - Clinicians' Reception with Poster Presentations

Thursday, May 30, 2019, 6:00 PM - 7:00 PM
Room: Hotel-Signature 1 Meeting Room

2197 Board #1 May 30 6:00 PM - 7:00 PM The Relationship between Bone Mineral Accrual and Changes of Body Composition in Competitive Girl Runners

Norimitsu Kinoshita¹, Eriko Uchiyama¹, Kenta Okuyama².
¹Hosei University, Tokyo, Japan. ²Shimane University, Shimane, Japan.
(No relevant relationships reported)

Low bone density is a complication of a long-term strict weight control during adolescence in women.

PURPOSE: To assess whether decrease in percent body fat (%BF) is associated with an impaired bone mineral accrual in girl runners.

METHODS: Consecutive 22 freshmen girl runners (15y/o, 158cm, 45kg) during 7 years in competitive high school teams were evaluated over 2 years of training. DXA was performed at the preparatory phase (baseline) and repeated after 23 ± 2 months (follow-up). The runners were divided into 2 groups; negative (DEC, n=11) or positive (GAIN, n=11) changes of %BF (Δ%BF) during the period. The effect of the period and the group on the changes in bone mineral content (BMC) and density (BMD) of total body less head and z-score were analyzed by 2-way repeated measures ANOVA. As for lean soft tissue mass (LSM) and fat mass (FM), paired t-test was used to compare between baseline and follow-up. Bivariate correlation analysis was used to examine the relationship between bone mineral accrual (ΔBMC and ΔBMD) and Δ%BF as well as the changes of FM (ΔFM) and LSM (ΔLSM). Written informed consent was obtained from the runners and their parents. P<0.05 was considered as statistically significant.

RESULTS: %BF changed from 17.4 to 14.3 (DEC) and 15.0 to 18.4 % (GAIN). The period had significant effects on BMC, BMD, and z-score without interactions. Contrast showed significant increases in those variables, while the group of Δ%BF had no significant effect, indicating the values of DEC and GAIN were similarly increased; 1.57 to 1.64 and 1.66 to 1.77 kg, 0.98 to 1.00 and 1.00 to 1.03 g/cm², and -0.25 to -0.20 and 0.04 to 0.22, respectively. The DEC runners gained LSM (34.2 to 36.1 kg) and reduced FM (7.7 to 6.4 kg) significantly, while the GAIN runners significantly increased FM (6.9 to 9.0 kg) without LSM change (36.6 to 37.0 kg). Neither Δ%BF nor ΔFM, but ΔLSM was significantly correlated with ΔBMC (r=0.45) and ΔBMD (r=0.55).

CONCLUSIONS: Bone mineral was equally accrued among the runners of which %BF increased or decreased, where the accretion was associated with LSM gain. Competitive distance runners would develop leanness by not only losing FM but also gaining LSM (i.e., skeletal muscle) along with long-term exercise training. This would ameliorate an impairment of bone mineral acquisition by strict weight control.

2198 Board #2 May 30 6:00 PM - 7:00 PM Pre-Race Risk Screening and Stratification Predicts Adverse Events - SAFER Study In 76654 Distance Runners

Martin Schwellnus¹, Sonja Swanevelder², Esme Jordaan².
¹SEMLI, University of Pretoria, Pretoria, South Africa. ²South African Medical Research Council, Capetown, South Africa.
(No relevant relationships reported)

PURPOSE: The purpose of this study was to determine if a pre-race medical screening and risk stratification program predicts adverse events (ability of a runner to finish the race, or develop a medical complication) during an endurance running event.

METHODS: This prospective study, conducted during the Two Oceans marathon races (21.1km and 56km) in South Africa over 4 years, involved 76654 consenting race entrants. Race entrants completed a pre-race medical screening questionnaire at registration (3-4 months before the race), and were risk stratified into four groups: very high risk (VHR; existing cardiovascular disease - CVD), high risk (HR; risk factors for CVD), intermediate risk (IR; existing other chronic disease, medication use or injury), and low risk (LR). All runners in the VHR and HR categories were provided with educational information to decrease the risk of medical complications, and were also advised to undergo a pre-race medical assessment. Runners were tracked from registration to starting and finishing the race, and medical encounters (ME) were documented. Main outcome variables were the did-not-start rate (DNS; % runners registering but not starting) and the adverse event rate (AE) [defined as % starters that did-not-finish (DNF) or had an ME] in each risk category.

RESULTS: The DNS rate (%: 95% CI) for runners was similar in all risk categories (VHR=19.5; 17.9-21.2, HR=18.8; 18.0-19.7, IR=18.4; 18.0-18.9, and LR=18.6; 18.2-19.1)(p=0.604). The DNF rates in the VHR (2.2; 1.6-3.0)(p=0.005), HR (1.8; 1.5-2.1)(p=0.017), and IR (1.9; 1.8-2.1)(p<0.001) were significantly higher compared to the LR (1.4; 1.2-1.5). The overall AE rates for runners in the VHR (2.3; 1.8-3.0) (p=0.0017), HR (1.8; 1.5-2.1)(p=0.0323), and IR (2.0; 1.9-2.2)(p<0.001) were significantly higher compared to the LR (1.5; 1.3-1.6).

CONCLUSIONS: A pre-race medical screening, risk stratification and educational intervention program did not change the DNS in the risk categories. However, runners in the higher risk categories, that chose to start the race, were more likely to suffer an adverse event (not finish the race or present with a medical encounter) compared with runners in the lowest risk category.

2199 Board #3 May 30 6:00 PM - 7:00 PM Impact of Silver Ion Laundry Treatment on Athletic Gear and Environmental Pathogens and Athlete Health

Priya Balachandran¹, John J. Openshaw². ¹Applied Silver, Hayward, CA. ²Stanford University, Palo Alto, CA.
(No relevant relationships reported)

Community-acquired infections caused by *Staphylococcus* and MRSA can spread easily through sharing towels, gear and contaminated surfaces. The resulting skin infections can lead to athlete disqualifications, cancellations of competitions and potential impact on team performance. In this study, we evaluate a residual antimicrobial textile treatment as an environmental hygiene and infection control strategy through improved textile cleanliness and reduced athlete risk for infection.

PURPOSE: To determine the impact of silver-based residual antimicrobial textile treatment on *Staphylococcus* and MRSA levels on athletic gear, environmental surfaces, athlete infection rates and number of missed play days. **METHODS:** The study, conducted at a professional sports facility over a six-month period, included pre-season and regular season use. Residual antimicrobial silver ion laundry additive was injected onto textiles during the final rinse stage of the facility's standard laundry process. Bioburden data for *Staphylococcus* and MRSA was collected approximately every 4 weeks using contact plates. Athletes' shirts, shorts, jerseys, girdles and towels, and locker room surfaces including carpets, upholstery and other hard surfaces were sampled. Infection rates and number of days missed pre- and post-laundry treatment are also being recorded. Samples collected before initiating the silver ion textile treatment served as the control data set. **RESULTS:** Prior to silver-ion treatment implementation, significant levels of *Staphylococcus* were measured on athlete textiles (average 75 CFU/100 sq. cm.) and on environmental surfaces (average 16 CFU/100 sq. cm.). Silver ion treatment of the textiles resulted in dramatic decreases in *Staphylococcus* by 77% on textiles and by 37.5 % on environmental surfaces. Similar trends were also observed with MRSA. The overall bioburden levels continue to trend downward during the period of treatment. **CONCLUSIONS:** The current results demonstrate that a normal laundry process augmented with an active antimicrobial treatment provide athletic gear and a locker room environment that are and stay cleaner. Final data related to cleanliness, infection rates and player days will be tallied at the close of 2018.

- 2200** Board #4 May 30 6:00 PM - 7:00 PM
Association Between Sport Specialization and Low BMD Among Female High School Distance Runners
 Mitchell J. Rauh¹, Michelle T. Barrack², Adam S. Tenforde³, Michael D. Rosenthal¹, Jeanne F. Nichols, FACSM⁴. ¹San Diego State University, San Diego, CA. ²California State University Long Beach, Long Beach, CA. ³Spaulding Rehabilitation Hospital/Harvard Medical School, Charlestown, MA. ⁴University of California San Diego, La Jolla, CA.
 (No relevant relationships reported)

Sport specialization has become increasingly common and has been related to sports injury and menstrual dysfunction among female high school distance runners. The association between sport specialization and low bone mineral density (BMD) is poorly described in this population. **PURPOSE:** To determine the association between sports specialization and low BMD in female high school distance runners. **METHODS:** Participants consisted of 64 female runners (age 15.6 ± 1.4y), not currently on birth control medication, who competed in interscholastic cross-country and distance track events in southern California. Each runner completed a survey on sport participation and menstrual function, and had her height and weight measured. Each runner's spine and hip BMD were assessed using DXA, standardized to BMD Z-score by age and sex normative values. Sport specialization classifications were: low specialization (distance running sport(s) for ≤8 months/year and participation in ≥1 other non-running high school sports); moderate specialization (only distance running sport(s) for ≤8 months/year, or participation in distance running sport(s) ≥9 months/year and ≥1 other non-running sports); and high specialization (participation in distance running sport(s) for ≥9 months/year and no other sports). Multivariable logistic regression was performed to determine the adjusted odds ratio (OR) and 95% confidence interval (CI), adjusting for BMI and gynecological age. **RESULTS:** Overall, 21.9% of the runners were high sport specialists, and 37.5% and 40.6% were moderate and low sport specialists, respectively. Twenty-three (35.9%) runners had low BMD (Z-score < -1.0). After adjusting for gynecological age and BMI, high sport specialists were five times more likely (OR=5.4, 95% CI: 1.3-23.3; p=0.02) to have low BMD than low sport specialists. **CONCLUSIONS:** Our findings indicated that high sport specialization was associated with low BMD among female high school distance runners. Further investigation of this association is warranted as low BMD has been related to increased risk of stress fracture.

- 2201** Board #5 May 30 6:00 PM - 7:00 PM
The Effects Of Subconcussive Impacts On The Neurocognitive Function Of Men's Collegiate Lacrosse Players From Pre-season To Post-season
 Caroline Varlotta (Sponsor: Dr. Gerard P Varlotta, FACSM), Joshua Giordano, Joseph Miceli, Brandon Burg, Haille Zwibel, Matthew VarlottaHeller. *NYIT-COM, Old Westbury, NY.*
 (No relevant relationships reported)

There is an estimated 1.6 to 3.8 million sports-related mild traumatic brain injuries (mTBI) per year in the United States. Football is more commonly studied than other sports, even though men's lacrosse has almost as great of a risk of mTBI. Since many players of this age group are in schools of higher education, mTBI can inhibit their ability to learn in the classroom. **PURPOSE:** To examine the effects of total number of impacts, cumulative magnitude, and cumulative rotation, as measured by accelerometer, on neurocognition, as measured by time to complete the Trails A task in pre- and post-season. **METHODS:** We examined 10 male freshmen NCAA Division II collegiate lacrosse players in pre- and post-season (January and May). Subjects wore the Vector mouthguard, which contains accelerometers, during full contact practices and 18 games. Vector mouthguard recorded impact number and magnitude. Subjects' cognition was evaluated by C3logix Trails A test. **RESULTS:** The data was analyzed by comparing athletes' mean scores of Trail A between pre- and post-season with paired samples t-test and correlating it with the total number of impacts, cumulative impact, and cumulative rotation with computation of Pearson correlation coefficients. Statistical significance was determined by p-value<.05. The association between completing the Trails A task and the following variables was statistically significant with a positive Pearson coefficient: total number of impacts (0.80, 0.006), cumulative impact (0.74, 0.014) and cumulative rotation (0.71, 0.022). **CONCLUSIONS:** The athletes took longer to complete the Trails A task in post-season if they experienced an increased total number of impacts, cumulative impact, or cumulative rotation. These changes may indicate the number of impacts, cumulative impact, and cumulative rotation affects athletes' cognitive abilities without clinical symptoms or reporting of mTBI. The results of this pilot study suggests further investigation is warranted.

- 2202** Board #6 May 30 6:00 PM - 7:00 PM
International Clinical Scholar Award - Effects of Mistletoe Extract Supplementation on Inflammation Markers after Strenuous Exercise in Rowers
 Soo-Min Ha¹, Jung-Sook Kim¹, Bo-Sung Kim¹, Jeong-Ah Lee², Yoon-Jung Choi¹, Do-Yeon Kim¹. ¹Pusan National University, Busan, Korea, Republic of. ²Kyungsung University, Busan, Korea, Republic of.
 (No relevant relationships reported)

Excessive long-term training and extensive exertion during exercise can inflammatory cytokine expression. Various measures have been explored to minimize this, and dietary supplements having anti-inflammatory and antioxidant functions can help athletes recover from repetitive intensive exercises, thereby preventing reduced vitality. **Purpose:** This study aimed to identify the effect of mistletoe extract consumption on inflammatory markers of university male rowing athletes for 8 weeks during the winter training period. **Methods:** This study included 20 male rowing athletes divided into the Korean Mistletoe extract supplement group (KME, n = 10) and the control group (CON, n = 10). The KME group took 110 mL of mistletoe extract every morning and evening after meals (total of 220 mL) for eight weeks. Before and after taking mistletoe for eight weeks, 2,000 m rowing performance capabilities were measured, and KME group took 110 mL of mistletoe extract after recovery from the rowing exercise. Blood samples were collected during the rest, immediately after exercise, and after 30 min of recovery. Among inflammatory markers, IL-6 and TNF-α were analyzed. **Results:** Both groups showed a significantly reduced 2,000-m rowing time (KME; p<0.001, CON; p<0.01), and the total number of strokes were significantly fewer in the KME group than in the CON group (p<0.05). After supplementation the levels of IL-6 and TNF-α were lower in the KME group than in the CON group in all periods of the rest (p<0.001), immediately after exercise (IL-6; p<0.01, TNF-α; p<0.001), and after 30 min of recovery (p<0.01). **Conclusion:** Therefore, mistletoe extract intake can reduce the serum inflammatory cytokine levels (which are otherwise increased due to high-strength exercise) among active individuals, indicating improved anti-inflammatory activity.

- 2203** Board #7 May 30 6:00 PM - 7:00 PM
Specific Dietary Practices In Female Athletes And Their Association With Disordered Eating
 Celina Francesca de Borja, Lauren M. McCall, Bryan Holtzman, Laura Moretti, Nicole Farnsworth, Kathryn E. Ackerman, FACSM. *Boston Children's Hospital, Boston, MA.*
 (No relevant relationships reported)

PURPOSE: Health and weight management benefits may influence athletes' decisions regarding specific dietary practices. Eating disorders/disordered eating (ED/DE) are highly prevalent in the athletic population. The purpose of this study was to determine if following specific diets correlated with a greater likelihood of responding positively to ED/DE screening tools compared to not adhering to a diet. **METHODS:** 1000 female athletes (15-30 yrs) were asked to complete a comprehensive health and wellness survey. Athletes were asked to specify their diet and completed 3 ED/DE screening tools: the Brief Eating Disorder in Athletes Questionnaire, the Eating Disorder Screen for Primary Care, and self-reported current or past history of ED/DE. We hypothesized that athletes adhering to specific diets were more likely to score positively on ED/DE screening tools than those not following a diet. The most common diets were included in the analyses: vegan, vegetarian, pescatarian, gluten free, low carbohydrate, low dairy, and ≥2 diets. Athletes following diets for health issues (e.g. Celiac disease) were excluded. Descriptive statistics were calculated for all study measures and Chi-square testing was performed to assess relationships between athletes' dietary practices and their responses to ED/DE screening tools. **RESULTS:** 234 of 1000 female athletes reported adherence to specific diets; 766 reported no diet adherence. 69 of the 234 athletes were excluded due to medically-related dietary practices or vague dietary descriptions. 133 athletes reported following 1 of the diets and 32 athletes reported following ≥2 diets. Of the diet-adherent athletes, 67.9% responded positively to ≥1 of the 3 ED/DE screening tools. Athletes practicing vegetarian, vegan, low carbohydrate, low dairy, or ≥2 diets were more likely to respond positively to ≥1 ED/DE screening tool vs. athletes without dietary restrictions (70.0%, 77.8%, 79.5%, 60.0%, and 65.6%, respectively vs. 41.8%; p≤0.048). **CONCLUSION:** Specific diet adherence in female athletes is associated with greater likelihood of positive screening for ED/DE using survey self-report. Health practitioners should consider further ED/DE questioning of athletes reporting specific diet adherence in order to enhance nutritional knowledge and help treat and prevent ED/DE.

- 2204** Board #8 May 30 6:00 PM - 7:00 PM
The Impact of Clinical Factors in Physician and ATC Decision Making for Concussion Return to Play: Insight from a Policy Capturing Study
 Darwin McKnight, Vicki Nelson, Franklin Sease, FACSM, Rg Gilliland. *Greenville Health System, Greenville, SC.*
(No relevant relationships reported)

PURPOSE: To scrutinize the role of several clinical factors in physician and clinical athletic trainer (ATC) return-to-play (RTP) decision making in high school athletes who sustained a concussion.

METHODS: Sports Medicine physicians and ATCs completed a policy capturing survey of 50 clinical scenarios and rated how likely they were to clear the athlete for RTP. Nine factors were randomly varied within the scenarios: age, gender, sport, prior concussion, initial symptom score, symptom duration, and ImPACT performance. Participants then ranked how important each variable was in their decision making process.

RESULTS: 16 physicians (87.5% CAQSM, 12.5% Fellows, mean 9.2 concussions managed per month) and 29 ATCs (mean 4.8 concussions managed per month) participated. ImPACT testing was the most significant contributor in RTP decisions. Physicians and ATCs weighed ImPACT changed from baseline (β 0.42 \pm 0.23 and 1.28 \pm 1.18 respectively) and ImPACT compared to normative values (0.39 \pm 0.24 and 1.38 \pm 0.90 respectively) most heavily. Respondents self-ranked prior concussion and age as most influential in their RTP decision making. There was no correlation between participants self-ranking of importance and the observed contribution of a variable to decision making.

CONCLUSIONS: Respondents displayed poor insight to the role of various clinical factors in their management of concussion RTP. ImPACT testing has a greater influence on RTP decisions than physicians and ATCs realize. Despite having low self-ranked importance, variables related to ImPACT results were among the most influential. Self-ranking importance of clinical variables is similar between physicians and ATCs; however, symptom duration is less important to ATCs compared to physicians. Although age was considered important in self-ranking it was not a significant contributor to RTP decision making.

- 2205** Board #9 May 30 6:00 PM - 7:00 PM
Spine Injuries and Concussions among Figure Skaters
 Kristen M. Lambrinakos-Raymond, Gregory Kobelski, Ellen Geminiani, Dai Sugimoto, William P. Meehan, III. *Boston Children's Hospital, Boston, MA.*
(No relevant relationships reported)

PURPOSE: To determine the prevalence and mechanism of spine injuries and concussions among a sample population of figure skaters. To assess for potential risk factors for these injuries.

METHODS: This is a cross-sectional analysis of spine injuries and concussions reported by figure skaters. Data was obtained through an anonymous, confidential online questionnaire distributed to members of participating figure skating clubs. The main outcomes included diagnoses, mechanism and source of medical care. Simple descriptive statistics were used; Fisher's exact test was used to assess for statistical differences in categorical variables between groups. SPSS was used for all analyses.

RESULTS: Thus far, 88 participants have completed questionnaires (recruitment ongoing). The mean age of participants is 25.2 years (SD 17.1). Most (79%) respondents are female. Most (85%) practice figure skating year-round; 85% participate in competitions. Some skaters participate in more than one discipline including singles(n=68), pairs(n=3), ice dance(n=21), synchronized skating(n=29), theatre on ice(n=17). More than a quarter (27%; n=24) of participants reported spine injuries/back pain. The most common diagnosis was muscular back pain. Treatment was primarily guided by primary care(n=10), sports medicine(n=13), physical therapists(n=14) and athletic trainers(n=10). Almost half of those who reported back pain did not present to a health care provider (HCP) (45%; n/N=11/24). All injuries occurred in practice. More than a quarter of participants (27%; n=24) sustained at least one concussion; 7 sustained two concussions. Several (42%; n/N=10/24) skaters did not present to a HCP for evaluation of their first concussion. All concussions occurred during practice and most (92%; n/N=22/24) were during on-ice activities. The most common mechanism of injury was a fall (62%; n/N=15/24). The sex of the skater was not associated with either mechanism of spine injury or history of concussion.

CONCLUSIONS: Nearly a third of skaters sustained a concussion or spine injury, yet nearly half did not report their injuries to a HCP. Our findings warrant further investigation into the reasons for such a low reporting rate among figure skaters and the potential effect on injury outcomes.

- 2206** Board #10 May 30 6:00 PM - 7:00 PM
Lisa S. Krivickas Clinician/Scholar Travel Award: Characterizing the Prevalence of Cam-Type Hip Impingement in Women's Professional Ice Hockey Players
 Cordelia W. Carter, Darryl Whitney, Matthew Kingery, Samuel Baron, Guillem Gonzalez-Lomas. *NYU-Langone Medical Center, New York, NY.*
(No relevant relationships reported)

Purpose Recent studies have demonstrated an increased prevalence of femoroacetabular impingement (FAI) in elite men's ice hockey players, yet little is known about the hips of players in the National Women's Hockey League (NWHL). The primary purpose of this study was to determine the prevalence of radiographic cam-type FAI in women's professional ice hockey players. The secondary purpose was to analyze the relationship between the presence of cam deformity and hip ROM; clinical impingement signs; and age of menarche.

Methods Clinical, radiographic and demographic data were collected for NWHL players during pre-participation physicals. Alpha angles were measured on 45° Dunn radiographs, with alpha angles >55° defined as cam-positive. Spearman correlations were performed to analyze the relationship between alpha angle and both ROM measurements and menarchal age. Players were grouped into those with and without cam lesions and group differences were assessed using the student's t-test.

Results Twenty-seven athletes were included. Nineteen (70%) had alpha angles >55°; 14 (52%) had bilateral cam deformity. Average menarchal age was 13.9 \pm 1.5 years. There was a significant association between age of menarche and alpha angle (right hips, p=0.01; left hips, p=0.04). There was no significant association between alpha angle and either hip ROM or clinical impingement signs.

Conclusion This study suggests that elite female ice hockey players have a higher prevalence of cam-type morphology than the general population. The positive association between alpha angle and age of menarche lends additional support to the etiological hypothesis of the cam lesion resulting from activity-related stress at the proximal femoral physis; players with earlier menarche (and therefore earlier physeal closure) seem to be less vulnerable to the development of cam deformity of the proximal femur. Thus, professional women's ice hockey players have a high risk of developing cam-type morphology of the proximal femur, although each player's age of menarche may mediate her individual risk for cam lesion development.

E-05 Thematic Poster - Cardiac

Friday, May 31, 2019, 9:30 AM - 11:30 AM
Room: CC-101A

2227 Chair: Daniel A. Boulosa. Universidade Católica de Brasília, Brasília, Brazil.

(No relevant relationships reported)

2228 Board #1 May 31 9:30 AM - 11:30 AM Cardiac Adaptation In Sprint Athletes: A New Phenotype Of 'Athlete's Heart'?

Jake Samuel¹, Samuel Cooke², Martin Schultz³, Iason Z. Apostolakis⁴, Koichi Akiyama⁵, Marie-Jeanne Buscot³, Eric J. Stöhr⁶. ¹University of Texas At Arlington, Arlington, TX. ²University of Lincoln, Lincoln, United Kingdom. ³University of Tasmania, Hobart, Australia. ⁴Columbia University Irving Medical Center, New York City, NY. ⁵Kyoto Prefectural University of Medicine, Kyoto, Japan. ⁶Cardiff Metropolitan University, Cardiff, United Kingdom.
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(No relevant relationships reported)

While it is widely accepted that chronic endurance exercise training leads to cardiac remodeling called 'athlete's heart', the effects of high intensity interval training on left ventricular (LV) structure and function remain equivocal.

PURPOSE: To determine whether the most extreme form of high intensity interval training, namely sprint training, leads to significantly different LV structure and function at rest and during exercise. We hypothesized that sprint athletes (SPR) would have similar systolic wall stress but reduced diastolic function because of the reduced compliance of smaller hearts compared with endurance athletes (ET).

METHODS: Eleven male ET and nine SPR were examined at rest and during progressive exercise (30, 40 & 50% of peak power output). To estimate differences in peripheral blood flow demand, the change in skeletal muscle oxyhaemoglobin saturation (sMO₂) during exercise was quantified with near-infrared spectroscopy. LV systolic and diastolic function were assessed using echocardiography (2D, speckle tracking, color M-mode). Modification of Laplace's Law allowed for the estimation of LV wall stress across the entire systolic period of the cardiac cycle. A quadratic model for continuous data was applied, reported as (Rest; slope with exercise).

RESULTS: Despite a greater peripheral blood flow demand in SPR (Δ sMO₂, $P < 0.0001$) and smaller hearts than ET (LV mass at rest: 95 ± 12 vs. 73 ± 7 g/m², $P < 0.0001$), cardiac index was similar (2.37 ± 0.15 vs. 2.55 ± 0.23 L/min/m², $P = 0.65$; slope $P = 0.16$) but total systolic wall stress per min was consistently lower in SPR (163 ± 14 vs. 115 ± 21 a.u., $P = 0.03$; slope: $P = 0.39$). In contrast, diastolic relaxation, as represented by the validated LV untwisting rate, increased more during exercise in SPR (-103 ± 12 vs. -94 ± 19 degrees/s, $P = 0.64$; slope: $P = 0.04$), but LV blood dynamics, as per intra-ventricular pressure gradients, were comparable (2.79 ± 0.29 vs. 2.55 ± 0.44 mmHg, $P = 0.44$; slope: $P = 0.89$).

CONCLUSION: Compared to ET, the similar cardiac output with lower LV wall stress and a greater LV relaxation with similar filling dynamics in sprint athletes indicates a specific 'athlete's heart' that is characterized by different associations between demand, haemodynamics and LV mechanical function. Future investigations in patient populations are warranted.

2229 Board #2 May 31 9:30 AM - 11:30 AM Exercise-Induced Cardiac Fatigue is Similar Across Increasing Trail-Running Race Distances

Alexandra M. Coates¹, Katharine D. Currie², Trevor J. King¹, Philip J. Millar¹, Jamie F. Burr¹. ¹University of Guelph, Guelph, ON, Canada. ²Michigan State University, East Lansing, MI.
(Sponsor: Jamie Burr, FACSM)
(No relevant relationships reported)

A transient reduction in cardiac function following prolonged endurance exercise, termed exercise-induced cardiac fatigue, has previously been reported following events ranging from 2-40hrs. Right-ventricular dysfunction has been demonstrated to occur prior to left-ventricular dysfunction and, similarly, diastolic impairments may occur prior to systolic impairments. While highly-trained athletes are more fatigue-resistant than lesser-trained subjects, the timing and magnitude of cardiac alterations following prolonged racing is unclear. **PURPOSE:** The aim of this study was to investigate the effects of varying distance trail running races on cardiac function in recreational runners of varying fitness levels, to determine the dose-response of cardiac fatigue.

METHODS: Forty-three distance runners competing in the Sulphur Springs trail races (25k,n=9; 50k,n=13; 80k,n=13; 160k,n=8) completed pre and post testing measures

including resting echocardiography, and an incremental running test to determine maximal oxygen consumption (VO₂max). **RESULTS:** Mean race durations were as follows; 25k: 2.5 ± 0.3 hrs, 50k: 6.0 ± 2.0 hrs, 80k: 11.6 ± 1.8 , and 160k: 25.2 ± 3.6 hrs (all $P < 0.001$). Echocardiographic results indicated diastolic impairments of both ventricles, with minimal systolic impairments, across all race distances post-race. Of the parameters investigated, only early-to-late diastolic filling ratio (E/A) was different between groups such that the 160k racers did not have as great a reduction (mean $\Delta -0.51 \pm 0.50$, 160k $\Delta -0.20 \pm 0.45$, $P = 0.02$). All racers had decreased blood pressure (MAP pre: 94 ± 10 vs post: 83 ± 9 mmHg, $P < 0.0001$), and elevated heart rates (pre: 55 ± 8 vs post: 78 ± 12 b/min, $P < 0.0001$) post-race. Fitness (VO₂max) and age were not related to changes in cardiac function, whereas race duration was related to changes in E/A ratio ($r = 0.37$, $P = 0.02$) only. Changes in diastolic blood pressure were related to many changes in cardiac function including peak longitudinal strain ($r = 0.34$, $P = 0.03$).

CONCLUSIONS: Prolonged trail-races appear to alter diastolic function regardless of race duration, and fitness, likely due to similar reductions in blood pressure post-race. A clear relationship between race duration and level of cardiac impairment is not apparent.

2230 Board #3 May 31 9:30 AM - 11:30 AM Cardiovascular Adaptations During the Hormonal Transition of a Male-to-Female Transgender Athlete

Shannon L. Wilson¹, Andrew C. D'Lugos¹, Nathan Serrano¹, Theresa M. Jorgensen¹, Joanna Harper², Glenn A. Gaesser, FACSM¹, Jared M. Dickinson, FACSM¹, Siddhartha S. Angadi, FACSM¹. ¹Arizona State University, Phoenix, AZ. ²Providence Portland Medical Center, Portland, OR.
(No relevant relationships reported)

PURPOSE: Cardiovascular consequences of female sex hormone exposure on human male biology are currently unknown. This level of investigation is critical given potential adverse outcomes reported in rodent models. This case study aimed to comprehensively assess cardiovascular phenotypes before and during estrogen treatment for gender reassignment.

METHODS: This is the case of a biologically male, distance runner (28 yr) undergoing male-to-female gender reassignment. Two baseline assessments were made prior to initiation of hormone treatment. Testing following initiation of estrogen treatment took place at 4-8 week intervals depending on subject's availability. Testing included resting echocardiography for assessment of biventricular function, dual energy x-ray absorptiometry (DXA), and central vascular blood pressures and stiffness assessments. Treadmill-based VO_{2 peak} and running economy, as well as non-invasive cardiac output and a-vO₂ difference at rest and at peak exercise were quantified at each visit.

RESULTS: Throughout the first 12 months of treatment, stroke volume decreased (136 to 80 ml/beat) with an initial reduction in peak heart rate (ranged 188-180 bpm). Consequently, peak cardiac output declined (28.4 L/min to 15.5 L/min) while a-vO₂ difference increased (11.6 to 19.9 ml O₂/100 ml blood). This resulted in only a minor decrease in absolute VO_{2 peak} (3.3 to 3.1 L/min). Ejection fraction (calculated using modified Simpson's method via echocardiogram) decreased (61% to 57%) along with left ventricular diastology (mitral valve E/e 6.0 to 4.1). Right Ventricular Fractional Area change was unaffected (53% to 53%), while measures of right heart diastology increased (tricuspid valve E/e 3.9 to 4.6). Both right ventricular (RV) and left ventricular (LV) strain initially improved with the addition of estrogen, before worsening over the course of hormone treatment (RV strain ranged from -36 to -31.5%; LV strain ranged from -23.5 to -19%). **CONCLUSIONS:** Therapeutic estrogen administration and testosterone blockade may adversely affect cardiopulmonary fitness via reduction in myocardial performance at peak exercise. This may be associated with a worsening of LV and RV strain at rest. More research is needed to examine the long-term effects of gender reassignment therapy on cardiovascular function.

2231 Board #4 May 31 9:30 AM - 11:30 AM Cardiovascular Disease Risk In Middle-Aged Ultra-Endurance Athletes

Nate P. Bachman¹, Janée D. Terwoord¹, Jennifer C. Richards¹, Barry Braun, FACSM¹, C Patrick Green², Gary J. Luckasen², Frank A. Dinunno¹. ¹Colorado State University, Fort Collins, CO. ²Medical Center of the Rockies Foundation, Loveland, CO.
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(No relevant relationships reported)

It is widely accepted that aerobic exercise reduces cardiovascular disease (CVD) risk. However, recent studies suggest that volumes of exercise that greatly exceed physical activity guidelines may be damaging to the heart. Currently, it is unclear if individuals who train for ultra-endurance races have an elevated risk of developing CVD compared to those that perform lower amounts of physical activity. Additionally, little work has been done to examine vascular function in these athletes. **PURPOSE:** To evaluate cardiovascular function and calculate CVD risk to determine if individuals that train for ultra-endurance races have a greater risk compared to individuals that engage in moderate physical activity. **METHODS:** We examined cardiovascular

function in athletes (ATH, 14M/11F, 50±1 y) that had been training for ultra-endurance events for 10+ years and controls (CON, 9M/9F, 49±2 y) that were meeting current ACSM physical activity guidelines. We used cardiac computed tomography (CT) to calculate coronary artery calcium scores (CACS) and contrast-enhanced magnetic resonance imaging (MRI) to identify myocardial fibrosis (MF). Carotid-femoral pulse wave velocity (cfPWV) was used to evaluate aortic stiffness and ultrasound assessment of carotid intima-media thickness (CIMT) was used to determine vascular structure of the carotid artery. Additionally, we used Doppler ultrasound to assess vascular endothelial function by measuring flow-mediated dilation (FMD) of the brachial artery. Finally, we used a risk score calculator to determine 10-year CVD risk. **RESULTS:** CACS > 0 was observed in 8 ATH and 2 CON; however, the presence of CAC was not significantly different between groups (P>0.05). Additionally, no participant in ATH or CON had MF. ATH had lower cfPWV compared to CON (6.2±0.2 vs 6.9±0.2 m/s, P<0.05), while no difference in CIMT (ATH; 0.64±0.02 vs CON; 0.62±0.03 mm, P>0.05) or FMD (ATH; 3.6±0.8 vs CON; 5.6±1.2 %, P>0.05) was observed. Furthermore, there was no group difference in calculated CVD risk (ATH; 2.4 ± 0.6 vs CON; 1.6 ± 0.3 %, P>0.05). **CONCLUSION:** Middle-aged ATH with 10+ years of training for ultra-endurance races are not at a greater risk of developing CVD than individuals that are meeting current physical activity guidelines.

2232 Board #5 May 31 9:30 AM - 11:30 AM

Can Marathon Running Induce Myocardial Microdamage?

Vincent L. Aengevaeren¹, Adrianus J. Bakermans², Martijn Froeling³, Maria T.E. Hopman, FACSM¹, Melissa T. Hooijmans², Jithsa R. Monte², Gustav J. Strijkers², Aart J. Nederveen², Thijs M.H. Eijssvogels¹. ¹Radboud University Medical Center, Nijmegen, Netherlands. ²Amsterdam University Medical Centers, Amsterdam, Netherlands. ³University Medical Center, Utrecht, Netherlands. (Sponsor: Maria T.E. Hopman, FACSM)
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(No relevant relationships reported)

An acute bout of high-volume high-intensity exercise, such as marathon running, can increase cardiac biomarker concentrations. It is unknown whether these biomarker elevations are related to myocardial micro-damage.

PURPOSE: To assess cardiomyocyte damage following a marathon run using troponin I and novel magnetic resonance imaging (MRI) techniques including T1, T2 mapping and diffusion tensor imaging (DTI), and subsequently relate troponin I to MRI parameters of cardiomyocyte damage.

METHODS: Cardiac MRI was performed at 3T in 12 male participants of the 2017 Amsterdam Marathon. MR data and blood samples were collected during 3 study visits: I) 1 week before, II) 4±2 hrs post-marathon and III) 2 weeks post-marathon. We measured troponin I, cardiac function (ejection fraction, strain, torsion) and morphology (volumes, T1 and T2 maps, and DTI).

RESULTS: 11 men (51 [50-56] years) finished the race (42.195km) in 236±35 min at 89±5% of their predicted maximum heart rate. Troponin I increased post-exercise (from 0 [0-0] at baseline to 57 [16-82] ng/L), but returned to baseline values after 2 weeks recovery (0 [0-0] ng/L). Cardiac ejection fraction and morphology (volumes, T1, T2 maps) did not change following the marathon run (native T1:1214±23 at baseline, 1221±26 4hrs post-marathon and 1206±24 ms 2 weeks post-marathon, p=.15; T2: 50 [48-51] vs. 50 [48-52] vs. 50 [48-52] ms, p=.44). Left ventricular basal strain became less negative from baseline (-25±2%) to post-marathon (-22±2%) and did not completely recover after 2 weeks (-23±3%, p=.003). Extracellular volume fraction (24.6±2.9 vs 26.5±2.6 vs 25.0±3.4 %, p=.37), mean diffusivity (1.49±.09 vs 1.60±.16 vs 1.48±.08 mm²/s, p=.09) and fractional anisotropy (.37 [.33-.39] vs .38 [.37-.40] vs .38 [.34-.40], p=.76) did not significantly change post-marathon. Post-exercise troponin was positively associated with changes in mean diffusivity (r=.62, p=.04).

CONCLUSION: We observed elevations in cardiac troponin I after marathon running, which were significantly associated with higher mean diffusivity of myocardial tissue water. These findings suggest that cardiac biomarker elevations may result from exercise-induced myocardial micro-damage such as disruption of cardiomyocyte integrity and associated edema. Recovery largely occurred within 2 weeks.

2233 Board #6

May 31 9:30 AM - 11:30 AM

Right Ventricle Systolic And Diastolic Function In Renal Transplant Recipients after 12 Months Of Unsupervised Exercise Training

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(No relevant relationships reported)

Purpose : RV function is strongly associated with clinical outcomes in the population at high cardiovascular risk . The RV chamber has been largely studied especially in the cardiopulmonary disease as predictive aspect for a reduced exercise capacity. More recently particularly deformation parameters as Speckle tracking echocardiography (STE) is applied as imaging technique for an accurate evaluation . Renal Transplant Recipient(RTR) is the new category involved in the physical activity program despite the high CV risk. The study aims to assess the global RV function in the RTR regularly submitted to physical activity(PA) at moderate intensity for 1 yr. **Methods :** a group of 50 RTR , aged 50 ±5, was trained for 1 year following a mixed exercise program 30 subjects with an high quality of image and trained for at least 3 times a week , were followed by echocardiographic exam every 6 months. They were investigated by 2D RV standard parameters and strain analysis by X-Strain software with the measurement of the Free Wall (FW) of the RV at T0, T6, and T12 months .**Results :** RTR had at initial phase, low values of RVFW strain with respect of the normal range and vs to the HC ; The RVFW strain was found significantly(P<0.01) increased at the end of the exercise program , restoring the normal range. The RV diastolic function maintained normal with a significant(p<0,05) and progressive adjustment of the E/A ratio in RTR only . No significant variations in controls.

RTR (30)	T0	T6	T12	HC (12) T0	T6	T12
RV FW strain %	-20,48±6,3	-23,55±4,9	-25,06±6,07	-28,43±4,9	-31,53 ±5,2	-30,23± 3,1
RV mean strain%	-18,73±6,3	-23,02±4,6	-25,52±6,7	-26,50±5,7	-29,52±4,5	-29,52± 4,5
RVAC %	40,28±8,4	41,2±8,1	41,5±7,9	45,5±8,2	43,4±6,7	46,3±2,9
RV Diameter mm	23,38±0,71	22,71±1,41	22,81±0,2	22,09±	21,5±0,3	21,77± 0,5
E/A	1,4±0,07	1,21±0,6	1,42±0,2	1,58±0,5	1,54±0,4	1,43±0,4
E/A ⁴	1,1±0,5	1,06±0,3	1±0,04	1,2±0,4	1,1±0,33	1,04±0,0

Conclusions : One year of moderate intensity of unsupervised physical exercise improves the RV chamber performance . The investigation of both of the systolic and diastolic parameters and by the strain analysis can contribute to a correct follow-up in RTR patients. This approach could be proposed especially in case of complete asyntheticity and during physical exercise program . More data will be necessary in future to support this hypothesis.

2234 Board #7

May 31 9:30 AM - 11:30 AM

Cardiac Reinnervation Affects Blood Pressure and Cardiorespiratory Adaptation to Exercise after Heart Transplant

Emmanuel G. Ciolac¹, Rafael E. Castro², Awassi Y. Ggomane¹, Ariane A. Viana¹, Fernando Bacal², Edimar A. Bocchi², Guilherme V. Guimarães². ¹São Paulo State University - UNESP, Bauri, Brazil. ²University of São Paulo - USP, São Paulo, Brazil.

(No relevant relationships reported)

PURPOSE: To investigate the hemodynamic and cardiorespiratory adaptation to exercise in individuals with heart transplantation (HTx) with (CR group) versus without evidence of cardiac reinnervation (NOCR group).

METHODS: Sedentary individuals with HTx (age = 45.5 ± 2.2 years; time elapsed since surgery = 6.7 ± 0.7 years) were allocated to the CR (N = 16) and NOCR (N = 17) group according to their heart rate response to cardiopulmonary exercise testing (CPX). 24-h ambulatory blood pressure (BP), carotid-femoral pulse wave velocity (PWV) and cardiorespiratory fitness were assessed before and after 12 weeks of a thrice-weekly exercise program (5 min of warm-up, 30 min of aerobic exercise, 1 set of 10-15 reps in 5 resistance exercises, and 5 min of cool-down).

RESULTS: The CR group had reduced (P < 0.01) 24-h systolic/diastolic BP (7/9 mmHg), daytime systolic/diastolic BP (9/10 mmHg) and nighttime diastolic BP (6

mmHg) after training (Figure). The NOCR group reduced ($P < 0.05$) only 24-h (5 mmHg), daytime (5 mmHg) and nighttime (6 mmHg) diastolic BP after training. Hourly analysis showed that the CR group reduced systolic/diastolic BP for 10/21 hours, while the NOCR group reduced systolic/diastolic BP for only 3/11 hours (Figure). The CR group also improved both maximal oxygen consumption (10.8 %) and exercise tolerance (13.4 %) after training, but the NOCR group improved only exercise tolerance (9.9 %). PWV did not change in both groups.

CONCLUSIONS: Greater improvements in ambulatory BP and maximal oxygen consumption in the CR than NOCR group. These results suggest that CR affects hemodynamic and cardiorespiratory adaptations to exercise training in individuals with HTx.

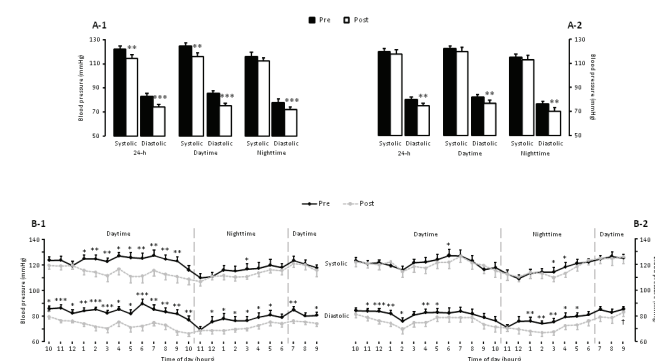


Figure. Ambulatory blood pressure before (pre) and after (post) 12 weeks of exercise training. A: Average 24-h, daytime and nighttime systolic and diastolic blood pressure. B: Hourly averages of systolic and diastolic blood pressures. 1: Individuals with clinical evidence of cardiac revascularization. 2: Individuals without clinical evidence of cardiac revascularization. Asterisks denote significant difference from pre-intervention in the same group (* $P < 0.05$; ** $P < 0.01$; *** $P < 0.001$). Dagger denotes significant difference from the CR group during the same period († $P < 0.05$).

E-06 Thematic Poster - Jumping and Landing

Friday, May 31, 2019, 9:30 AM - 11:30 AM
Room: CC-101B

2235 Chair: Nelson Cortes. *George Mason University, Manassas, VA.*

(No relevant relationships reported)

2236 Board #1 May 31 9:30 AM - 11:30 AM
The Effect Of Cold-water Immersion On Joint Power During Drop-landings

Henry Wang, Yui Nomoto, D. Clark Dickin. *Ball State University, Muncie, IN.*
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(No relevant relationships reported)

Exposure to cold environments results in pronounced alterations in many physiological systems. Military exercises, recreational situations, and popular winter sports could introduce large changes in tissue temperatures of the lower body. To date, the effect of cold exposure on joint mechanics during high impact activities (e.g. drop-landings) remains unknown. It is unclear whether cold exposure could reduce joints' ability to absorb landing impact, which may increase risks of landing related injuries. **Purpose:** To determine the effect of cold-water immersion on lower-extremity joint power during drop-landings. **Methods:** On four separate occasions, 11 female recreational athletes (22 ± 2 yr, 65 ± 7 kg, 1.67 ± 0.06 m) performed drop-landings (single-leg and double-leg landings) from a 0.6-m height following 30-minute immersion in thermoneutral water (CON) (34°C) to the hip-joint level and in cold-water (20°C) to the ankle- (LOW), knee- (MED), and hip- (HIGH) joint levels. 3D motion capture was conducted. Lower-extremity joint power was calculated. One way repeated measures ANOVA was used to determine differences among the four conditions. **Results:** No significant differences in peak power absorption among all testing conditions for either the single-leg landing ($p > 0.05$) or double-leg landing ($p > 0.05$). For single-leg landing, the mean \pm SD of the power absorption (W/kg) during water-immersions (CON, LOW, MED, and HIGH) were 22.1 ± 3.4 , 21.9 ± 2.9 , 22.0 ± 3.1 , 22.8 ± 3.1 , for the ankle, respectively, and 34.7 ± 7.1 , 34.4 ± 6.3 , 33.3 ± 6.2 , 34.4 ± 7.5 , for the knee, respectively, and 39.1 ± 8.9 , 39.9 ± 11.3 , 38.4 ± 5.1 , 39.5 ± 8.3 , for the hip, respectively. For double-leg landing, the power absorption during water-immersions (CON, LOW, MED, and HIGH) were 18.7 ± 2.9 , 19.2 ± 2.8 , 18.8 ± 1.9 , 18.6 ± 2.8 , for the ankle, respectively, and 32.6 ± 6.0 , 32.5 ± 5.6 , 31.5 ± 4.0 , 33.3 ± 7.4 , for the knee, respectively, and 33.3 ± 14.1 , 31.9 ± 16.6 , 29.9 ± 12.8 , 31.8 ± 16.0 , for the hip, respectively. **Conclusion:** For recreational athletes, drop-landing engages sub-maximal eccentric effort at leg's muscle-tendon units to absorb

impact. Although cold-water lowers tissue temperature, the ability of lower-extremity joints to absorb landing impact remains intact. Thus, the risk of landing related injuries may not be elevated due to cold exposure.

2237 Board #2 May 31 9:30 AM - 11:30 AM
Landing Mechanics Differences between the Drop Vertical Jump and Stop Jump

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(No relevant relationships reported)

ACL injury prevention studies have used both the drop vertical jump (DVJ) and the stop jump (SJ) to assess ACL injury risk. Given the anterior motion in the SJ, it may better mimic movement patterns present at the time of ACL injury. Previous studies have not directly compared the landing mechanics between a SJ and DVJ in order to determine which task would be better to use when assessing ACL injury risk and during evaluations of return to sport readiness. **PURPOSE:** To investigate sex-specific differences in lower extremity landing mechanics between the SJ and DVJ. **METHODS:** Fifty healthy participants, 26 male (23 ± 3 years, 1.79 ± 0.64 m, 78.8 ± 10.7 kg) and 24 female (23 ± 3 years, 1.67 ± 0.59 m, 61.4 ± 6.5 kg), were recruited and signed informed consent. Participants performed seven trials per task (SJ and DVJ). Data was collected using a modified Helen Hayes marker set and a ten-camera motion capture system (120 Hz) time synchronized with 2 embedded force plates (1440 Hz). Peak posterior GRF (pGRF), vertical GRF (vGRF), peak knee flexion (KF) and abd/adduction (KA) angles, KF and KA range of motion (ROM), and peak knee extension (pKEM) and abduction moments (pKAM) were quantified for the dominant limb. To examine the sex-specific differences and the differences between the landing tasks, a 2x2 mixed model, repeated measures ANOVA was conducted in SPSS ($\alpha = 0.05$). **RESULTS:** No main effects or interactions were found for the pKEM or KA ROM. Main effects for landing and sex were found for peak KA moment and angle (Table 1). Interactions between sex and landing type existed for the remaining variables of interest (Table 1). **CONCLUSION:** Landing mechanics are different between the SJ and the DVJ with and these responses are sex dependent. Therefore, selection of the landing task could influence results and needs to be considered when assessing injury risk as well as return to sport readiness.

Table 1: Sex and landing task differences.

Variable	Female SJ	Male SJ	Female DVJ	Male DVJ	Interaction	ME Landing	ME Sex
Peak KA Angle (add (+), abd (-))	-7.4 ± 9.8	7.7 ± 8.7	-5.4 ± 9.6	9.8 ± 8.8	0.888	0.003	<0.001
Peak KA Moment (add (+), abd (-))	0.8 ± 0.5	0.2 ± 1.3	0.3 ± 1.1	-0.3 ± 1.0	0.755	0.022	0.006
vGRF (BW)	1.5 ± 0.3	1.7 ± 0.4	1.8 ± 0.4	1.8 ± 0.3	0.015	0.001	0.459
pGRF (BW)	0.4 ± 0.1	0.5 ± 0.1	0.4 ± 0.2	0.4 ± 0.1	0.032	0.125	0.936
Peak KF Angle	85.6 ± 12.5	94.2 ± 14.0	90.2 ± 11.2	94.2 ± 15.4	0.021	0.023	0.097
KF ROM	104.8 ± 14.5	120.8 ± 18.8	107.1 ± 12.3	115.4 ± 23.0	0.012	0.297	0.016

2238 Board #3 May 31 9:30 AM - 11:30 AM
Biomechanical Loading Magnitude Differences During Landing in Male Athletes with and without Patellar Tendinopathy

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(No relevant relationships reported)

Mechanical loading of the patellar tendon (PT) is considered a primary factor associated with tendinopathy in jumping athletes. Prior research has not established if overloading or underloading movement profiles are present in symptomatic and asymptomatic athletes with PT structural abnormality (PTA) compared to healthy athletes.

PURPOSE: To compare involved limb landing biomechanics between male athletes with and without patellar tendinopathy.

METHODS: 43 males were grouped based on PT pain and ultrasound imaging of the proximal PT: symptomatic with PTA (SYM-PTA; $n = 13$; 20 ± 2 yrs; 1.8 ± 0.1 m; 84 ± 5 kg), asymptomatic with PTA (ASYM-PTA; $n = 15$; 21 ± 2 yrs; 1.8 ± 0.1 m; 82 ± 13 kg), and healthy control (CON; $n = 15$; 20 ± 2 yrs; 1.8 ± 0.1 m; 79 ± 12 kg). 3D biomechanics were collected during double-limb jump-landing trials from a 30cm box placed 50% of participant height from 2 force plates. Kinematic (knee flexion angle (KF)) and kinetic (vertical ground reaction force (VGRF); internal knee extension moment (KEM); patellar tendon force (F_{PT})) variables were analyzed as continuous waveforms during stance phase. Mean values were calculated for each 1% of stance, normalized over 202

data points across stance phase (0-100%), and plotted with 95% confidence intervals for each group. Statistical significance was defined as a lack of 95% CI overlap for ≥ 3 consecutive %; average mean differences (MD) were calculated.

RESULTS: SYM-PTA had lesser KF than CON over stance phase (8-76%, MD: $15.8 \pm 2.7^\circ$). ASYM-PTA had lesser KF than CON in the early (8-13%, MD: $8.0 \pm 0.4^\circ$; 21-24%, MD: $11.11 \pm 0.32^\circ$) and late (74-94%, MD: $9.6 \pm 1.1^\circ$) stance phase. SYM-PTA group had lesser KEM than CON in early stance (6.5-9%, MD: 0.04 ± 0.004 Nm[kgm]⁻¹), as well as ASYM-PTA in mid-stance (38-56%, MD: 0.03 ± 0.001 Nm[kgm]⁻¹). SYM had lesser F_{PT} in early stance (6-9%, MD: 0.9 ± 0.2 BW) than CON and in mid-stance (36-60%, MD: 0.7 ± 0.1 BW) than ASYM-PTA. There were no differences in VGRF between groups.

CONCLUSIONS: Male athletes with SYM-PTA demonstrated a PT load-avoidance profile during a double-limb landing task compared to ASYM-PTA and CON athletes. ASYM-PTA did not show evidence of overloading compared to CON. Our findings support the use of individualized treatments for athletes along the continuum of patellar tendinopathy to maximize load-bearing capabilities of tendon.

2239 Board #4 May 31 9:30 AM - 11:30 AM

Is Visual-Cognitive Loading During Jumping A Potential Risk Factor For Sports Injuries?

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(No relevant relationships reported)

PURPOSE: Failed jump landings represent a key mechanism of musculoskeletal trauma. It has been speculated that cognitive dual-task loading during the flight phase may moderate the injury risk. This study aimed to explore whether increased visual distraction can compromise landing biomechanics.

METHODS: Twenty-one healthy, physically active participants (15 females, 25.8 ± 0.4 years) completed a series of 30 counter-movement jumps (CMJ) onto a capacitive pressure platform. In addition to safely landing on one leg, they were required to memorize either one (1N), two (2N) or three (3N) jersey numbers shown during the flight phase. Conditions were randomly selected and equally balanced over all jumps. Outcomes included the number of recall errors as well as landing errors and three variables of landing kinetics (time to stabilization/TTS, peak ground reaction force/pGRF, length of the centre of pressure trace/COPT). Differences between the conditions were calculated using Friedman tests and post hoc Bonferroni-Holm corrected Conover tests.

RESULTS: Regardless of the condition, the number of landing errors remained unchanged ($p=.46$). In contrast, increased visual distraction resulted in a higher number of recall errors (median 1N: 1, 2N: 2, 3N: 3; $p=.001$). Higher cognitive loading, furthermore, appeared to negatively impact the total (1N: 323 mm, 2N: 340 mm, 3N: 332 mm; $p=.05$) and mediolateral (1N: 261 mm, 2N: 273 mm, 3N: 270 mm; $p=.01$) COPT. TTS and pGRF ($p=.84$) and time to stabilization ($p=.78$) were unaffected.

CONCLUSIONS: A simple visual distraction in a controlled experimental setting is sufficient to adversely affect landing stability and task-related short-term memory during CMJ. The ability to precisely perceive the environment during movement under time constraints may, hence, represent a new risk factor of musculoskeletal injury and should be investigated in a prospective trial.

2240 Board #5 May 31 9:30 AM - 11:30 AM

Effects of Arm Swing and Overhead Target on Vertical Jump Performance in Children and Adolescents

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(No relevant relationships reported)

PURPOSE: To examine the effects of including an arm swing and overhead target on vertical jump performance in children and adolescents.

METHODS: Young males ($n=21$, mean $\pm 95\%$ confidence interval, age = 12.1 ± 1.1 years) performed counter-movement vertical jump testing with (CMJA) and without (CMJ) the use of an arm swing and overhead target on force plates sampled at 1 kHz. For both conditions, participants stood in the middle of the force plates, performed a rapid counter-movement of self-selected depth, and immediately finished with a maximal, explosive vertical jump. For the CMJA, participants were instructed to visually focus on the overhead target (Sports Imports, Freestanding Vertec Jump Trainer, Hilliard, OH, USA), use the arms to swing during the countermovement phase, and use the dominant hand to reach for the overhead target. For the CMJ, participants kept their hands on their hips and eyes forward. Vertical ground reaction forces from force plates under each foot were summed to provide total vertical ground reaction forces (N). Performance outcomes included peak force (PF, N), peak rate of

force development (pRFD, N·s⁻¹), peak power (PP, W), concentric impulse (CON, Ns), and eccentric impulse (ECC, Ns). Five separate one-way repeated measures ANOVAs were used to compare means between CMJA and CMJ conditions.

RESULTS: There were no differences between CMJA and CMJ for PF (CMJ = 712.1 ± 183.6 N, CMJA = 716.3 ± 151.9 N, $p=0.941$), pRFD (CMJ = 6209.3 ± 1628.4 N·s⁻¹, CMJA = 6456.2 ± 2082.1 N·s⁻¹, $p=0.657$), or CON (CMJ = 133.4 ± 20.9 Ns, CMJA = 134.6 ± 27.6 Ns, $p=0.849$). PP was greater during the CMJA (CMJ = 2136.2 ± 550.9 , CMJA = 2632.6 ± 558.4 W, $p=0.014$), and ECC was greater during the CMJ (CMJ = 102.5 ± 17.6 Ns, CMJA = 88.1 ± 17.5 Ns, $p=0.015$).

CONCLUSIONS: Including an arm swing and reaching for an overhead target resulted in 23% greater PP with 14% less ECC during the vertical jump test. Reducing eccentric pre-loading, while increasing power production is optimal for youth performance testing. Since PF, pRFD, and CON were not different, while ECC was lower during the CMJA, complex underlying mechanisms involving movement velocity may be responsible for the greater power output during the CMJA, which is consistent with previous studies in adults.

2241 Board #6 May 31 9:30 AM - 11:30 AM

Physical and Psychological Predictors of Single-leg Drop Landing Biomechanics ACL Reconstruction.

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(No relevant relationships reported)

Physical function, psychological factors, and biomechanical adaptations all play roles in risk of second ACL injury after ACLR. However, a gap in knowledge exists regarding the predictive relationships between modifiable risk factors that can be evaluated early in the recovery process and biomechanical adaptations during sport-specific tasks.

PURPOSE: To assess the ability of involved limb knee extension maximal voluntary isometric contraction (MVIC) strength, psychological readiness for sport, and self-reported knee function to predict sagittal plane single-leg drop landing (SLL) kinematics and kinetics after ACLR.

METHODS: Fifty-two participants (19 M/33 F, age = 22.6 ± 4.4 yrs, height = 1.7 ± 0.1 m, weight = 73.5 ± 11.9 kg, time since surgery = 37.8 ± 23.8 mo.) with unilateral ACLR were included in this cross-sectional study. Participants completed involved limb knee extension MVIC torque (Nm/kg) assessment, the ACL Return to Sport After Injury (ACL-RSI) Scale to assess psychological readiness for sport, and the International Knee Documentation Committee (IKDC) subjective knee evaluation to assess knee-related function. Peak sagittal plane hip and knee joint moments and joint angles were assessed during three SLL trials. Separate multivariable linear regression models with forward entry were used to assess the ability of physical and psychological outcomes to predict sagittal plane kinematics and kinetics.

RESULTS: Knee extension MVIC strength, but not ACL-RSI score or IKDC score, significantly predicted peak knee flexion angle ($R^2 = 0.43$, $p=0.001$) and internal knee extension moment ($R^2 = 0.31$, $p=0.001$) during the SLL. Knee extension MVIC strength was positively correlated with ACL-RSI score ($r = 0.30$, $p = 0.03$) and IKDC score ($r = 0.39$, $p = 0.01$).

CONCLUSIONS: Poor quadriceps strength is associated with high-risk, "stiff" sagittal plane kinematics during a SLL task; however, psychological readiness for return to sport and self-reported knee function did not significantly contribute to the predictive models. Therefore, addressing quadriceps strength deficits throughout recovery may be important to reducing biomechanical risk factors for secondary ACL injury while addressing psychological readiness for sport may play a greater role promoting return to sport following ACLR.

2242 Board #7 May 31 9:30 AM - 11:30 AM

Static Loading of the Knee Joint Results in Modified Single Leg Landing Biomechanics

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the mechanical and neuromuscular responses to single leg drop landing perturbations before and after passive loading of the knee joint.

METHODS: Participants' (male [$n=7$] and female [$n=14$], 21.3 ± 2.1 yrs, 1.69 ± 0.09 m, 69.3 ± 13.0 kg) right hip, knee, and ankle kinematics were captured with a 3D motion capture system. Electromyography (EMG) signals were recorded from rectus femoris (RF), vastus lateralis (VL), vastus medialis (VM), semimembranosus (SM), and biceps femoris (BF) muscles. EMG were normalized to maximum voluntary efforts. Participants performed 10 single leg landings from a 30 cm height onto a force platform before and after static knee loading. Participants were seated and secured to a chair while the right knee was flexed and secured at 35° during static loading. A load (150 N/females, 200 N/males) was applied at a 90° angle to the proximal leg for

10 min. Maximum, minimum, range of motion (ROM), and angular velocities were assessed for the hip, knee, and ankle joints, while normalized average EMG (NAEMG) and average vertical ground reaction forces (aVGRF) were calculated over the initial 200 ms of landing. Rate of force development (RFD) was calculated during the landings. One-way ANOVAs analyzed kinematics variables, NAEMG during loading, aVGRF and RFD; while a two-factor ANOVA (condition x muscle) analyzed NAEMG. Alpha level was set at 0.05.

RESULTS: Maximum hip flexion velocity decreased (87.1 ± 56.9 vs. 56.9 ± 63.4 °/s, $p < 0.01$). Minimum knee flexion velocity increased (-14.9 ± 25.2 vs. -27.9 ± 34.2 °/s, $p < 0.02$). Minimum knee ad/abduction velocity decreased (-528.5 ± 127.5 °/s vs. -399.9 ± 129.3 °/s, $p < 0.001$). Ankle ROM decreased ($56.2 \pm 8.5^\circ$ vs. $52.6 \pm 8.5^\circ$, $p < 0.001$). aVGRF decreased (1297.1 ± 392.4 N vs. 1231.3 ± 392.4 N, $p < 0.02$). RFD had a non-significant trend ($16,602 \pm 1057$ N/s vs. $17,368 \pm 1447.6$ N/s, $p = 0.076$). NAEMG was significant between muscle groups (RF: $46.4 \pm 28.9\%$ vs. VL: $26.2 \pm 27.7\%$, $p < 0.01$; VM: $56.3 \pm 46.6\%$ vs. VL: $26.2 \pm 27.7\%$, BF: $38.8 \pm 27.8\%$, and SM: $32.4 \pm 23.0\%$, $p < 0.02$).

CONCLUSIONS: Changes in velocity parameters are attributed to the altered mechanical behavior of the knee joint tissues and may contribute to changes landing mechanics. Overall, results indicate modified hip and knee control in response to potential reduction in knee joint stiffness.

2243 Board #8 May 31 9:30 AM - 11:30 AM Relationship Between Fear Of Reinjury And Single-Leg Landings In ACL Reconstructed Individuals

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(No relevant relationships reported)

High fear of reinjury following ACL reconstruction (ACLR) is related to lower rates of return-to-sport (RTS) and altered neuromuscular and biomechanical patterns during double-leg landings that increase the risk of secondary ACL injury. However, single-leg landings are observed as an ACL injury mechanism and used for RTS decisions following ACLR. Whether fear of reinjury is related to landing patterns on a single limb in ACLR individuals is unknown. **PURPOSE:** To determine the relationship between fear of reinjury and lower extremity muscle activation and biomechanics during single-leg landings in individuals with ACLR. **METHODS:** Thirty-six females (18.9 ± 1.5 yrs, 168.7 ± 6.5 cm, 67.2 ± 10.0 kg) with a history of ACLR completed the Tampa Scale of Kinesiophobia-11 (TSK-11) and three trials of a single-leg hop for distance. 3D motion capture recorded lower extremity biomechanics. Surface electromyography recorded the average peak root mean square (RMS) amplitude of 6 muscles [gluteus medius, gluteus maximus, biceps femoris, semitendinosus, vastus lateralis, rectus femoris] 50ms prior to initial contact (PRE) and during landing (LAND), and was normalized to peak RMS. Spearman's rank correlations examined the relationship between total TSK-11 scores and lower extremity landing muscle activation and biomechanics. **RESULTS:** Fear of reinjury was not related to any lower extremity single-leg landing muscle activation or biomechanics. Specifically, there was no significant relationship to knee kinematics ($r_{s(\text{range})} = -0.251 - 0.000$, $P_{\text{range}} = 0.146 - 0.999$) or kinetics ($r_{s(\text{range})} = -0.273 - 0.249$, $P_{\text{range}} = 0.150 - 0.705$), hip kinematics ($r_{s(\text{range})} = -0.055 - 0.182$, $P_{\text{range}} = 0.295 - 0.753$) or kinetics ($r_{s(\text{range})} = -0.091 - 0.161$, $P_{\text{range}} = 0.355 - 0.602$), or lower extremity muscle PRE activation ($r_{s(\text{range})} = -0.129 - 0.190$, $P_{\text{range}} = 0.274 - 0.861$), or LAND activation ($r_{s(\text{range})} = -0.234 - 0.283$, $P_{\text{range}} = 0.100 - 0.852$). **CONCLUSIONS:** Caution should be used when assessing RTS readiness using single-leg landings. ACLR individuals who demonstrate proper single-leg landings may still be at risk of secondary ACL injury if they have a high fear of reinjury. To comprehensively assess RTS readiness, single-leg landings should be used in conjunction with measures that effectively identify fear of reinjury.

E-07 Thematic Poster - Muscle Physiology

Friday, May 31, 2019, 9:30 AM - 11:30 AM
Room: CC-102A

2244 Chair: Hayden Hyatt. University of Florida, FL. (No relevant relationships reported)

2245 Board #1 May 31 9:30 AM - 11:30 AM The Effects of Resistance Training On Cardiac Muscle Function During Cancer Cachexia

Ashton Legenza¹, Chase Reyes¹, Matthew Dovgan¹, Allison Tigner¹, Wisam Najdawi¹, Eric Bredahl¹, Jacob Siedlik¹, Joan Eckerson, FACSM¹, Kristen Drescher². ¹Creighton University, Omaha, NE. ²Creighton University School of Medicine, Omaha, NE. (Sponsor: Joan Eckerson, FACSM)
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It is estimated that half of all patients with cancer will eventually develop a condition called cachexia that is characterized by systemic inflammation, negative protein and energy balance, and an involuntary loss of cardiac and skeletal muscle. It is a dangerous syndrome that not only has a dramatic impact on patient quality of life but is also associated with poor responses to chemotherapy and decreased survival. **PURPOSE:** To investigate the effects of resistance training (RT) on cancer cachexia-induced cardiac muscle loss. **METHODS:** All procedures were done in accordance with an IACUC approved protocol. Male-Wistar rats ($n=48$) were randomly assigned to a sedentary (SED), RT, SED+cancer, and RT+cancer group. Animals assigned to RT groups trained for a total of 13 weeks using an elevated food model to simulate low intensity RT. SED animals were placed in standard animal housing for an equivalent amount of time. At week 10, animals were injected with Walker 256 mammary carcinoma cells (10^6 cells) or an equivalent amount of 0.9% saline. Left ventricular morphology was measured using echocardiography prior to injection and at the end of the 13-week experiment. Animals were anesthetized with isoflurane during imaging. Differences in ventricular thickness and diameter between groups were analyzed using one-way ANOVA. Significance was set at $\alpha=0.05$. **RESULTS:** There were no significant findings for ventricular morphology between or within groups. **CONCLUSIONS:** The findings suggest that RT had no effect on cancer-cachexia induced cardiac muscle loss. Since the Walker 256 mammary carcinoma cells did not provide a significant cardiotoxic effect, future studies are warranted using different cancer cell lines or incubation periods to induce cardiotoxicity. This work was funded through a Haddix research grant.

2246 Board #2 May 31 9:30 AM - 11:30 AM Repetitive Activation Compromises Motoneuron Excitability During Fatiguing Exercise

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(No relevant relationships reported)

Although fatiguing exercise is known to decrease motoneuronal excitability, the mechanisms underlying this impact remain unclear.

PURPOSE: To investigate the role of repetitive motoneuron activation in determining the decrease of motoneuronal excitability during fatiguing exercise.

METHODS: On 2 separate days, healthy young subjects (26 ± 6 yrs) performed intermittent isometric knee extensions (at 20% of maximal voluntary quadriceps torque): 1) voluntarily (VOL; i.e. requiring repetitive motoneuron activation), and 2) electrically-evoked (EVO, femoral motor nerve stimulation at 20 Hz; no motoneuron activation). The exercise consisted of 50 s contractions followed by 10 s breaks during which potentiated twitches (Qtw) were assessed to monitor the development of peripheral fatigue during each trial. Exercise continued in each trial until the goal of achieving a similar ~40% reduction in Qtw (ΔQ_{tw}) was reached. Before and immediately after exercise, cervicomedullary stimulations (CMS) were used to elicit unconditioned (CMS only) and conditioned (transcranial magnetic stimulation followed by CMS, 100 ms interval) cervicomedullary motor-evoked potentials (CMEPs). All CMEPs were normalized to M-waves and evoked during a constant electromyographic (EMG) activity corresponding to 20% of the EMG obtained during pre-exercise MVCs.

RESULTS: In both trials, ΔQ_{tw} was, per design, comparable (~40%; $P = 0.9$) and unconditioned CMEPs were similar before and after exercise ($P = 0.23$). Conditioned

CMEPs were decreased following VOL (-79%, $P < 0.05$). While conditioned CMEPs were also significantly decreased following EVO (-62%), the exercise-induced reduction was substantially smaller compared to VOL.

CONCLUSION: Repetitive activation of the motoneurons contributes to the decrease in motoneuronal excitability during voluntary exercise. It remains unclear whether motoneuronal responsiveness to synaptic input and/or the efficacy of the corticomotoneuronal synapse account for the repetitive activation-related depression. However, as motoneuron excitability still falls during evoked exercise, other mechanisms, potentially related to neural feedback, also contribute to the exercise-induced fall in motoneuronal excitability.

2247 Board #3 May 31 9:30 AM - 11:30 AM
Dietary Nitrate Supplementation Attenuates Fatigue in Rat Skeletal Muscle

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Nitrate supplementation via oral beetroot juice (BR) has been shown to increase the partial pressure of oxygen in the interstitial space (PiO₂) in rat skeletal muscle. PiO₂ reflects the balance between oxygen delivery and oxygen consumption, and BR is thought to increase PiO₂ and to slow PiO₂ on-kinetics via increased nitric oxide availability. However, it is not known whether nitrate supplementation via BR enhances skeletal muscle contractile performance. **PURPOSE:** The purpose of this study was to 1) validate the effect of oral BR juice on PiO₂ in the rat extensor digitorum longus muscle (EDL) and 2) to determine whether nitrate supplementation attenuates fatigue in the EDL. **METHODS:** Twenty female Sprague Dawley rats (~270g) were randomly divided into three groups: beet juice (BR, n=7), nitrate depleted beetroot juice (dBR, n=8), and water (CON, n=5). BR rats received beetroot juice in their drinking water (1 mmol/kg/day; Beet It, James White, UK) for 5 days before experimentation while dBR rats received an equivalent volume of nitrate depleted BR. CON rats received water *ad libitum*. After pentobarbital anesthesia (50 mg/kg ip), the EDL muscle was isolated and attached to a load cell interfaced with a muscle tension analyzer. PiO₂ was measured using the phosphorescent quenching method. **RESULTS:** The EDL was first stimulated at 1 Hz (6 V, 2 ms) to elicit isometric contractions. Resting PiO₂ was not different among the groups (BR, 26 ± 2 ; dBR, 21 ± 1 ; CON 25 ± 3 mmHg). However, the rate of fall of PiO₂ at the onset of contractions (on-kinetics) as reflected by the mean response time, was slower in BR rats (BR, 23 ± 3 s; dBR, 12 ± 2 s; CON, 12 ± 1 s; $p < 0.002$). Second, the EDL was stimulated at 3 Hz to elicit fatigue. There was no difference in peak tension development among the groups (BR, 0.18 ± 0.01 ; dBR, 0.23 ± 0.02 ; CON, 0.14 ± 0.01 g/mg). However, percent fatigue was less in the BR rats (BR, 18 ± 3 ; dBR, 30 ± 3 ; CON, 28 ± 4 %; $p < 0.05$). There was also a decrease in the peak positive dT/dt during contractions (BR, 14.8 ± 1.4 ; dBR, 19.7 ± 1.9 ; CON, 18.9 ± 1.0 s; $p < 0.05$). **CONCLUSION:** These findings validate the observation that nitrate supplementation with oral BR slows PiO₂ on-kinetics in rat skeletal muscle. Although developed tension was not different, muscle fatigue was less in the BR treated rats which may be attributable to the slower PiO₂ on-kinetics.

2248 Board #4 May 31 9:30 AM - 11:30 AM
Exercising Skeletal Muscle Blood Flow is Diminished in a Rat Model of Pulmonary Arterial Hypertension

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 (No relevant relationships reported)

PURPOSE: Skeletal muscle dysfunction including a shift toward glycolytic metabolism has been suggested to contribute to exercise intolerance in pulmonary arterial hypertension (PAH) but an exercise perfusion limitation of skeletal muscle has not been identified. Therefore, we performed novel characterization of skeletal muscle blood flow response to exercise in a rat model of PAH. **METHODS:** Treadmill running at 50% VO₂max was performed by male Sprague-Dawley rats (368±13g) injected with monocrotaline (MCT, 60mg/kg) to elicit a severe PAH phenotype (MCT, n=7), or vehicle control (saline) (CON, n=7). Fluorescent microspheres injected during run and rest bouts were utilized to determine blood flow via photo spectroscopy of harvested skeletal muscles. VO₂max was measured prior to terminal blood flow studies to characterize exercise capacity of each rat and determine relative exercise intensity for flow analysis. Echocardiographic determination of right ventricular (RV) morphometry and function was also performed. Values are mean ± SE. **RESULTS:** As expected, MCT exhibited RV hypertrophy (as elevated ratio of RV to LV+S mass, $p=0.002$, and RV wall thickness in echocardiography, $p=0.004$), higher RV systolic pressure ($p=0.02$) and lower VO₂max ($p=0.03$) vs. CON. During exercise, blood flow (expressed as as

ml/min per 100g tissue) of the vastus lateralis, semitendinosus, gastrocnemius and biceps femoris was significantly reduced ($p=0.02$) in MCT (0.187 ± 0.07) compared to CON (0.662 ± 0.17) concomitant with higher ($p=0.008$) whole blood lactate in MCT (10.44 ± 1.65 mmol/L) vs. CON (4.33 ± 0.72 mmol/L). Further, exercising blood flow was inversely related to blood lactate at exercise ($r=-0.603$, $p=0.03$), and positively related to cardiac output ($r=0.61$, $p<0.05$). At rest, there was a tendency for both blood flow reduction ($p=0.06$) and higher lactates ($p=0.09$) in MCT (0.053 ± 0.01 , 5.98 ± 2.48 mmol/L) vs. CON (0.148 ± 0.04 , 1.82 ± 0.19 mmol/L). **CONCLUSIONS:** Exercising blood flow is reduced in a rat model of PAH and may contribute to metabolic limits to exercise capacity. Future studies will explore ways to augment skeletal muscle exercising blood flow in PAH, with the hope of improving tolerance for exercise in patients. Funding: NIH-NHLBI R-15 (MB Brown)

2249 Board #5 May 31 9:30 AM - 11:30 AM
Low-load Resistance Exercise During Inactivity is Associated With Greater Fibre Area and Satellite Cell Expression in Older Skeletal Muscle

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Age-related sarcopenia is accelerated by physical inactivity. Low-load resistance exercise (LLRE) counters inactivity-induced muscle atrophy in older adults, but changes in muscle fibre morphology are unstudied. The **PURPOSE** of this study was to determine the impact of LLRE during short-term inactivity (step-reduction) on muscle fibre size, satellite cell (SC) and capillarity content in older skeletal muscle. **METHODS:** Fourteen older (~71 years) male adults underwent 14 days of step reduction (<1500 steps/day) while performing six sessions of LLRE (~30% maximal strength) with one leg (SR + EX) while the contralateral leg served as an untrained control (SR). Seven healthy ambulatory age-matched male adults (~69 years) served as a comparator group (COM). Muscle biopsies were taken from the vastus lateralis after 14 days, and immunohistochemical analysis was performed to determine muscle fibre cross-sectional area (CSA), myonuclear content, SC content (PAX7⁺ cells), and total (C:F) and fibre type-specific (C:Fi) capillary-to-fibre ratios. **RESULTS:** Type I and II fibre CSA was greater in SR + EX compared with SR. Whereas there were no differences across fibre types between SR + EX and CON, type II fibre CSA was significantly lower in SR compared with COM. Type II myonuclear domain was greater in SR + EX compared with COM and SR. Pax7⁺ cells associated with type I and II fibres were lower in SR compared with SR + EX. Type II PAX7⁺ cells were also lower in SR compared with COM with a similar trend for type I fibres. There were trends for a lower C:Fi in SR compared with SR + EX for both fibre types with no differences for each compared with COM. Minimal LLRE during a period of decreased physical activity is associated with greater muscle fibre CSA, SC content, and capillarization. **CONCLUSION:** These results support the use of LLRE as an effective countermeasure to inactivity-induced alterations in muscle morphology with age.

2250 Board #6 May 31 9:30 AM - 11:30 AM
Skeletal Muscle Fatigue: Mechanisms And Mitigation At The Cellular And Molecular Levels In Older Adults

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Skeletal muscle fatigue, or the contraction-induced decline in whole muscle force or power, decreases physical function in older adults. Fatigue primarily results from elevated hydrogen (H⁺) and phosphate (P_i) altering myosin-actin interactions; however, which steps of the myosin-actin cross-bridge cycle are altered and whether these changes are reversible at the molecular and cellular levels are unclear. **PURPOSE:** The study objectives were to: 1) Examine the effects of simulated fatigue on molecular and cellular function, and 2) Test the ability of deoxyadenosine triphosphate (dATP), an alternative energy to adenosine triphosphate (ATP), to reverse fatigue-induced changes. **METHODS:** Maximal force production, myofibrillar mechanics and cross-bridge kinetics were measured in single fibers (20 per person) from the vastus lateralis of 8 (4 men) healthy, sedentary older adults (65-75 years) under normal (5 mM P_i, pH 7.0), fatigue (30 mM P_i, pH 6.2) and fatigue with dATP conditions. ANOVAs with post-hoc tests were used to evaluate differences between means by fiber-type and results were considered significant at $P \leq 0.05$. **RESULTS:** Force declined with fatigue in slow- (myosin heavy chain (MHC) I, 22%) and fast-contracting (MHC II, 30%) fibers due to a reduced number or stiffness of strongly bound myosin heads (30-36%) and slower cross-bridge kinetics (longer myosin attachment times (18-31%) and

reduced rates of force production (17-37%). MHC I myofilaments became stiffer with fatigue (59%), suggesting a fiber-type specific mechanism to partially mitigate fatigue-induced force reduction. Fatigue with dATP moderately improved force production similarly in both fiber types (10-12%) compared to fatigue with ATP. In MHC I fibers, fatigue with dATP returned the number or stiffness of myosin heads and cross-bridge kinetics to normal values. In MHC II fibers, fatigue with dATP left the number or stiffness of myosin heads similar to fatigue conditions, while the cross-bridge kinetics were 19-22% faster than normal. **CONCLUSION:** These results identify novel fiber-type specific changes in myosin-actin interactions and myofilament stiffness that help explain fatigue-related force reduction in older adults as well as an alternative energy source that partially reverses the effects of fatigue.

Supported by: NIH AG047245

2251 Board #7 May 31 9:30 AM - 11:30 AM

Eccentric Overload during Strength Training: A Stimulus for Enhanced Satellite Cell Activation

Michaela Wehrstein¹, Axel Schöffel¹, Nadine Weiberg¹, Theresa Betz¹, Thomas Gwechenberger², Mareike Rittweg², Helmut Müller², Birgit Friedmann-Bette¹. ¹University Hospital Heidelberg, Heidelberg, Germany. ²Olympic Training Center Heidelberg, Heidelberg, Germany.

(No relevant relationships reported)

The effective stimulation of satellite cells (SCs) is crucial for muscular adaptations to various forms of exercise. **PURPOSE:** to find out if strength training with eccentric overload (CON/ECC⁺), which is known to cause microtrauma in skeletal muscle, induces enhanced SC activation, proliferation and differentiation to new myofibers. **METHODS:** 30 recreationally active male subjects were randomly assigned to one bout of intense leg-extension strength training performed as conventional concentric/eccentric resistance exercise (CON/ECC, $n = 15$, 23.3 ± 3.5 yr, 181 ± 5 cm, 74.5 ± 7.6 kg) or as CON/ECC⁺ ($n = 15$, 24.7 ± 3.3 yr, 182 ± 6 cm, 77.4 ± 8.9 kg). Biopsies from the vastus lateralis muscle were obtained in rested condition and again 7 days after the resistance exercise from the contralateral leg. Immunohistochemical analyses of cryosections were performed for myosin heavy chain isoforms I, II and neonatal (MHC_{neo}) as well as for total SC number (DAPI/Pax7; SC_{tot}) and for activated SCs (DAPI/Pax7/MyoD; SC_{act}). CK and myoglobin were determined in venous blood. **RESULTS:** CK (CON/ECC⁺: 4587 ± 7069 vs. 142 ± 55 U · L⁻¹; CON/ECC: 3942 ± 5422 vs. 128 ± 51 U · L⁻¹) and myoglobin (CON/ECC⁺: 720 ± 1335 vs. 41 ± 20 µg · L⁻¹; CON/ECC: 796 ± 1248 vs. 34 ± 12 µg · L⁻¹) were significantly ($P \leq 0.005$) increased after resistance exercise. Only after CON/ECC⁺, significant increases in total SC number per myofiber (0.13 ± 0.05 vs. 0.10 ± 0.03 , $P = 0.017$) and related to type II fibers (0.13 ± 0.04 vs. 0.10 ± 0.05 , $P = 0.009$) were observed. Also, the proportion of activated SCs went up after CON/ECC⁺ only (from 13.2 ± 8.9 to 20.7 ± 9.2 % of SC_{tot}, $P = 0.008$), the average 8 % increase being significantly ($P = 0.026$) different from the non-significant 0.5 % decrease after CON/ECC (from 11.0 ± 10.1 to 10.5 ± 7.4 %). After CON/ECC⁺, the proportion of SC_{act} was significantly correlated with the maximal values for CK ($r = 0.607$, $P = 0.016$) and myoglobin ($r = 0.679$, $P = 0.005$). No change occurred in the low number of MHC_{neo} positive myofibers in either group. **CONCLUSION:** The considerable increases in CK and myoglobin suggest substantial myofiber damage after both forms of intense resistance exercise. However, only CON/ECC⁺ induced a significant activation and proliferation of SCs. With regard to the lack of increase in MHC_{neo} expression, there was no evidence for de-novo synthesis of myofibers.

2252 Board #8 May 31 9:30 AM - 11:30 AM
Doublets Initiating Low Frequency Stimulation Improve Dynamic Contractility Without Exacerbating Fatigue

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(No relevant relationships reported)

Purpose: Doublets, two action potentials (AP) with a very short inter-impulse interval, frequently occur initially in impulse trains from motor nerves during muscle activation. Such doublets improve dynamic contractile parameters such as rate of force development (RFD), velocity and power. In addition, previous studies have shown delayed fatigue development from repeated isometric contractions when a doublet initiates a sub-tetanic train compared with constant frequency stimulation. However, these comparisons were not matched for impulse number, train duration and work, which may have confounded the interpretations. Furthermore, it is unknown how doublets would affect endurance during dynamic contractions. We, therefore, compared the development of fatigue from repeated shortening contractions activated with doublet-initiated sub-tetanic train (DT) or constant-frequency sub-tetanic train (CFT) using protocols matched for work, AP and train duration.

Methods: EDL muscles were isolated from 4 week old rats and incubated at 30°C in Krebs Ringer buffer. To induce fatigue, 100 shortening contractions were elicited either by a doublet-initiated sub-tetanic train (DT; 60 Hz) or a constant-frequency

sub-tetanic train (CFT; 71 Hz). Contractions in the two groups were matched for work, train duration and pulse number. Isometric contractility was tested before and immediately after fatigue.

Results: Work of each contraction was similar in DT- and CFT-stimulated muscles both initially (368 ± 10 vs 369 ± 13 µJ, respectively) and after 100 fatiguing contractions (202 ± 9 vs 193 ± 8 µJ, respectively). However the contraction force and shortening developed faster in the DT-fatigued than the CFT-fatigued muscles: Initial values (RFD 20 ± 0.7 vs 13 ± 0.3 N/s and shortening velocity 48 ± 2 vs 41 ± 1); fatigued values (RFD 16 ± 0.7 vs 10 ± 0.4 N/s, velocity 29 ± 2 vs 23 ± 1 mm/s). Isometric tetanic force was equally affected in both groups; DT-fatigued muscles decreased to 73 ± 2 % and CFT-fatigued muscles to 75 ± 1 % of initial force.

Conclusion: The results indicate that during repeated contractions matched for total work, stimulation duration and pulse number, an initiation by a doublet does not exacerbate fatigue development, but provides an activation strategy for muscles to produce a higher RFD and shortening velocity.

E-08 Thematic Poster - Physical Activity and Health in Older Adults

Friday, May 31, 2019, 9:30 AM - 11:30 AM
Room: CC-102B

2253 **Chair:** Loretta DiPietro, FACSM. The George Washington University School of Public Health and Health Services, Washington, DC.

(No relevant relationships reported)

2254 Board #1 May 31 9:30 AM - 11:30 AM
Walking Efficiency as a Predictor of Brain Atrophy with Aging

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(No relevant relationships reported)

Purpose: Emerging evidence suggests decreasing gait speed may precede declining cognitive function with age. Rising energetic costs of walking precede age-related declines in gait speed, making poor walking efficiency a potential early marker of changes in brain structure and function. The purpose of this study was to examine whether diminished walking efficiency precedes aging-related changes in brain structure.

Methods: Longitudinal data from 767 participants (mean age 64.8 ± 14.8 years, 51% women) enrolled in the Baltimore Longitudinal Study of Aging neuroimaging substudy over up to 7 years (range 1-7) were examined using linear mixed models to estimate the effects of baseline walking efficiency on brain volumes at the most recent visit. Energy expended during 2.5 minutes of usual paced overground walking was assessed using a portable, indirect calorimeter and standardized per meter walked to derive walking efficiency (ml/kg/m). Using MRI scans, brain volume measurements (cm³) were derived with semi-automated region-of-interest algorithms.

Results: In models adjusted for baseline age, sex, time since baseline, race, education, BMI, intracranial volume, and mild cognitive impairment/dementia status, a 0.01 ml/kg/m higher baseline cost of walking was associated with lower total brain volumes ($\beta = -1.2$ cm³), white matter ($\beta = -0.9$ cm³), gray matter ($\beta = -0.7$ cm³), and larger ventricular volumes ($\beta = 0.4$ cm³) at follow-up ($p < 0.03$ for all). Standardized coefficients indicated these associations tended to be strongest for white matter, particularly in the frontal and temporal lobes.

Conclusion: As walking efficiency declines with age, there is associated brain atrophy explained by an observed increase in ventricle volume and shrinkage of total brain, gray and white matter, independent of cognitive impairment and dementia. These findings suggest that rising inefficiencies related to mobility may precede brain atrophy that occurs with aging and serve as novel targets for future interventions that may improve brain health through adaptive motor learning and/or skill development.

2255 Board #2 May 31 9:30 AM - 11:30 AM
Exercise Type And Intensity In Older Women: Preliminary Results Of Community-based Interventions On Functional Capacity
Gabriel de Souza Zanini, Guilherme Moreno Falcão, Isabela Roque Marçal, Vanessa Teixeira Amaral, Emmanuel Gomes Ciolac. *Universidade Estadual Paulista, Bauru, Brazil.*
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(No relevant relationships reported)

Exercise type and intensity in older women: Preliminary results of community-based interventions on functional capacity
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São Paulo State University - UNESP, School of Sciences, Physical Education Department, Exercise and Chronic Disease Research Laboratory
PURPOSE: To assess the effect of different community-based exercise interventions on functional capacity in older women.
METHODS: 80 sedentary or insufficiently active older women (69.2 ± 7.9) were randomly assigned to perform a twice-weekly community-based moderate-intensity continuous aerobic training plus resistance training (MICT+RT)(N=28), high-intensity interval training plus resistance training (HIIT+RT)(N=24) or resistance training (RT) (N=28) programs. Anthropometric (weight, height and BMI) and functional capacity (seat-and-reach, handgrip, sit-up, timed up-and-go (TUG), and 6-minute walking (6MW) tests) were assessed before and after 12 weeks of follow-up.
RESULTS: Weight, BMI and seat-and-reach did not change significantly during follow-up in any group. Handgrip strength improved ($P < 0.05$) after MICT+RT and RT, but not after HIIT+RT. Sit-up, TUG and 6MW performance improved ($P < 0.05$) similarly between groups during follow-up (Table 1).
CONCLUSION: The present preliminary results suggest that community-based exercise programs are effective to improve functional capacity in older women, independent of their type and intensity.

Table 1. Functional capacity before and after follow-up.

Variable	MICT+RT			HIIT+RT			RT		
	Pre	Post	P	Pre	Post	P	Pre	Post	P
Weight	72.2±12.7	71.8±14.9	0.833	69.4±10.1	68.6±13.1	0.492	74.6±18.1	71.8±15.4	0.674
Stature	1.56±0.05			1.53±0.05			1.55±0.06		
BMI	29.1±5.2	29.5±6.3	0.544	29.5±4.7	29.1±5.5	0.342	28.6±9.1	29.8±5.1	0.234
Wells	21.1±7.7	22.5±6.9	0.251	21.8±5.8	26.2±9.0	0.144	24.9±7.1	25.6±7.6	0.962
HandGrip	23.3±4.5	25.0±4.3	0.029*	22.6±6.0	24.7±6.1	0.506	23.6±5.3	25.7±5.6	0.002*
SitUp	12.4±2.9	9.1±1.6	0.045*	12.0±2.9	9.8±2.5	0.012*	12.1±3.3	9.5±2.5	0.041*
TUG	8.5±1.7	7.2±1.8	0.001*	9.4±2.6	6.9±2.2	0.001*	9.1±2.5	6.8±1.6	0.008*
6MW	433.2±93.69	463.1±83.1	0.043*	401.7±85.1	452.0±109.9	0.039*	409.6±90.8	458.8±119.3	0.001*

MICT+RT: moderate-intensity continuous aerobic training plus resistance training group; HIIT+RT: high-intensity interval training plus resistance training group; RT: resistance training group; TUG: Timed up-and-go test; 6MW: six minute walking test; * $P < 0.05$.

2256 Board #3 May 31 9:30 AM - 11:30 AM
Longitudinal Relationship between Energy Reserves and Brain Atrophy
Amal A. Wanigatunga¹, Yujia Qiao¹, Yang An², Christos Davatzikos³, Vadim Zippunnikov¹, Adam P. Spira¹, Eleanor M. Simonsick², Susan M. Resnick², Jennifer A. Schrack¹. ¹Johns Hopkins Bloomberg School of Public Health, Baltimore, MD. ²National Institute on Aging Intramural Research Program, Baltimore, MD. ³University of Pennsylvania, Philadelphia, PA.
(No relevant relationships reported)

Purpose: Energy reserves for ambulation deteriorate progressively with age due to climbing energy costs and declining peak energy capacity. We examined whether declines in energy reserves necessary for gait contribute to brain atrophy.
Methods: We studied 597 cognitively-intact participants (mean age 69 years, 54% women) in the Baltimore Longitudinal Study of Aging neuroimaging study with repeated energetic and neuroimaging measures. Energy expenditure was measured using indirect calorimetry. Energetic reserve was defined as a cost ratio between the average VO_2 (ml/kg/min) expended during a slow-paced (0.67 m/s) treadmill walking

test and peak VO_2 (ml/kg/min) expended during a rapid-paced 400m walk, with a higher cost ratio representing lower energetic reserve. Using MRI brain scans, brain volumes were derived using an automated multi-atlas approach to define regions-of-interest. Multivariable mixed-effects models were used to estimate whether: 1) baseline and 2) longitudinal changes in cost ratio were associated with annual changes in brain volumes.
Results: In fully-adjusted baseline models, a 10% higher baseline cost ratio was associated with a 0.18 cm^3 ($\text{SE}=0.04$; $p<0.001$) annual increase in ventricular volume. Additionally, baseline cost ratio was inversely related to parahippocampal gyrus volume averaged over time (main effect= -0.05 (0.02) cm^3 , $p=0.001$). In fully-adjusted longitudinal models, an annual 10% increase in cost ratio was associated with a 0.04 (0.01) cm^3 ($p=0.002$) annual decrease in parahippocampal gyrus volume. Though not statistically significant, increased cost ratios were observed with declines in all other regions.
Conclusion: As the energetic cost of walking approaches energetic capacity, associated brain atrophy is explained by increased ventricle volume and shrinkage of the parahippocampal gyrus in cognitively-intact individuals. These findings suggest that declines in energy reserves may contribute to brain atrophy with aging.

2257 Board #4 May 31 9:30 AM - 11:30 AM
Device Measured Physical Activity And Sedentary Behavior In Chilean Older Adults: The Latin American Cities For Healthy Aging Study
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(No relevant relationships reported)

PURPOSE: To describe device measured physical activity (PA) and sedentary behaviour (SB) in older adults from Temuco, Chile.
METHODS: Community-dwelling adults aged 60 and older were recruited from 17 different neighbourhoods in Temuco, Chile. The participants were asked to wear an ActiGraph GT3X+ accelerometer on the hip for 7 consecutive days. A sleeping and a non-wear-time algorithms were used to detect daily wearing time. Accelerometer data were considered valid if the participant wore the device for at least 8 hours on any 4 days of the week. Accelerometer vector magnitude counts (cpm) were used to classify all worn time as either SB (<200 cpm), light (LPA, 200-2689 cpm), moderate (MPA, 2690-6166 cpm), vigorous (VPA, 6167-9642 cpm), very vigorous PA (VVPA, ≥9643 cpm) and moderate-to-vigorous PA (MVPA, ≥2690 cpm) using a combination of Aguilar (2014) and Sasaki (2011) cut-points. For those participants who were unable to provide 7 complete days, total time spent in different activity intensities was calculated as: $(5 \times \text{mean weekday time} + 2 \times \text{mean weekend day time})/7$, thus providing an average day estimate for each behavior. PA recommendation compliance was defined as accumulating either ≥ 150 min/week of MVPA or 30 min/day of MVPA on at least 5 days. Multivariate regressions were used for analysis. **RESULTS:** 316 participants were recruited, but 228 provided valid accelerometer data (69.5 ± 6.86 years, 32% male). On an average day the participants spent 303.7 ± 87.1 min/day in SB, 375.4 ± 88.5 min/day in LPA and 40.8 ± 29.3 min/day in MVPA. In relative terms, the older adults spent $42.3 \pm 11.5\%$ of their waking hours in SB and only $5.6 \pm 3.9\%$ in MVPA per day. Age was negatively associated with time spent in MPA ($\beta=-0.75$ min/day, $p=0.003$) and MVPA ($\beta=-0.78$ min/day, $p<0.001$). Being male was positively associated with MPA ($\beta=14.7$ min/day, $p<0.001$), VPA ($\beta=1.0$ min/day, $p<0.001$) and MVPA ($\beta=15.7$ min/day, $p<0.001$). 33.3% of the sample met the PA recommendations with no differences by gender. The oldest old were less likely to meet PA recommendations ($\text{OR}=0.93$, $p=0.003$). **CONCLUSIONS:** This study provides relevant information for reinforcing strategies to promote PA in elderly population, considering that the oldest old and women were less likely to engage in MVPA. Funded by CONICYT-CNPq/PCI/441970/2016-8, DIUFRO16-0110, DIE17-0006

2258 Board #5 May 31 9:30 AM - 11:30 AM
Moderate Intensity Walking Cadence (Steps/min) in 61-85 Year Old Adults
Catrine Tudor-Locke, FACSM, Scott Ducharme, Aston K. McCullough, Christopher C. Moore, Colleen J. Sands, Zachary R. Gould, Marcos Amalbert-Birriel, Elroy J. Aguiar, John M. Schuna, Jr., Tiago V. Barreira, Stuart R. Chipkin. *University of Massachusetts Amherst, Amherst, MA.*
(No relevant relationships reported)

Consistent evidence supports a strong relationship between walking cadence (steps/min) and intensity. However, this relationship has primarily been examined in young adults. **PURPOSE** To identify a heuristic (evidence based, reasonable, rounded) cadence threshold associated with absolutely-defined moderate intensity defined as 3 METs (metabolic equivalents; $\text{MET}=3.5 \text{ mL/kg/min}$) in older adults (61-85 years of age). **METHODS** Thirty-seven participants (23 women; age= 71.6 ± 14.0 years; BMI= $25.8 \pm 4.7 \text{ kg/m}^2$) completed a progressive treadmill walking test. The protocol

included 5 minute bouts increasing by 0.5 mph increments from 0.5 to 6.0 mph until: 1) the participant naturally selected to jog or run, 2) reached >75% of their age-predicted maximum heart rate, or 3) reported a Borg scale rating of perceived exertion (RPE) >13. Oxygen consumption (VO_2 ; mL/kg/min) was measured using indirect calorimetry and cadence was determined by dividing directly-observed steps by bout duration. METs were calculated as the average VO_2 over the last two minutes of each bout, divided by 3.5 mL/kg/min. Receiver Operator Characteristic (ROC) curves and Youden's index were used to determine moderate intensity based on cadence. Additionally, the cadence-intensity relationship was evaluated using a segmented regression model with random coefficients. **RESULTS:** All but three participants reached at least 3 METs during treadmill walking. The ROC cadence threshold for absolutely-defined moderate intensity was 100.3 steps/min. Specificity and sensitivity values were above 85% for moderate intensity. The cadence-intensity relationship was also explained by bi-linear relationship with a breakpoint at 94.4 steps/min, where cadence explained 74% of the variance. The cadence threshold for absolutely-defined moderate intensity was 101.3 (95% Prediction Intervals=68.2-112.8). **CONCLUSION:** A growing number of studies have provided evidence supporting the utility of 100 steps/min as a reasonable heuristic threshold value associated with absolutely-defined moderate intensity walking in younger adults. This study confirms that 100 steps/min is also as an appropriate proxy threshold of absolutely-defined moderate intensity in ambulatory and ostensibly healthy older adults. **FUNDING:** NIH-NIA-5R01AG049024

2259 Board #6 May 31 9:30 AM - 11:30 AM
Effects Of Exergaming On Cognition And Dual-task Mobility In Older Adults At Risk For Falling

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Exergaming is a new and popular exercise regimen that can combine physical exercise and cognitive training, and has the potential to improve cognitive function and dual-task mobility among older adults. **PURPOSE:** To test whether an 8-week exergaming program that utilizes custom Microsoft Kinect-based motion-tracking exergames would improve cognitive function and dual-task mobility compared to a traditional physical exercise program among older adults at risk for falling. **METHODS:** A quasi-experimental intervention study was conducted with adults aged ≥ 65 years living in senior living communities and reporting mobility difficulties or a fall in the past year were enrolled to an exergaming program or a traditional physical exercise program, offered twice weekly for 8 weeks. Cognitive function and dual-task mobility were measured before and after the 8-week intervention. A Wilcoxon rank-sum test was used to compare the group difference and further adjust for exercise intensity (ratings of perceived exertion, RPE) using a rank transform method. **RESULTS:** Twenty-nine participants (age 77 ± 7 yrs) completed either the exergaming program ($n=15$) or the traditional physical exercise program ($n=14$). Statistically significant group differences in Trail Making Test Part A (TMT-A, $p<0.05$) and single-task gait speed, stride length, and stride width (all $p<0.05$) and marginal group differences in Mini-Mental State Examination (MMSE, $p=0.06$) were observed, all favoring the exergaming program. After adjusting for RPE, effects remained statistically significant for most single-task gait measurements (all $p\leq 0.05$), and marginal group differences in TMT-A ($p=0.06$) and MMSE ($p=0.07$) were observed. There were no statistically significant group differences in dual-task gait performance. **CONCLUSIONS:** Exergaming marginally improved global cognitive status and had a protective effect against declines in executive function and single-task gait measurements compared to traditional physical exercise. The findings support the need for larger studies to determine cognitive and mobility benefits related to exergaming.
 (Supported by a Doctoral Dissertation Research Grant from the University of Massachusetts Boston)

2260 Board #7 May 31 9:30 AM - 11:30 AM

Associations of Accelerometer and Questionnaire Measured Physical Activity and Sedentary Behavior with All-cause Mortality in Older Multiethnic Women

Michael J. LaMonte, FACSM¹, John Belletiere², Kelly R. Evenson, FACSM³, Eileen Rillamas-Sun⁴, I-Min Lee, FACSM⁵, Chonchi Di⁴, Andrea Z. LaCroix². ¹University at Buffalo - SUNY, Buffalo, NY. ²University of California, San Diego, CA. ³University of North Carolina, Chapel Hill, Chapel Hill, NC. ⁴Fred Hutchinson Cancer Research Center, Seattle, WA. ⁵Harvard University, Boston, MA.
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PURPOSE: Few studies have evaluated whether associations with health risks differ between accelerometer and questionnaire measures of physical activity (PA) and sedentary behavior (SB), which was the objective of this study.

METHODS: We followed 5,992 women (mean age 79 yr; 49.8% white, 33.3% black, 16.9% Hispanic) for all-cause mortality in the Objective PA and Cardiovascular Health Study. Vector magnitude counts/15 sec epoch from a hip worn ActiGraph GT3X+ triaxial accelerometer (required ≥ 4 of 7 days with ≥ 10 hr/d wear) were used to define time spent in SB (<19 counts/15 sec), light (19-518), moderate to vigorous (MVPA; ≥ 519), and total PA (≥ 19). The CHAMPS and CARDIA questionnaires were used to obtain detailed self-reports on PA and SB, respectively. Cox regression was used to estimate hazard ratios (HR) and 95% confidence intervals (CI) for a 30-min/day increment in PA or SB, controlling for age, race-ethnicity, education, smoking, number of comorbidities, self-rated health and SF36 physical function score (and awake wear time for accelerometer model).

RESULTS: Mean time (min/d) from the accelerometer (wear time adjusted) and questionnaire were 337.9 and 600.4 for total PA, 287.3 and 337.8 for light PA, 50.7 and 222.6 for MVPA, and 555.7 and 482.7 for SB. Wear time-adjusted Spearman correlations between these measures were 0.29, 0.16, 0.34, and 0.28 for total, light, MVPA, and SB, respectively. There were 706 (11.9%) deaths documented during a mean 4.5 year follow-up. HRs (95% CIs) for accelerometer and questionnaire were 0.88 (0.87, 0.91) and 0.98 (0.97, 0.99) for total PA; 0.88 (0.85, 0.91) and 0.98 (0.97, 0.99) for light PA, 0.65 (0.59, 0.72) and 0.98 (0.97, 0.99) for MVPA, and 1.14 (1.10, 1.17) and 1.02 (1.01, 1.03) for SB. Associations did not meaningfully differ when stratified on categories of race-ethnicity (white, black, Hispanic) or age (<80 vs ≥ 80 year).

CONCLUSIONS: Associations with all-cause mortality risk are stronger for accelerometer compared with questionnaire measures of PA and SB. The differences in strength of associations and the modest correlations between accelerometer and questionnaire measures suggest less precision with questionnaires and that accelerometer measures are capturing health-promoting aspects of movement in older women that are not captured in widely used questionnaires.

E-09 Thematic Poster - Resistance Training

Friday, May 31, 2019, 9:30 AM - 11:30 AM
 Room: CC-104B

2261 Chair: Matthew D. Barberio. George Washington University, Washington DC., DC.

(No relevant relationships reported)

2262 Board #1 May 31 9:30 AM - 11:30 AM
Eccentric and Blood Flow Restriction Exercises in Women Induce Hypertrophy

Jennifer Bunn, Elizabeth Wells, Danielle Eustace, Stuart Gupton, Greg Dedrick. *Campbell University, Buies Creek, NC.* (Sponsor: Michael J Webster, FACSM)
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 (No relevant relationships reported)

Blood flow restriction (BFR) is a new clinical method used to induce hypertrophic responses with low mechanical loads. However, women have been largely under-represented in this area of research.

PURPOSE: To assess the mechanical and metabolic effects of eccentric (ECC) exercise and BFR therapy on the elbow flexors in recreationally trained females.

METHODS: Seventeen healthy, recreationally trained females (ECC: 30.0 ± 7.6 yrs, 165.6 ± 5.4 cm, 67.1 ± 8.5 kg; ECC+BFR: 24.4 ± 2.2 yrs, 163.7 ± 9.3 cm, 67.6 ± 12.2 kg) were randomly assigned to either the ECC+BFR group or the ECC group. Testing was conducted at weeks 0 and 4, and included: body composition via bioelectrical

impedance analysis, cross-sectional area (biceps brachii) and thickness of the elbow flexors via ultrasound measures, arm circumference, 1-rep max (1-RM) of a bicep curl, and maximal reps of an inverted row. All participants underwent training of the elbow flexors twice per week for four weeks. The ECC+BFR group trained at 30% 1-RM, 3 x 20 repetitions and the ECC group trained at 60% 1-RM, 3 x 10 repetitions. Participants performed an eccentric bicep curl with the technician lifting the participant's arm from the bottom of the bicep curl to return to the starting position. Thirty seconds of rest was provided in between sets with occlusion maintained for the ECC+BFR group. Rate of perceived exertion (RPE) was taken following each set and blood lactate measurements were taken at the end of the second training session each week. **RESULTS:** There was no significant group difference for any of the variables ($p>0.05$). A training effect was shown with both groups increasing right arm circumference ($p=0.004$), muscle thickness ($p<0.001$), cross-sectional area ($p=0.001$), 1-RM for the right ($p=0.001$) and left arms ($p=0.014$), and inverted rows ($p=0.001$). Both groups showed significant decreases in lactate ($p=0.047$) and RPE ($p<0.001$) over time. **CONCLUSION:** Training at a lower percentage of 1-RM with BFR can induce significant changes in muscle mass composition that equate to functional gains (inverted rows completed) similar to training at a higher percentage of 1-RM without BFR. BFR is a viable option for female patients who are unable to lift 70% 1-RM due to surgical protocols or other medical restrictions and was shown to not be more physically demanding to the patient.

2263 Board #2 May 31 9:30 AM - 11:30 AM
Muscular Morphological Adaptations Following Two High Intensity Interval Training Configurations

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(No relevant relationships reported)

High intensity interval training (HIIT) refers to a group of short bouts separated by rest periods. It has been suggested that HIIT activates fast-twitch muscles; the shorter and more intense the burst is, the more it targets fast-twitch fibers. **PURPOSE:** To compare the effects of ultrashort (UH) versus short (SH) functional HIIT on muscular adaptations of rectus femoris (RF) and vastus lateralis (VL). **METHODS:** Thirty-four recreationally active participants were randomly assigned to SH (8 males and 9 females) and UH (8 males and 9 females) groups to complete 6 cycles of 6 exercises at all-out intensity (i.e. kettlebell snatches; step-up jumps; jumping jacks; goblet squat; burpees; high knees) 3 d/wk for 4 weeks. SH was performed with 20s:10s work-to-rest ratio, and a 2-minute recovery between cycles, while UH was completed with 10s:5s work-to-rest ratio, and 1-minute recovery after each cycle. Muscle thickness (MT), fat thickness (FT), cross-sectional area (CSA) and echo intensity (EI) of RF and VL were assessed via ultrasound before and after 4-week interventions. The MT and FT scans were captured in sagittal plane, while the CSA and EI were taken in transverse plane. Two-way mixed factorial ANOVAs were used for analyses. **RESULTS:** No significant differences between groups were observed following training. The results displayed no significant ($p>0.05$) change in EI of the RF and VL. However, both groups significantly ($p<0.05$) increased RF CSA (UH: 12.1 ± 4.2 to 13.0 ± 4.3 cm², SH: 11.5 ± 3.1 to 12.1 ± 3.2 cm²), as well as VL CSA (UH: 26.2 ± 6.6 to 28.4 ± 7.0 cm², SH: 24.6 ± 5.8 to 27.0 ± 5.2 cm²). Additionally, the thicknesses of RF (UH: MT = 1.3 ± 0.3 to 1.5 ± 0.4 cm; FT = 0.6 ± 0.3 to 0.5 ± 0.3 cm, SH: MT = 1.2 ± 0.3 to 1.4 ± 0.3 cm; FT = 0.5 ± 0.2 to 0.4 ± 0.2 cm) and VL (UH: MT = 1.3 ± 0.4 to 1.4 ± 0.3 cm; FT = 0.5 ± 0.3 to 0.4 ± 0.2 cm, SH: MT = 1.4 ± 0.4 to 1.5 ± 0.4 cm; FT = 0.5 ± 0.3 to 0.3 ± 0.2 cm) significantly ($p<0.05$) improved in both groups. **CONCLUSION:** To date current literature has shown functional HIIT to be an effective protocol to improve anaerobic and aerobic performances. However, in the present study, both groups similarly improved muscular morphology of the RF and VL by performing functional HIIT. Furthermore, these findings suggest that the UH protocol induces benefits comparable to those of the SH protocol, while reducing the total exercise time to 50 percent.

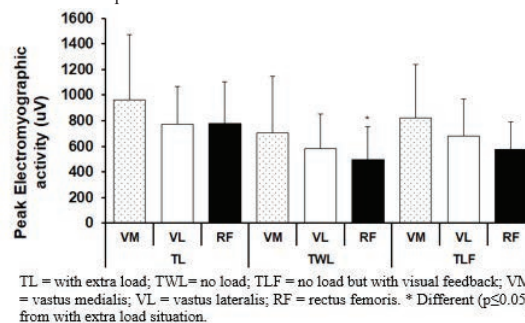
2264 Board #3 May 31 9:30 AM - 11:30 AM
Resistance Training With Or Without Load Promotes Similar Changes In Electromyography Activity But Not In Blood Lactate

Rafael Ribeiro Alves, Sr., Bruno Cavalcante Gomes, Murilo Augusto Soares de Araújo, Carlos Alexandre Vieira, Vitor Alves Marques, Thayná Coelho Guimarães, Claudio André Barbosa de Lira, Douglas de Assis Teles Santos, Paulo Roberto Viana Gentil. *Federal University of Goiás, Goiânia, Brazil, Goiânia, Brazil.*
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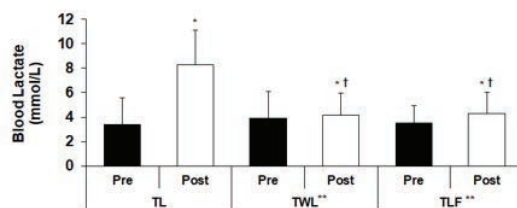
(No relevant relationships reported)

PURPOSE: to comparison the changes in peak electromyography (EMG) activity and levels of blood lactate (mmol/L) during a specific resistance exercise by three different moments, with extra load (TL), no load (TWL) and no load but with visual feedback (TLF). **METHODS:** twenty healthy men (age: 26.5 ± 4.8 height: 1.77 ± 0.1

weight: 80.6 ± 12.9) volunteered to participate in the study. Participants were scheduled in two visits on laboratory, a) 10 repetition maximum test (10-RM test) and b) performance of three aleatory and different situations of a knee extension (1 - extra load, 2 - no load and 3 - no load with visual feedback) with movement velocity of a 2-second to concentric and eccentric phase (controlled by a mobile app metronome) and 10 minutes of rest between then. Blood lactate was measure before and after each situation. EMG activity was evaluated on vastus medialis (VM), vastus lateralis (VL) and rectus femoris (RF). A significance level of $p \leq 0.05$ was adopted for all statistical tests. **RESULTS:** There were an increase in blood lactate after all the moments when compared to before exercise performance ($p<0.05$) and the blood lactate was higher in post situation TL ($p<0.05$) when comparison TWL and TLF (8.2 ± 2.9 , 4.2 ± 1.8 , 4.3 ± 1.7 , respectively). Additionally, significant difference was found between in all moments ($p<0.05$). The significant difference on EMG activity ($p<0.05$) only occurred on rectus femoris in TL set when compared to TWL (775.9 ± 325.1 , 492.7 ± 262.5 , respectively), but not significant difference ($p>0.05$) in the TLF situation (573.2 ± 219.7). **CONCLUSIONS:** Performing exercise using no load can be efficient to promote increase in EMG activity and metabolic responses being an important training strategy when extra load is not possible.



TL = with extra load; TWL = no load; TLF = no load but with visual feedback; VM = vastus medialis; VL = vastus lateralis; RF = rectus femoris. * Different ($p \leq 0.05$) from with extra load situation.



TL = with extra load; TWL = no load; TLF = no load but with visual feedback. * Different ($p \leq 0.05$) from pre and post situation. † Different ($p \leq 0.05$) from post TL situation. ** Different ($p \leq 0.05$) from situation TL.

2265 Board #4 May 31 9:30 AM - 11:30 AM
Effects Of A Rugby Training On Anthropometric And Fitness Of Female Adolescents With High Physical Performance

Camila B. Müller, Gabriel Gustavo Bergmann, Eraldo Pinheiro. *Federal University of Pelotas, Pelotas, Brazil.*
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(No relevant relationships reported)

PURPOSE: To verify the effects of a program of tactical, technical and physical training of rugby and the behavior of maturity in anthropometric and physical fitness variables of female adolescents with high physical performance for this sport. **METHODS:** 30 female adolescents (14.00 ± 0.53 years old) were selected from a database of a youth program for sportive development. Adolescents ($n=15$) with high physical performance for rugby (more than percentile 80 in speed, agility and power - MORE80) were divided into two groups: intervention (INT) ($n=8$), with two weekly sessions during 16 weeks of rugby training, and control (CON) ($n=7$), without participation of systematized training. Fifteen students without high physical performance for rugby (less than percentile 80 in speed, agility and power) were randomly selected from the program database (LESS80). A battery of physical tests and anthropometric measures were evaluated before and after the intervention period as well the maturity measurement was performed. For statistical analysis, two-way ANOVA with repeated measures were used to compare the anthropometric and physical variables between groups, with Bonferroni post-hoc to identify the significant differences (moment, group and interaction) and independent Student's T test to verify differences between MORE80 and LESS80. **RESULTS:** The variables that presented significant differences between the pre and post moments ($p<0.05$), in both INT and CON groups, were increase in height and wingspan and reduction in sum of skinfolds for anthropometric parameters, and improvement in countermovement jump, sprints in 10 and 20m and 5-m multiple

shuttle test for fitness variables. Squat jump, mean power and peak power generated in tests of ability to repeat sprints and test of speed of change of direction showed significant interactions, with improvement of the INT group between moments. Body mass did not present significant differences. In addition, MORE80 showed greater maturity deviation than LESS80.

CONCLUSIONS: Tactical-technical and physical rugby training can produce increment in specific variables of the modality, anthropometric variables are not influenced by the training and maturity is more advanced in female adolescents with high physical performance for rugby.

2266 Board #5 May 31 9:30 AM - 11:30 AM
The Effects of a Short-Term Guideline Recommended Hypertrophy Training versus Blood Flow Restriction Training on Pulse Wave Velocity

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(No relevant relationships reported)

PURPOSE: To determine the effects of guideline recommended hypertrophy and blood flow restriction training protocols on pulse wave velocity in recreationally active males.

METHODS: Fourteen male subjects (age = 23.7±2.6) were randomly assigned to one of two groups that trained the knee flexors, extensors, and split squat for 6 weeks. The two training groups included: a blood flow restriction group (BFR, N=8) and hypertrophy (HYP, N=6). All training groups began with subjects warming up on the cycle ergometer at 50 rpm with 2.0 kg resistance and subjects were then lead through the resistance training programs that remained constant for each session thereafter. The HYP group followed NSCA guideline for recommended intensity, set, and rest period. The HYP group performed exercise for 4 sets of 10 repetitions 3x/wk at 75% of 1RM with 90 second rest between each set. The BFR group performed exercises for 4 sets of 30, 15, 15, 15 reps 3x/wk at 40% of 1RM with 30 second rest between each set. Each training session was monitored by a trained individual to make sure the correct breathing pattern were maintained during lifts to avoid the Valsalva maneuver. As for pre and post testing sessions, fasted subjects (for at least 8 hours) reported to the lab and hydration level was assessed by clinical urine refractometer before testing sessions. PWV was measured non-invasively using applanation tonometry, in which a probe was used on the surface of the skin over the carotid, radial, femoral, and pedal arteries to obtain segmental measures.

RESULTS: One-way ANOVA found no between-group differences in any of the outcome measures of interest at baseline. There were no significant condition main effects for carotid-radial (CR), carotid-femoral (CF), femoral-distal (FD), however a significant time main effect was detected for CF ($p < 0.05$). CF-PWV significantly decreased from baseline to post testing.

CONCLUSIONS: The findings of the study suggest that both BFR and HYP training programs are similarly effective in decreasing the central arterial stiffness. The data also indicates that avoiding the Valsalva maneuver may be necessary for positive changes in aortic stiffness and BFR training protocol can be used an alternative method for those who can't or do not want to lift high loads to improve central arterial elasticity.

2267 Board #6 May 31 9:30 AM - 11:30 AM
Effects of an 8 Week Upper Body Resistance Training Program on Aerobic Capacity in Untrained Females

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(No relevant relationships reported)

PURPOSE: VO₂peak and 1RM in untrained females were compared before and after an eight week upper body strength training plan to determine the effect of upper body strength training on aerobic capacity.

METHODS: Twelve untrained college females completed a VO₂peak and 1RM bench press test. The subjects were then randomly split into 2 groups of 6. Both groups maintained their normal aerobic exercise routine with the exception of the treatment group, who completed an upper body strength training protocol twice a week for eight weeks. VO₂peak and 1RM were reassessed immediately following the eight week period.

RESULTS: A one-way repeated measures ANOVA was conducted to determine whether a statistically significant difference existed in VO₂peak, RERmax, HRmax, final time, and 1RM over the course of the 8 week strength training program. A change did occur in VO₂peak for the treatment group from pre to post exercise intervention (34.22 mL/kg/min pre to 35.37 mL/kg/min post). In addition, 1RM increased in the training group from 70.83 lbs to 75.83 lbs. However, the exercise intervention did not

elicit statistically significant changes in measures of training variables over time, $F(5, 6) = .540, p = .742$, partial $\omega^2 = .310$. No change was seen in either VO₂peak or 1RM in the control group.

CONCLUSIONS: Although not statistically significant, a slight overall increase in VO₂peak in the treatment group was observed, while no change in the VO₂peak of the control group occurred. A longer resistance training period could result in more significant differences in both 1RM and aerobic capacity. Therefore, upper body resistance training alone will not impact aerobic capacity dramatically in untrained athletes, especially when done short term. Resistance training may, however, be beneficial in competitive athletes where even a slight difference in performance could be the difference between winning and losing. Future researchers should look at how upper body resistance training impacts running biomechanics specifically, and if a direct connection exists with running economy.

2268 Board #7 May 31 9:30 AM - 11:30 AM
Effects of Dynamic or Static Stretching Performed Before Resistance Training on Muscle Adaptations in Untrained Men

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(No relevant relationships reported)

Stretching and resistance exercises are often recommended due to their positive effects on health and quality of life. Stretching exercises are frequently performed before a session of resistance exercise, however, muscle stretching has been shown to acutely reduce muscular strength, and impair chronic muscular adaptations to training. However, the chronic effects of static stretching exercises performed prior to bouts of resistance exercise are conflicting. Additionally, the chronic effects of dynamic stretching on muscle adaptations to resistance training remain unknown. Therefore, research that evaluates the chronic effects of both static and dynamic muscle stretching before resistance exercise is needed. **PURPOSE:** To evaluate the chronic effects of dynamic and static stretching performed before resistance training on muscle adaptations in untrained young men. **METHODS:** Forty-five untrained young men (21.2±0.5 yrs., 72.2±5.6 kg and 178±1 cm) were randomly assigned to one of three groups: 1) static stretching (SS, n= 14) in which subjects performed 80s of static stretching prior to resistance exercise; 2) dynamic stretching (DS, n= 13) that included 80s of dynamic stretching prior resistance exercise; or 3) control group (CON, n= 18) in which subjects performed no stretching prior to exercise. All subjects performed 4 sets of 8-12RM (repetition maximum) of knee flexion exercise two days per week for 8 weeks, with a period of at least 48 h between sessions. Unilateral knee flexor maximal isometric strength (MIS) and posterior leg muscle thickness (MT) were measured before and after the training period. Data normality was confirmed by the Shapiro-Wilk test and a two-way repeated measures ANOVA (group x time) was performed. Statistical significance was set a priori at $p \leq 0.05$. **RESULTS:** There were significant increases in MIS (SS= 48.3%, DS= 37.6%, CON= 49.4%, $p < 0.05$) and MT (SS= 13.3%, DS= 13.1%, Control= 11.4%, $p < 0.05$) with no significant differences across groups ($p > 0.05$). **CONCLUSIONS:** Eighty seconds of static or dynamic muscle stretching performed prior to bouts of resistance exercise did not affect the training-induced muscular adaptations in untrained young men.

Supported by FAPEMIG and IF Sudeste MG- Brazil.

2269 Board #8 May 31 9:30 AM - 11:30 AM
The Impact of Volume-Matched, Heavy vs Moderate Weight Resistance Training on Inflammation and Muscular Damage

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(No relevant relationships reported)

Background: It is well documented that resistance exercise training improves muscular strength and hypertrophy. Heavy loads greater than 65% of 1 repetition maximum (1RM) are typically required for optimal induction of muscular hypertrophy. Heavy loads tend to induce greater muscular damage and repair, resulting in enhanced muscular hypertrophy. However, there is little information comparing intensities

of hypertrophy inducing resistance loads on muscular damage and inflammatory response. The purpose of this study was to compare heavy vs moderate hypertrophying loads on markers of post exercise muscular inflammation and damage.

METHODS: 11 resistance-trained, college-aged males were recruited for this study. Participants were asked to complete 3 data collection sessions, each 1 week apart. During session 1, a baseline venous blood draw was collected, followed by evaluation of 1RM barbell squat. With sessions 2 and 3, participant performed volume-matched barbell squats at 2 different intensities using a counter-balanced design: 5 sets of 5 reps at 85% (High) or 3 sets of 11 reps at 67% (Low). Blood draws were taken 1 hour post-exercise for sessions 2 and 3. Plasma was isolated and evaluated via ELISA assay.

RESULTS: There were no significant changes ($p < .05$) in plasma C-Reactive Protein (CRP) for any of the 3 time points (358.78 ± 180.32 , 454.52 ± 520.68 , 322.01 ± 188.02 ng/mL for Baseline, High, Low, respectively). Myoglobin, a marker of muscular damage, is awaiting analysis.

CONCLUSIONS: Current results suggest that the utilized volume of hypertrophying resistance training, at either load, does not induce detectable changes in inflammation in the plasma.

E-10 Free Communication/Slide - Pediatric Exercise Science

Friday, May 31, 2019, 9:30 AM - 11:15 AM
Room: CC-105A

2270 Chair: Karin A. Pfeiffer, FACSM. Michigan State University, East Lansing, MI.

(No relevant relationships reported)

2271 May 31 9:30 AM - 9:45 AM Testosterone Determines Erythropoiesis And Changes In Hemoglobin Mass During Adolescence

Erica Mabel Mancera¹, Edgar Cristancho¹, Diana Ramos¹, Walter Schmidt², Lohover Duque³, Joel Rojas³. ¹Universidad Nacional de Colombia, Bogotá, Colombia. ²Bayreuth University, Bayreuth, Germany. ³Unidad Central del Valle, Tulud, Colombia. (Sponsor: William Byrnes, FACSM)
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(No relevant relationships reported)

In prepubertal stage, total hemoglobin mass (Hbmass) is similar in boys and girls. With the beginning of puberty, Hbmass increases in boys, while it stagnates in girls. This divergence might be explained by the selective increase in androgen production in males which has, however, not yet been studied.

PURPOSE: To study the relationship between the blood testosterone concentration and hemoglobin mass in boys and girls. A second aim was to find out the impact of altitude and training status.

METHODS: In total, 313 children and adolescents with different endurance training status and different altitude of residence entered the study (age 9 to 18 yrs; females $n=94$, males $n=219$; low altitude (1000m) $n=150$, moderate altitude (2500m-3000m) $n=163$; endurance trained $n=190$, untrained $n=123$). The sexual maturation was estimated by the scale of Tanner (stage I-V). Hbmass and blood volume (BV) were determined by the optimized CO-rebreathing method. Testosterone (Test) and erythropoietin (EPO) were measured in cubital venous blood. For statistical purposes multiple linear regression analyses and regression trees (CART) were used.

RESULTS: While [Test] was low in all females (0.2 ± 0.6 ng/ml) it markedly increased from Tanner stage III (stage I/II: 0.4 ± 0.8 ng/ml, stage III: 2.7 ± 2.0 ng/ml, stage IV/V: 4.2 ± 2.1 ng/ml). In the whole group (males and females) a strong correlation was found between [Test] and absolute Hbmass ($r = 0.8$, $p < 0.001$) as well as relative Hbmass (Hbmass/kg, $r = 0.6$, $p < 0.001$). In the male group, the increase in [Test] by 1 ng/mL was associated with an increase of 34.2 ± 4.3 g of Hbmass ($p < 0.001$), the training status with 45.8 g and altitude with 32.1 g. Highest Hbmass values (15.3 ± 0.7 g/kg) were observed in the trained group from altitude with [Test] > 4.9 ng/ml. The general impact of [Test] on Hbmass was 45%, of biological maturation 34.4%, of training 16.0%, and of altitude 5.0%. A strong correlation of [Test] with BV was found ($r = 0.7$, $p < 0.001$). There was no correlation between [Test] and EPO ($r = 0.04$, $p = 0.5$).

CONCLUSION: In boys there is a strong increase in [Test] from Tanner stage III, which considerably stimulates erythropoietic processes. We suggest testosterone being the determining factor for the different development of Hbmass in girls and boys during puberty and explaining the gender differences in adults.

2272 May 31 9:45 AM - 10:00 AM

Modeling The Dose-Response Rate Associations Between VO₂max And Self-reported Physical Activity In Children

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(No relevant relationships reported)

The benefits of physical activity (PA) on aerobic fitness are well known. What is not so well understood is the nature of this relationship, i.e., is the association between PA and fitness linear or curvilinear and does the dose-response rates vary in different populations? **PURPOSE:** To explore the dose-response rate and association between VO₂max and self-reported physical activity, and to assess whether this association varies by sex, age and weight status. **METHODS:** VO₂max was assessed in 8,002 (10.0-15.9-year olds) children (3,775 girls) using the 20-metre shuttle-run test. Physical Activity was assessed using the Physical Activity Questionnaire for Adolescents (aged >11 years, PAQ-A) or for Children (aged <11 , PAQ-C). The associations between VO₂max and PAQ were analyzed using ANCOVA adopting PAQ and PAQ² as covariates, allowing the intercepts but more importantly the slope parameters of PAQ and PAQ² to vary with the categorical variables sex, age group and weight status. **RESULTS:** ANCOVA identified a significant quadratic polynomial association between VO₂max and PAQ (entered as both a linear PAQ and PAQ² terms), where the positive linear PAQ term varied by weight status and sex but the quadratic PAQ² term was negative ($-.39$; 95% CI $-.57$ to $-.21$), common to all groups. The curvilinear (inverted U) association suggests that the benefits of increasing PA (same dose) on VO₂max is greater when children report low levels of PA compared to children who report higher levels of PA. These dose-response rates were also steeper for boys, and steeper in lean compared with overweight/obese children. **CONCLUSIONS:** In this paper we demonstrate, for the first time in children, that the dose response between physical activity and VO₂max is curvilinear in nature, i.e., the benefit of increasing physical activity on aerobic fitness is greater in children who report low levels of habitual physical activity. This has important public-health implications, in that getting sedentary children active is likely to have a disproportionately greater benefit to their health and fitness.

2274 May 31 10:00 AM - 10:15 AM

Skeletal Muscle Oxidation During an Incremental Exercise Test in Younger and Middle-aged Individuals

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(No relevant relationships reported)

Previous research has suggested that age-related decline in mitochondrial enzymes consequently results in reduction of skeletal muscle oxidative function. Limited research exists investigating effects of healthy aging on these observed changes, especially with middle-aged individuals. **Purpose:** The purpose of this study was to investigate the effects of healthy aging on changes in tissue oxygenation in skeletal muscle (SmO₂) during a self-paced VO₂max (SPV) test in younger and middle-aged subjects. **Methods:** This study included seven younger (ages 18-35 years, 4 males, BMI 28.1 ± 3.4 kg/m²) and nine middle-aged (ages 40-55 years, one male, BMI 25.1 ± 3.8 kg/m²) healthy, recreationally active individuals. Subjects visited the lab once to complete the SPV test on a Wattbike cycle ergometer. The Moxly sensor, which uses near-infrared spectroscopy, was used to estimate SmO₂. Four Moxly sensors were used and were placed on the right and left quadriceps (vastus lateralis), and right and left gastrocnemius muscles. The SPV test was exactly ten minutes in length, with five 2-minute stages. Each stage was perceptually regulated using the 6-20 rating of perceived exertion (RPE) scale: 11, 13, 15, 17, and 20 (in that order). Repeated-measures ANOVAs were used to compare SmO₂ between anatomical sites and stages of the SPV. Age group was used as a between-subjects factor. **Results:** Measured VO₂max was 48.33 ± 7.56 ml/kg/min for the younger and 38.10 ± 7.45 ml/kg/min for the middle-aged subjects. For SmO₂, there was no main effect of anatomical site ($p=0.170$) and no differences between age groups ($p=0.906$). A main effect was present for SPV stages ($p < 0.001$); values remained steady until the last two stages, where they decreased in both groups (younger: 71.0 ± 3.1 , 69.5 ± 3.5 , 67.9 ± 3.7 , 63.6 ± 4.5 , 58.3 ± 5.9 percent; middle-aged 69.4 ± 2.8 , 70.4 ± 3.1 , 70.4 ± 3.3 , 65.4 ± 4.0 , 56.1 ± 5.3 percent). **Conclusion:** Since no age-related differences were found in SmO₂ during the exercise test, healthy aging (i.e. regular aerobic exercise) can be seen as an effective intervention for maintenance skeletal muscle blood flow and a profound influence for sustaining quantity and quality of mitochondria function. Future research should determine whether the same findings occur with healthy, active elderly subjects.

2275 May 31 10:15 AM - 10:30 AM

High Intensity Exercise Training for High Functioning Children with Autism Spectrum Disorder Improves Physical Performance

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(No relevant relationships reported)

PURPOSE: This study assessed the effectiveness of a five-week high intensity exercise program offered over two years for high-functioning children with autism spectrum disorder (HFASD). **METHODS:** Children with HFASD ($n=56$, M age: 10.22 ± 1.5 yr) engaged in a 1 hr exercise session, 4 d/wk for 5 weeks. Each session included an instruction period, warm-up, high intensity workout, related game, and cool-down to be completed in either an individual (I) or cooperative (CO) format. Child satisfaction surveys (7-pt. Likert) assessed perceived enjoyment, level of support, physical benefits, etc. Staff satisfaction surveys assessed their enjoyment of running the session(s), and clarity and utility of the training. Fidelity of implementation (accuracy) was assessed in 64.9% of all sessions. Biometric (i.e., height, weight, waist circumference, BMI) and physical performance data (i.e., strength, flexibility, aerobic fitness, power, physical activity intensity) were also collected. Paired t -tests were used to assess pre to post program performance differences. **RESULTS:** Results indicated that the program was implemented accurately (94%). Satisfaction ratings indicated that the overall feeling about the program was very positive from both the participants (M : 6.4) and staff ($n=14$, M : 6.93). There was no difference in post-satisfaction ratings between the I and CO formats (I $M = 5.81$, CO $M = 5.45$, $p = .30$). Pre-posttest comparisons yielded statistically significant improvements in sit-ups in 60 sec ($M \Delta = 3.5$ reps, 95%CI = 1.41, 5.59), squats in 60 sec ($M \Delta = 4.4$ reps, 95%CI = 1.67, 7.15), and standing long jump ($M \Delta = 4.0$ in., 95%CI = -.79, 7.21). Additionally, the rounds completed on repeated parallel workouts improved significantly ($M \Delta = 2.3$, 95%CI = 1.49, 3.07). Significant improvements in percentage of time in moderate-vigorous activity were observed in both the I and CO exercise formats (I $M \Delta = 4.1\%$, 95%CI = 3.19, 5.06; CO $M \Delta = 1.9\%$, 95%CI = .59, 3.24). The I format produced significantly greater improvement in activity level (% time) than the CO format across the 5-weeks ($M \Delta = 2.22\%$, 95%CI = .63, 3.81). There were no significant changes in biometric measures. **CONCLUSION:** A high intensity exercise program for children with HFASD is feasible (high fidelity, satisfaction) and improves physical performance.

2276 May 31 10:30 AM - 10:45 AM

Talent Identification in Elite Youth Sports

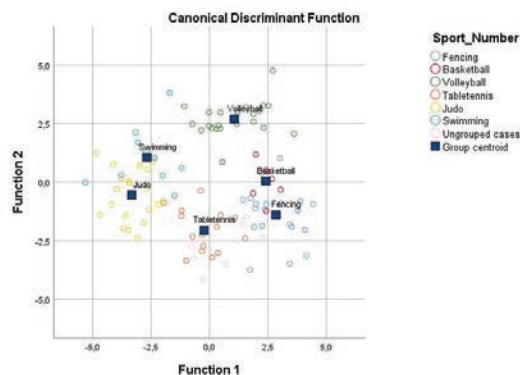
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(No relevant relationships reported)

Several talent selection programs in elite sport schools are based on motor diagnostics for the purpose of recommending or transferring promising talents to general groups of sports; game sports, combat sports or endurance sports, and to more concrete sports such as gymnastics, skiing, or tennis. However, in most sports, the predictive value of such testing is unclear.

PURPOSE: The aim of the talent prediction was to assign each individual of the Under-15 athletes to his own sport. **METHODS:** The sample consisted of $N = 97$ youth athletes from Shanghai Elite Sport school belonging to six different sports including basketball ($n = 7$), fencing ($n = 23$), judo ($n = 20$), swimming ($n = 10$), table tennis ($n = 15$), and volleyball ($n = 22$). The performance diagnosis took place between September 2016 and March 2017, and comprised eighteen anthropometric parameters, two motor tests on back strength and complex reaction speed, five physiological measurements of the heart rate at rest, vital capacity, systolic and diastolic blood pressure, and hemoglobin concentration in the blood. The prognostic validity of the morphological, motor, and physiological tests was determined using linear discriminant analysis and nonlinear neural networks (multilayer perceptron). **RESULTS:** The between-sports differences in a battery of generic anthropometric, motor, and physiological tests allow one to distinguish the young athletes' talents according to their individual sport provenience. The linear and nonlinear statistical methods that were used in parallel to identify the most relevant talent characteristics of each of the six sports by means of the leave-one-out procedure reversely confirmed the quality of the results. **CONCLUSION:** All diagnostic methods exhibited medium to high validity to discriminate between the six different sports. The relevance of the eighteen body dimensions, five physiological measures, and two motor tests for talent identification was confirmed.



2277 May 31 10:45 AM - 11:00 AM

Physical Literacy Levels Of Canadian Children In Grades 7-9 (12-16 Years): Descriptive Results

Joël Blanchard¹, Nadine Van Wyk², Anastasia Alpous³, Emily Ertel³, Patricia E. Longmuir¹. ¹*Children's Hospital of Eastern Ontario Research Institute, University of Ottawa, Ottawa, ON, Canada.* ²*Mount Royal University, Calgary, AB, Canada.* ³*Children's Hospital of Eastern Ontario Research Institute, Ottawa, ON, Canada.*

(No relevant relationships reported)

PURPOSE: The Canadian Assessment of Physical Literacy (CAPL) is the first validated protocol to accurately and reliably assess the physical literacy level of children between 8 and 12 years of age. However, a ceiling effect was found when using the CAPL in older children, within the knowledge/understanding domain and in the Canadian Agility and Movement Skill Assessment, one component of the physical competence domain. The purpose of this study was to evaluate the validity of a modified version of the CAPL for older children.

METHODS: The modified CAPL (CAPL 789) was used to assess physical literacy among Canadian youth in grades 7-9 (aged 12-16 years). Data were collected from schools and recreation facilities in the provinces of Alberta and Ontario (Canada), yielding a sample of 245 participants (129 girls, mean age 13.7 ± 0.9 years). Descriptive statistics were calculated for all CAPL assessments. Age and gender effects were examined to establish the validity of the CAPL 789 within this age group.

RESULTS: Physical competence increased significantly with age ($p < 0.05$), the means in grades 7 to 9 being 19 ± 3 , 21 ± 4 and 21 ± 3 respectively. Gender did not influence most scores. For example, the Canadian Agility and Movement Skill Assessment total score (/36) showed no significant difference ($p > 0.05$) between boys (25 ± 5) and girls (25 ± 4). Girls scored significantly higher ($p < 0.05$) than boys (6.6 ± 1.2 vs. 6.3 ± 1.3) in the knowledge assessment (/10). There was also a significant increase ($p < 0.05$) in knowledge scores among girls as they got older.

CONCLUSIONS: This study described the physical literacy of youth in grades 7 to 9 (12-16 years old). Gender did not influence physical competence, a result different from the data for younger children. Knowledge increased with age among girls but not boys. Future research might be necessary to identify if these unexpected results can be explained by different rates of maturation at this age, unique characteristics of this sample or that the CAPL 789 requires additional protocol modifications.

2278 May 31 11:00 AM - 11:15 AM

Associations of Awareness of National Physical Activity Recommendations and Self-Reported Physical Activity Behaviors among Students

Taylor A. Wahl¹, Benjamin T. Pope¹, Jennifer R. Ricketts¹, Naofumi Yamamoto², Nobuko Hongu, FACSM¹. ¹*The University of Arizona, Tucson, AZ.* ²*Ehime University, Matsuyama, Japan.*
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(No relevant relationships reported)

PURPOSE: College students majoring in nutritional sciences are taught the national recommendation of weekly moderate-vigorous physical activity within their curriculum. The objective of this study was to examine 1) the awareness of the national physical activity recommendation for moderate-vigorous exercise (150 min/week), 2) where nutrition students obtain their recommendations, and 3) if their awareness and knowledge affected their physical activity behaviors. **METHODS:**

Using a 10-question survey, 331 introductory level nutrition students and 89 upper division nutrition students were asked an array of questions. The questions involved demographic questions, the number of days of their regular physical activity, if they knew the weekly physical activity recommendation, and where they have acquired most of their physical activity knowledge from. **RESULTS:** Of the total student responses, 70.9% (n=295) responded that they did not know the national physical activity recommendation, leaving 29.1% (n=121) saying that they did. Of the 121 students who responded saying that they did know the recommendation, 18 % of these students (n=22) knew the recommended minutes (150 minutes), with an additional 36 students overestimating the recommendation. The results showed that male students exercised significantly more often than female students ($p < 0.001$). Additionally, looking at ethnicity as a factor, African Americans exercised significantly less than Whites ($p = 0.02$). There was a significant positive association between the amount of people who exercised and whether they knew the recommendation ($p = 0.0031$). Students were obtaining their knowledge of physical activity from a vast variety of sources. A positive association was also observed between the amount of people who exercised and whether they had the recommendation correct or not ($p = 0.0041$). **CONCLUSION:** Nutrition students who are not exercising do not know the physical activity recommendation, despite being taught the recommendation in their curriculum. Further studies need to find more effective ways to communicate the physical activity recommendation to college students.

E-11 Clinical Case Slide - Knee III

Friday, May 31, 2019, 9:30 AM - 11:10 AM
Room: CC-105B

2279 Chair: Ashley Zapf. *University of Texas, Austin, TX.*
(No relevant relationships reported)

2280 Discussant
Brian A. Davis, FACSM. *University of California-Davis, Sacramento, CA.*
(No relevant relationships reported)

2281 Discussant
Daryl Osbahr. *Orlando Health, Orlando, FL.*
(No relevant relationships reported)

2282 May 31 9:30 AM - 9:50 AM
ACL Injury Prevention Program-Recreational Softball
Doug W. Dendy, C Roger James, FACSM, Toby J. Brooks. *Texas Tech University Health Sciences Center, Lubbock, TX.* (Sponsor: C. Roger James, FACSM)
Email: doug.dendy@ttuhsc.edu
(No relevant relationships reported)

HISTORY: A 13-year-old female athlete went through a 7 week ACL injury prevention program (IPP) during a recreational softball season consisting of movement preparation skills and drills intended to assist the athlete in learning to dynamically stabilize the knee.

PHYSICAL EXAMINATION: Athlete's anthropometric measurements were as follows body mass 68.6 kg, body height 1.83 m, leg length 0.94 m bilaterally, and knee width 0.96 m bilaterally. Field agility examination demonstrated the patient did not have any impairment or diagnosis that would preclude her from participating in the IPP.

DIFFERENTIAL DIAGNOSIS-FINAL/WORKING DIAGNOSIS: The athlete exhibited typical neuromuscular control patterns for her age during sports participation. She did not exhibit any obvious high-risk behaviors such as excessive knee valgus or asymmetry.

TESTS AND RESULTS: The athlete performed three double-leg drop vertical jumps (DVJ) from each of two landing heights (30, 50 cm). Performance was recorded using a motion capture system. Biomechanical measures were obtained at the beginning and end of the season. At post-test, the athlete demonstrated 13.7° greater maximum hip flexion and 7.3° less maximum ankle dorsiflexion bilaterally from both heights. She also demonstrated 2.3° greater ankle inversion bilaterally from both heights, as well as 20.1° greater maximum right knee valgus from 50 cm.

TREATMENT AND OUTCOMES: The IPPs consisted of 15 minutes of stretching and agility focusing on improved neuromuscular control and cues for ACL injury prevention that were emphasized during practices and games. In addition, 2-3 fielding drills were incorporated into practices to work on controlling knee mechanics.

A 7-week IPP during a softball season affected positive changes in hip and ankle mechanics during landing from both heights, but not in the right knee from the higher height.

Negative changes at the right knee were likely a consequence of an immature motor pattern resulting from learning a new skill. In addition, right knee valgus could reflect a weakness in the right hip or that more neuromuscular training is needed. The athlete was recommended for more IPP training with a continued focus on improving knee mechanics. More investigation is needed to address neuromuscular control over a longer period using the IPP in this and other athletes.

2283 May 31 9:50 AM - 10:10 AM

Knee Injury - Dancer

Kevin Huang, Samuel Chu. *Northwestern/Shirley Ryan AbilityLab, Chicago, IL.* (Sponsor: Joseph Ihm, FACSM)
(No relevant relationships reported)

HISTORY: A 20 year old female dance instructor was performing split jump lunges when she developed acute onset of pain and swelling in the medial left knee while loading the leg in the posterior position. She reported feeling a tearing sensation and was unable to immediately weight bear. On presentation to the emergency room was partially weightbearing. Initial left knee radiographs were negative for acute fracture. She was given a soft knee sleeve, started ibuprofen 600mg TID, and initially used ice. She presented to outpatient sports medicine clinic 1 week later with persistent 7/10 pain and swelling in the medial knee. She denied locking or buckling of the knees.

PHYSICAL EXAMINATION: Exam revealed mild-to-moderate effusion of the left knee and restricted range of motion due to pain (flexion to 100 degrees, extension to 10 degrees). There was tenderness to palpation over the medial joint line and pain with valgus stress testing. Anterior drawer with bilateral mild laxity but symmetric. McMurray's was limited by guarding and restricted range of motion. Gait was antalgic with limited knee flexion on the left. Hip abduction strength 4-/5 bilaterally.

DIFFERENTIAL DIAGNOSIS:

1. Medial meniscus tear
2. Medial collateral ligament injury
3. Anterior cruciate ligament injury
4. Patellar dislocation/subluxation
5. Osteochondral injury

TESTS AND RESULTS:

Left Knee X-ray:

- No acute osseous findings
- Suggestive of lateral patellar tilt and subluxation

Left Knee MRI:

- Sequela of prior transient lateral patellar dislocation and medial patellar retinaculum rupture
- Osseous contusions of the medial patella and lateral femoral condyle
- Shallow trochlear groove with minimal lateral patellar subluxation

FINAL/WORKING DIAGNOSIS:

Acute lateral patellar dislocation and medial patellar retinaculum rupture in setting of trochlear dysplasia

TREATMENT AND OUTCOMES:

1. Left knee immobilizer started 1-week post-injury.
2. Isometric quadriceps strengthening exercises started 1-week post-injury.
3. Improved range of motion, swelling, and gait at 1 month follow up.
4. Started in physical therapy for knee range of motion, strengthening and stabilization exercises, hip abduction strengthening, and progression to return to dance/exercise.
5. Discussed orthopedic referral if no further improvement or recurrent dislocation.

2284 May 31 10:10 AM - 10:30 AM

Knee Injury-football

Ankur Verma¹, Jeremy Burnham², Vincent Shaw¹, Jerrica Watson². ¹Baton Rouge General, Baton Rouge, LA. ²Bone & Joint Clinic of Baton Rouge, Baton Rouge, LA. (Sponsor: Mary Lloyd Ireland, FACSM)
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(No relevant relationships reported)

HISTORY: A 16-year-old male high-school football player presents to the sports medicine clinic with left leg weakness and numbness. He was injured during a game three weeks previously when another player collided with the lateral aspect of his knee. At an after-hours clinic post-game, he was placed in a hinged knee brace and sent to the ED for CT angiogram to evaluate for arterial injury and US to evaluate for DVT. Both were negative. However, he has since developed swelling, stiffness, and left foot drop, which prompted his appearance at our clinic. He also complains of decreased sensation in his foot. The symptoms are worsened with sitting and weight-bearing.

PHYSICAL EXAMINATION: Left knee: Large effusion present. ROM is from 5- to 85-degrees. MJL, LJL, and fibular head tenderness. Gapping with varus stress. Stable

to valgus stress. Increased ER with the dial test. Positive Lachman's. 0/5 EHL and tibialis anterior strength, otherwise 5/5. Absent sensation to light touch along the deep and superficial peroneal nerve distributions.

DIFFERENTIAL DIAGNOSIS: ACL tear, LCL tear, Meniscus tear, Peroneal nerve injury, PCL tear **TEST AND RESULTS:** XR: Intra-articular calcifications near ACL tibial attachment. No other fractures identified.

MRI: Full-thickness tear of the ACL without definitive evidence of fracture, Full-thickness tear of the biceps femur tendon at the fibular insertion with 3.2 cm of proximal retraction, disruption of the fibular collateral ligament, interstitial tearing of the distal popliteus tendon.

FINAL WORKING DIAGNOSIS: Left ACL tear, Left LCL tear, Left partial popliteus tear, left knee hamstring avulsion of the biceps femur, left complete foot drop with peroneal nerve injury.

TREATMENT AND OUTCOMES: 1. Placed in a brace and referred to orthopedic surgery 2. Surgery done for ACL/PLC/LCL reconstruction, distal hamstring repair, popliteus tendon reconstruction, and decompression of the peroneal nerve as scar tissue was noted around the nerve 3. NWB in a boot for 6 weeks with limited ROM from 0-90 degrees 4. Referred for PT 5. Referred for EMG 6 weeks post-surgery He eventually developed 1+ strength of the EHL. Sensation in the deep and superficial peroneal distribution significantly improved. He was placed in a custom AFO. He understands it is unlikely he will be able to play football at the same level again.

2285 May 31 10:30 AM - 10:50 AM

Atraumatic Recurrent Knee Effusion in a Collegiate Athlete - Soccer

Darwin R. McKnight, Vicki R. Nelson, Wayne F. Sease.
Greenville Health System, Greenville, SC. (Sponsor: Wayne Sease, FACSM)
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(No relevant relationships reported)

HISTORY: An 18-year-old male sophomore collegiate soccer player presented to training room with a 2 month history of recurrent atraumatic left knee effusion and lateral knee pain. He reported multiple episodes of swelling that lasted several days before resolving. An X-ray obtained after initial evaluation was unremarkable and patient was advised to use ice, compressive dressing and take oral anti-inflammatories which improved symptoms temporarily and allowed him to participate with team. Two weeks later, he reported intense sharp anterior pain while walking down the steps with subsequent inability to bear weight. During follow up evaluation he was given crutches, allowed to partial weight bear and MRI was ordered.

PHYSICAL EXAMINATION: No angular deformity of either lower extremity. Left knee has moderate effusion. Full extension with flexion to 90°. Tenderness present over patella facets and lateral joint line. He has no medial joint line tenderness. No increased anterior/posterior translation or varus/valgus instability. He reports lateral sided pain with McMurray and Thessaly. Full range of motion and strength at the left hip and ankle.

DIFFERENTIAL DIAGNOSIS:

1. Synovitis (reactive vs pigmented villonodular)
 2. Chondromalacia
 3. Patella chondral flap tear
 4. Occult Fracture/Loose Body
 5. Meniscus Tear
 6. Osteochondritis Dissecans
 7. Arthritis (RA vs SLE)
- TEST AND RESULTS:**

2 cm x 2.3 cm x 5 mm osteochondral defect in lateral femoral condyle with large effusion, synovial thickening, vertical signaling within posterior medial meniscus, lateral meniscus extrusion, medial compartment chondromalacia and popliteus strain

FINAL WORKING DIAGNOSIS: Osteochondritis Dissecans Lesion

TREATMENT AND OUTCOMES: The patient was seen by Orthopedic Surgery and underwent arthroscopic surgery. Two screws were placed intra-operatively for internal fixation. There was no evidence of meniscal injury intra-operatively. Patient will sit out the remainder of soccer season.

2286 May 31 10:50 AM - 11:10 AM

Atraumatic Calf Swelling in Recreational Cyclist

Brian Hill, Stephen Spadafore, Kyle Knierim, Morteza Khodaei, FACSM. *University of Colorado, Denver, CO.*

(No relevant relationships reported)

HISTORY: 51 year-old male presented with intermittent left calf pain and swelling for the past 2 months. The pain and swelling became constant the week preceding his presentation. He had no known injury but first noticed the pain after a spin class 2 months ago. The pain was worse with cycling, jogging, and swimming and at the end of the day. He had no knee pain, ankle pain, or hip pain. He denied lower extremity weakness or numbness. The pain did not radiate.

PHYSICAL EXAMINATION: There was a soft tissue enlargement in posterior medial aspect of left calf that was mildly tender to palpation, soft, and non-mobile. Transillumination of the area was positive. No overlying erythema or skin changes were noted. Calf musculature and strength were normal. There was no tenderness along the rest of the gastrocnemius or Achilles tendon and no pretibial edema was present. Neurovascular examination was unremarkable.

DIFFERENTIAL DIAGNOSIS:

1. Deep Vein Thrombosis
2. Synovial Cyst
3. Abscess
4. Morel-Lavallée lesion
5. Lipoma
6. Hematoma

TESTS AND RESULTS:

- Knee x-rays: Grossly normal; generally preserved joint space, with osteophyte formation and mild patellofemoral arthritis
- Bedside ultrasound of calf: Large, hypoechoic, cystic appearance; connected with a small stalk to the posterior knee joint capsule (popliteal); no vascularity seen on Color Flow Doppler
- Fluid analysis: Yellow, hazy; no crystals seen; minimal nucleated cells

FINAL/WORKING DIAGNOSIS: Synovial cyst connected to the popliteal aspect of the knee joint

TREATMENT AND OUTCOMES:

1. Bedside ultrasound evaluation
2. Aspiration of popliteal cyst, 85cc of straw-colored fluid, sent for analysis
3. ACE wrap recommended in attempt to prevent re-accumulation of fluid
4. Orthopedic evaluation due to re-accumulation of fluid, recommended continued monitoring given asymptomatic nature
5. Could consider surgical excision if becomes symptomatic

E-12 Clinical Case Slide - Medical Issues

Friday, May 31, 2019, 9:30 AM - 11:10 AM
Room: CC-306

2287 **Chair:** Kathryn E. Ackerman, FACSM. *Children's Hospital Boston, Boston, MA.*

(No relevant relationships reported)

2288 **Discussant**

John Mark MacKnight, FACSM. *University of Virginia, Charlottesville, VA.*

(No relevant relationships reported)

2289 **Discussant**

Martin Schweltnus, FACSM. *SEMLI, University of Pretoria, Pretoria, South Africa.*

(No relevant relationships reported)

2290 May 31 9:30 AM - 9:50 AM

Electrocardiogram Abnormal Finding During a Pre-participation Screening in an Asymptomatic Professional Soccer Player

Iliana E. Quintero-Raygoza, José A. Garza, Tomás J. Martínez-Cervantes, Karina Salas-Longoria, Oscar Salas-Fraire. *Hospital Universitario, Monterrey, Mexico.*
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(No relevant relationships reported)

HISTORY: A 17-year-old asymptomatic male soccer player undergoes a pre-participation physical evaluation which consists of a resting electrocardiogram (ECG), ECG monitored exercise stress test, and an aerobic capacity fitness measurement. He has a family history of hypertension in his father. He denied any family history of other diseases. He denies any episodes of syncope, heart palpitations, dyspnea, cyanosis, or chest pain during exercise or at rest. He does not take any medications.

PHYSICAL EXAMINATION: Normal neurological assessment, no neck adenopathy, no carotid bruit or jugular vein distention. Respiratory assessment was normal, with symmetric chest expansion. The cardiac auscultation had a normal S1 and S2, with regular rate and rhythm, no splitting of the heart sounds heard, and no murmur. There was a normal palpation of peripheral pulses in extremities, with regular rate and rhythm. Blood pressure at rest was 110/80 mmHg in right arm and 105/60 mmHg in

right leg. Heart rate was 62 beats per minute and respiratory rate of 14. Body weight was 58.3 kg with a height of 1.75 meters, body mass index (BMI) of 19 kg/m². Resting electrocardiogram: sinus rhythm, 71 beats per minute, right axis deviation, right bundle branch block, right ventricular hypertrophy and early repolarization pattern.

DIFFERENTIAL DIAGNOSIS: 1. Borderline electrocardiogram findings in athlete 2. Congenital heart defects (atrial septal defects or primary cardiomyopathies)

TEST AND RESULTS: Treadmill Exercise Stress Test: Attained 98% of age-predicted maximum heart rate, Normal exercise ECG. Transthoracic Echocardiogram: Normal left ventricular function with an ejection fraction of 58%. Bicuspid aortic valve, left sided aortic arch, image suggestive of turbulent blood flow in descending aorta with a pressure gradient of 12 mmHg. CT Coronary Angiogram: Post-ductal coarctation of the aorta

FINAL WORKING DIAGNOSIS:

Bicuspid aortic valve and Post-ductal coarctation of the aorta

TREATMENT AND OUTCOMES:

Conservative treatment without interruption of physical activity, with a yearly medical evaluation. Pre-participation screening in athletes may detect diseases and lower morbidity and mortality rates in sports related activities.

2291 May 31 9:50 AM - 10:10 AM

Menstrual Dysfunction - Cross Country/Track

Bryan Holtzman¹, Kathryn E. Ackerman, FACS². ¹Perelman School of Medicine, University of Pennsylvania, Philadelphia, PA. ²Boston Children's Hospital, Boston, MA. (Sponsor: Kathryn E. Ackerman, FACS)

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(No relevant relationships reported)

History

A 16.5 year old biologically female, privately self-identifying male high school junior distance runner presented for evaluation of menstrual dysfunction, history of eating disorder, and guidance about being a transgender high school and future NCAA athlete. The patient would like to hold off on hormonally and potentially socially transitioning to male until after college to compete as a female. The patient was hospitalized for an eating disorder 2.5 years previously. The patient uses sertraline 75 mg/day for anxiety, OCD, and depression. The patient achieved menarche at age 15 and reports menstruating 3-4 times per year since (with amenorrhea during weight nadir 2 years ago).

Physical exam

Patient dresses with a male gender expression. Ht 159.8 cm, Wt 48.75 kg, BMI 19.1 kg/m², BP and pulse non-orthostatic. Skin: no hirsutism, acne, skin discoloration, rashes, or Russell's signs. Tanner stage: 4/5 breasts, 3+ axillary hair, 5/5 pubic hair. Normal external genital exam. Musculoskeletal exam is wnl.

Differential diagnosis

1. Female athlete triad/relative energy deficiency in sport
2. Anorexia nervosa
3. Polycystic ovary syndrome/hyperandrogenism

Nutritional evaluation by registered sports dietitian

Grazing throughout day, leading to inadequate energy intake and insufficient protein and fat intake while running 60 miles per week

Tests and results:

Normal TSH (1.07 uIU/mL), 25-OH vitamin D (38.8 ng/mL), WBC (5.7 K/uL), ferritin (43 ng/mL)

DXA Z-scores:

Total body less head: -0.2

Lumbar spine: -0.1

Percent body fat: -2.0

Final working diagnosis

Oligo-amenorrhea from dietary insufficiency/over-exercising in the setting of a transgender biological female not wanting to menstruate or develop secondary sex characteristics

Treatment and outcomes

1. Discussion with athlete and family about transgender sports participation options at high school, collegiate, and national level
2. Dietary optimization through meetings with registered sports dietitian
3. Continued psychological counseling regarding gender dysphoria/gender incongruence
4. 4.75 kg weight gain in less than a year (BMI increase from 19.1 to 20.5 kg/m²)
5. Resumption of monthly menses
6. Maintenance of normal lab values; extensive work-up unnecessary
7. Plans to run in college as a female but to transition socially to male gender

2292 May 31 10:10 AM - 10:30 AM

Bone Health - Running. Can You Outrun Your Past?

Karin VanBaak, MD¹, Kimberly Detwiler, MS ATC². ¹University of Colorado School of Medicine, Aurora, CO. ²University of Colorado, Boulder, CO. (Sponsor: Morteza Khodaei, FACS)

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(No relevant relationships reported)

HISTORY: A 20 year-old female distance runner with a history of recurrent bone stress injuries was referred for evaluation of back pain. Diagnostic workup revealed a left sacral stress fracture. Her workup was expanded to address her significant injury history. She had recently returned to her typical training volume of 70 miles/week following a left fibula stress fracture. She had a history of 2 prior stress fractures - left tibia & left sacrum. She reached menarche at age 17 & reported fewer than 6 periods per year. A short trial of oral contraceptives was discontinued 6 months prior to presentation. She had not had a menstrual cycle since that time. She had a history of Celiac Disease, diagnosed during a workup of iron deficiency as a teenager. She reported compliance with a gluten free diet since age 16. She had no history of disordered eating, chronic illness, or chronic medication use.

PHYSICAL EXAMINATION: The patient was a well appearing, fit female. Her BMI was 21 kg/m². She exhibited no acne or signs of hirsutism including abnormal weight distribution or hair growth. Single leg hop test was positive. **DIFFERENTIAL DIAGNOSIS:** 1. Uncontrolled Celiac Disease 2. Overtraining Syndrome 3. Vitamin D Deficiency 4. Hyperthyroidism Hyperparathyroidism

TEST AND RESULTS: DXA: - Total Body Z-score: -0.3 - L1-4 Z-score: -1.8 - L/R femoral neck Z-score: -0.3/-0.5 - Total body fat: 18.3% Lab workup: - TTG IgG 19 U/mL, TTG IgA 2 U/mL, ferritin 53 ng/mL - Estradiol 24 pg/mL, FSH 5.8 mIU/mL, LH 3.1 mIU/mL, Prolactin 4.3 ng/mL, total Testosterone 21 ng/dL, DHEA 400 ng/mL, TSH 1.5 uIU/mL, Free T3 2.5 pg/mL - Vitamin D 56 ng/mL - 24 hour urine Ca:Cr ratio 167, BS Alk Phos 22.2 mcg/mL, PTH 21 pg/mL, Ca 10.1 mg/dL **FINAL WORKING DIAGNOSIS:** Recurrent bone stress injuries due to: - Low bone density secondary to uncontrolled Celiac Disease during time of adolescent bone mass accrual. - Functional hypothalamic amenorrhea due to current low energy availability.

TREATMENT AND OUTCOMES:

1. Treatment for sacral stress fracture, running progression started at 9 weeks with MRI evidence of fracture healing.
2. Biomechanical assessment & rehabilitation.
3. Medically modified training plan.
4. Monitoring by Sports Nutrition.
5. Discussion with patient of treatment with transdermal estrogen. This was deferred given return of menses during stress fracture treatment.

2293 May 31 10:30 AM - 10:50 AM

Lung Function - Ultraendurance Marathon

Courtney M. Wheatley¹, Caitlin C. Fermoye², Glenn M. Stewart², Bryan J. Taylor³, Loic Chabridon⁴, Alice Gavet⁴, Briana L. Ziegler², Jesse C. Schwartz¹, Paul Robach⁴, Bruce D. Johnson². ¹Mayo Clinic, Scottsdale, AZ. ²Mayo Clinic, Rochester, MN. ³University of Leeds, Leeds, United Kingdom. ⁴Ecole Nationale des Sports de Montagne, Chamonix, France.

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(No relevant relationships reported)

HISTORY: An experienced 39-year-old male ultraendurance runner started experiencing shortness of breath, coughing and inspiratory difficulties 80km into the 170km Ultra-Trail du Mont Blanc. He was able to finish the race by reducing his exercise intensity and was examined ~2 hours after crossing the finish line.

PHYSICAL EXAMINATION: The runner appeared weak, pale, with breathing shallow and constrained and oxygen saturation reduced from 97 to 92%. Resting respiratory rate and heart rate were elevated pre vs. post-race at 15 vs. 8 breaths and 52 vs. 103 beats per minute respectively. Lung auscultation found diffuse crackling in both lungs, but no wheezing.

DIFFERENTIAL DIAGNOSIS:

1. Exercise-induced asthma/bronchoconstriction
2. Pulmonary edema

TEST RESULTS:

Pulmonary function testing:

- FVC and FEV₁ dropped 3L from baseline, with coughing making PFTs difficult

Lung Diffusion:

- DLCO dropped 25%, higher than the 13-16% range seen in other racers

- Alveolar-capillary membrane conductance (Dm) fell 50%, this was not observed in other racers

- Pulmonary capillary blood volume (Vc) dropped 28% from baseline, this was typical of the group

Resting Echocardiography:

- Post-race stroke volume was reduced, but cardiac output remained elevated compared to baseline (SV: 70 vs. 56mL; Q: 3.9 vs. 4.8L/min)

- RV diastolic area and RA area both increased post-race and RV function was reduced (RV area: 22.7 vs. 26.1 cm²; RA area: 16.7 vs. 19.6 cm²; RV FAC: 37.9 vs. 30.7%)

Blood work:

- 38-fold increase in CK-MB (3.7 to 142.7 pg/mL)
- 8-fold increase in cTnI (0.00 to 0.08 ng/mL)
- 4-fold increase in BNP (15 to 64 pg/mL)

FINAL/WORKING DIAGNOSIS:

Runner exhibited evidence of acute injury to the heart and skeletal muscle. The race, which was characterized by intermittent altitude exposure, likely induced a substantial pressure-volume overload. Further, the reduction in pulmonary function and lung diffusion with the unique reduction in Dm, along with desaturation and lung sounds suggested mild pulmonary edema.

TREATMENT AND OUTCOMES:

1. Rest
2. Within 24 hours, everything was recovering: saturation returning to 97%, PFT close to predicted and lung diffusion improving, but not back to baseline
3. Runner reported it taking about a week for his lungs to feel normal again
4. He has returned to training at normal intensity

2294 May 31 10:50 AM - 11:10 AM**Intermittent Dizziness & URI Symptoms in a Young Athlete**

James Pearson¹, Jonathan Siu², Hamed Shalika¹. ¹Citrus Valley Family Medicine Residency Program, West Covina, CA. ²Kaiser Permanente, Fontana, CA. (Sponsor: Aaron Rubin, FACSM)
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(No relevant relationships reported)

HISTORY:

A 21-year-old female division 1-track athlete presented multiple times with episodes of lightheadedness and headache with visual symptoms. Also reported recurrent rhinitis, residual cough and chest congestion. Symptoms were intermittent during periods of increased activity and relieved by rest. She missed multiple practices and workout sessions. Pt. was seen in 2013, 2016, 2017 and 2018 with dx including migraine, URI, influenza, and concussion with prolonged recovery respectively. She was empirically treated with albuterol and antibiotics without relief. Initial CXR negative but given the ongoing symptoms, serial x-rays noted a prominent main pulmonary artery.

PHYSICAL EXAMINATION:

Over the course of multiple examinations:

NAD

Nasal congestion and cough present

RRR with normal heart sounds

No respiratory distress but decreased breath sounds in the left lung's upper and middle field. No rales/wheezes

Neuro exam was unremarkable

Skin was warm and dry

DIFFERENTIAL DIAGNOSIS:

- 1) Recurrent Upper Respiratory Tract Infection
- 2) Asthma (EIB)
- 3) Vocal Cord Dysfunction
- 4) Migraine
- 5) Cardiovascular abnormality unspecified
- 6) Concussion with prolonged symptoms

TESTS AND RESULTS:

9/2016: Labs: wnl, EKG: NSR, no acute ischemic change

2/2017: CXR: wnl

4/2018: Repeat CXR: normal heart size, prominent main pulmonary artery

5/2018: EKG: wnl, TTE: pulmonic valve not well seen, tricuspid regurgitation with PA systolic pressure of 32

6/2018: MRA chest w/o contrast: mild diffuse cardiomegaly, prominent right atrium & main pulmonary outflow. Partial anomalous right pulmonary venous return to right-sided SVC.

7/2018: EKG wnl, TEE: Moderate increased right ventricular size & right atrial enlargement.

8/2018: Cath noted PAPVR of entire right lung to azygous vein with large left to right shunt.

FINAL/WORKING DIAGNOSIS:

Partial v. Total Anomalous Pulmonary Venous Return

TREATMENT AND OUTCOMES:

- 1) Referral placed to pediatric cardiac surgery for repair.
- 2) Exercise stress test to quantify exercise tolerance.
- 3) Counseled and encouraged to participate in steady-state aerobic exercise.
- 4) Counseled on approximately 5% chance of passing on congenital heart disease to her offspring and fetal echo is indicated at 20 weeks.
- 5) Infective endocarditis prophylaxis not indicated.

E-13 Clinical Case Slide - Wrist and Hand

Friday, May 31, 2019, 9:30 AM - 11:10 AM

Room: CC-202C

2295 Chair: Pierre Rouzier, FACSM. University of Massachusetts, Amherst, MA.

(No relevant relationships reported)

2296 Discussant

Kaleigh Suhs. Advocate Lutheran General Hospital, Park Ridge, IL.

(No relevant relationships reported)

2297 Discussant

Brian M. Babka, FACSM. Northwestern Medicine Sports Medicine, Warrenville, IL.

(No relevant relationships reported)

2298 May 31 9:30 AM - 9:50 AM**Forearm Pain- Ice Hockey**

Melissa Lau, William Pease. Ohio State University, Columbus, OH.

(No relevant relationships reported)

History

The patient is a 21 year old right hand dominant female who plays collegiate ice hockey. Past medical history includes remote left shoulder dislocation. One year prior, she had insidious onset of constant and dull left wrist pain without any precipitating event. Over time, it progressed to numbness and paresthesias that radiated to the radial and dorsal aspects of her forearm; she denied swelling or discoloration. It was worse in the morning and after exercise. She denied pain, trauma or weakness involving her neck, shoulder, elbow, wrist or hand. She failed conservative measures including rest, NSAIDs, bracing and ice.

Physical Exam

- Extensor more than flexor musculature slightly tender to palpation
- Nontender palpation of: left triangular fibrocartilage complex, ulnar/radial styloids, distal radioulnar joint, medial/lateral epicondyles
- Trace left forearm musculature fullness but overall with soft compartments
- Full and painless active/passive range of motion
- 5/5 upper limb strength (including pincer, grip strength)
- Painless resisted wrist extension
- Negative Phalen's, Finkelstein tests
- Neurovascularly intact (pulses, capillary refill, sensation, reflexes)

Differential Diagnosis

- Posterior interosseous nerve (PIN) entrapment/neuritis
- Radius or ulna stress reaction/fracture
- Intersection syndrome
- Lateral epicondylitis
- Exertional compartment syndrome

Tests and Results

- XR (left wrist, forearm): unremarkable
- Ultrasound (left forearm): trace fluid around tendons in second compartment
- MRI (left forearm with and without contrast): unremarkable, with normal appearing radial and posterior interosseous nerves
- EMG (left arm): unremarkable
- Compartment testing (mmHg):
*pre-exercise: volar 25, dorsal 11, mobile wad 26
*post-exercise: volar 35, dorsal 33, mobile wad 45

Final Diagnosis

Exertional compartment syndrome

Treatment and Outcomes

- Failed 5-day prednisone burst and ultrasound-guided tendon sheath injection for possible intersection syndrome
- Referred to orthopedic hand specialist who measured compartment pressures
- Underwent successful 4-compartment fasciotomy
- 2 weeks post-op: Weight bear as tolerated; OT/PT referral for ROM, stretches, soft tissue mobilization and strengthening
- 6 months post-op: Started new ice hockey season

2299 May 31 9:50 AM - 10:10 AM

Little Finger Injury - Football

Andre A. Abadin¹, Raul A. Rosario-Concepcion¹, John Ciccario², George Pujalte, FACSM¹, Kristina DeMatas¹. ¹Mayo Clinic, Jacksonville, FL. ²University of St. Augustine for Health Sciences, St. Augustine, FL.

(No relevant relationships reported)

HISTORY: A 16-year-old, high school football running back, sustained a left 5th finger injury while catching a football at practice. He ran a route to his right and caught a low pass thrown to him. He initially reported pain and then noticed that his left little finger bone was sticking out of the skin. The mechanism of the injury was unclear. He did not recall whether he hit his finger on his leg or the football hit his finger while attempting to catch the ball.

PHYSICAL EXAMINATION: Examination revealed swelling of the left 5th digit with a two-centimeter laceration over the palmar side of the proximal phalanx. The left 5th proximal interphalangeal phalanx (PIP) joint appeared superficial to the musculature and skin, exposing the PIP joint. There was no evidence of fracture or any additional deformity of the finger. He was unable to move the PIP and DIP joint actively with normal MCP range of motion.

**DIFFERENTIAL DIAGNOSIS**

Interphalangeal open dislocation
Interphalangeal fracture
Interphalangeal collateral ligament strain

TEST AND RESULTS

Left hand x-rays pre-reduction
Left PIP 5th finger dislocation
No acute or healing fracture
Soft tissue swelling of the fifth digit
Left hand x-rays post-reduction
No acute or healing fracture
Soft tissue swelling of the fifth digit
Alignment of the PIP joint was normal

FINAL/WORKING DIAGNOSIS

Unusual volar PIP open dislocation of the left 5th finger without fracture

TREATMENT AND OUTCOMES

Reduction of left 5th digit PIP joint in the emergency department
2-cm laceration repair with sutures
Placed an extension block splint and on cephalexin antibiotic for 10 days
Referred to Hand Orthopedic Surgery for evaluation of PIP post-reduction
Orthopedic surgeon recommended diagnostic hand ultrasound to evaluate any ligament or tendon damage
Ongoing evaluation

2300 May 31 10:10 AM - 10:30 AM

Musculoskeletal Injury - Weightlifting - More Than Just a Hand Injury in a World Champion

Joseph Medellin¹, Ryan Rompolo², Mark E. Lavallee, FACSM¹. ¹WellSpan York Hospital Sports Medicine, York, PA. ²Franciscan Health Sports Medicine, Lafayette, IN. (Sponsor: Mark E. Lavallee, MD, CSCS, FACSM)

Email: joemedellinmd@gmail.com

(No relevant relationships reported)

HISTORY: LB, a 51-year-old female competing for team USA at the International Weightlifting Federation (IWF) World Masters Championships in Barcelona, Spain on August 20, 2018 was on her third attempt (70kg) in the clean and jerk when she sustained intense pain in her right hand on the bottom of the jerk which caused her to not complete the lift. She came directly to medical area for evaluation.

EXAMINATION: Right Hand: Sensation intact, 2+ radial pulse, <2 second capillary refill of first finger. The first finger extended posteriorly angulated off the metacarpophalangeal (MCP) joint.

DIFFERENTIAL DIAGNOSIS: 1. Dislocation of MCP joint of 1st finger 2. Ulnar collateral ligament of thumb injury 3. First finger fracture

TEST AND RESULTS: None obtained

FINAL WORKING DIAGNOSIS: Dislocation of MCP joint of first finger

TREATMENT AND OUTCOMES: Reduction of first finger MCP joint dislocation was achieved in the medical area at the competition with normal exam post reduction.

The patient then found out her prior lift of the clean and jerk (66kg) was enough to secure her the World Championship title for her weight class. We then found out her complete medical background, which included an ongoing battle with breast cancer for the past two years, diagnosed in the fall of 2016. Due to the aggressive nature of the cancer, she has undergone a bilateral radical mastectomy (including resection of both pectoralis major muscles), partial right lung resection, partial diaphragm resection and partial gastrectomy in November 2017. The operation kept her from training for 8 months. She has undergone chemotherapy and radiation as her cancer has metastasized to her brain and bone. In February 2018, 6 months prior to the competition, she sustained a pelvic fracture after a fall. Despite this, she continued to train in her garage in Arizona leading up to the Master's competition.

Her finger was completely healed two weeks after competition. LB, the IWF Master's World Champion for the Female 90kg Class, had another surgery one month after the competition with radiation to follow. Upon completion of surgery, her first question to the surgeon was, "when can I start lifting?" Despite the 8 months her Oncologist has given her, LB is hopeful, kind spirited and a World Champion.

2301 May 31 10:30 AM - 10:50 AM

Sports-Related Wrist Pain In A Musician

Svetlana Dani. University of Maryland, Baltimore, MD.

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(No relevant relationships reported)

HISTORY:

23-year-old man, fell on an outstretched left wrist while playing flag football 5 months prior to presentation. He developed ulnar wrist pain was told he had a fracture of one of the carpal bones at an urgent care center. He followed up at an orthopedic center, where a congenital carpal coalition was noted. He wore a wrist brace for a month. He returned to regular activity until 2 months prior to presentation when he had a repeat injury to the left wrist and developed recurring pain on the ulnar aspect of his left wrist. He wore a brace for another month with improvement. Two weeks prior to presentation, he felt a popping sensation on the ulnar aspect of the left wrist while lifting. He only has pain with loading activities. No numbness or tingling. He is a trombone player and a music major and plans on using his hand for his career.

PHYSICAL EXAMINATION:

MSK: Left wrist: Skin is dry, clean, intact. Wrist range of motion is 70 degrees of extension and 75 degrees of flexion with full pronation and supination. Non-TTP over the ECU or TFCC. Mildly tender over the triquetrum. Painful click reproduced with volarly-directed pressure on the triquetrum. Strength 5/5 in FPL, EPL, interossei and FDP. Grip strength on left side is 70 lbs and 130 lbs on the right side.

DIFFERENTIAL DIAGNOSIS:

Extensor carpi ulnaris tendinopathy and subluxation
Triangular fibrocartilage complex injury
Triquetral, hook of hamate or ulnar styloid fracture
Ulnar nerve entrapment at Guyon's canal
Ulnocarpal abutment syndrome
Lunotriquetral ligament injury
Lunotriquetral coalition with injury
Ulnar styloid impaction syndrome
Pisotriquetral or ulnocarpal arthrosis

TESTS AND RESULTS:

MRI of the left wrist:

Lunotriquetral coalition, likely fibrocartilaginous. Fluid signal within the synchondrosis and stress edema within lunate and triquetrum, suggesting instability. Scapholunate ligament, TFCC and FCU tendon and ulnar nerve are intact.

FINAL WORKING DIAGNOSIS:

Congenital left-sided lunotriquetral coalition with an injury resulting in instability.

TREATMENT AND OUTCOMES- Discussed fusion of the lunotriquetral joint

- Wrist brace for several weeks
- NSAIDs
- Use grips for wrist-loading activities
- Possibility of a cortisone injection if no improvement with conservative measures

2302 May 31 10:50 AM - 11:10 AM

Fifth Metacarpal Pain With Extensor Lag In An 18 Year Old Football Player

Ryan Robin, Brittany Moore, Karen Newcomer, FACSM. *Mayo Clinic, Rochester, MN.* (Sponsor: Karen Newcomer, FACSM)
(No relevant relationships reported)

HISTORY: An 18-year-old high school football player presented to the clinic following an in-game injury to his left 5th digit during a tackling attempt. History is significant for 2 previous football injuries to the same digit. The initial injury occurred 1 year prior with pain and swelling of the 5th PIP joint with limited range of motion. He returned to normal following weeks of buddy taping. Second injury occurred 2 weeks prior to current injury, after direct, traumatic contact to the PIP joint. Again there was pain, swelling, and improvement with buddy taping. The final injury requiring medical attention occurred during a tackling attempt with unclear mechanism. There was no sensation of dislocation. Pain localized to the dorsal MCP joint (MCPJ) without radiation.

PHYSICAL EXAMINATION: On inspection, there was mild soft tissue swelling about the dorsal 5th MCPJ. Maximal tenderness to palpation was over the dorsal MCPJ, with secondary tenderness at the ulnar and radial PIP. On active ROM his 5th digit was unable to extend from the flexion biased natural resting hand position, which created an extensor lag of 1-2cm from the horizon at the MCP and extensor lag of 15° at the DIP. Active flexion was limited at the MCPJ and DIPJ by 10-15° compared to the normal, contralateral side. There was 0.5cm flexion lag of the 5th digit making a fist. Strength was 4/5 for FDS and FDP with pain reproduction. He had difficulty firing the extensor digiti minimi

DIFFERENTIAL DIAGNOSIS: 1. Metacarpal fracture 2. Proximal phalanx fracture 3. Mallet finger 4. MCP extensor sheath injury

TEST AND RESULTS: Hand X-rays: Small avulsion fracture off the volar aspect of the base of the 5th middle phalanx. MSK Ultrasound: Intact distal extensor mechanism MRI hand: Distal 5th metacarpal bone contusion without acute fracture, MCPJ capsular sprain with low-grade partial tear of the ulnar collateral ligament, and joint effusion.

FINAL WORKING DIAGNOSIS: Left 5th MCPJ capsule sprain, partial tear of the 5th MCP ulnar collateral ligament, and 5th metacarpal bone contusion

TREATMENT AND OUTCOMES: 1. Immobilization with hand based intrinsic plus splint encompassing the 4th + 5th MCP for 4 weeks 2. No contact sports due to osseous edema and risk of fracture until 4 week follow up 3. Follow up in 4 weeks for x-rays 4. More follow up to be presented at the conference as patient returns

E-14 Rapid Fire Platform - Biomechanics in Fatigue

Friday, May 31, 2019, 9:30 AM - 10:40 AM
Room: CC-Hall WA2

2303 **Chair:** Roger Enoka. *University of Colorado, Boulder, CO.*
(No relevant relationships reported)

2304 May 31 9:30 AM - 9:40 AM

The Biomechanical Effects of Fatigue on Drop-Jump Performance in Basketball Athletes

Warren C. Ondatje, Guillermo J. Noffal, Pablo B. Costa, Jared W. Coburn, FACSM. *California State University Fullerton, Fullerton, CA.*

(No relevant relationships reported)

Anterior Cruciate Ligament (ACL) injuries have high occurrences in the sport of basketball due to the high amounts of landing, cutting, and other sudden deceleration maneuvers. During landing, studies have prospectively linked insufficient amounts of knee flexion, greater knee valgus angles, and greater knee valgus moments accompanied by greater vertical ground reaction force to increased risk of ACL injuries. These mechanisms have shown to be increased in a fatigued state therefore

suggesting an athlete may be at greater risk for ACL injury when they are fatigued.

Research to support this claim, however, is inconclusive. **PURPOSE:** To examine the difference in peak knee flexion angle (pKFA), peak knee valgus angle (pKVA), peak knee valgus moment (pKVM), and peak vertical ground reaction force (vGRF) pre and post fatigue during the landing phase of a drop jump task in basketball athletes.

METHODS: Twenty-five subjects participated in the study and performed three drop jump trials before and after a fatigue protocol involving repeated counter movement jumps touching a customized target specific to each subject. Data was captured using a Qualisys 9-camera motion capture system sampling at 240-Hz and two AMTI force plates sampling at 2400-Hz. **RESULTS:** Paired t-tests showed subjects landed with significantly greater pKFA post fatigue ($p < .05$) while pKVA, pKVM, and pGRF showed no difference pre- and post-fatigue ($p > .05$). **CONCLUSION:** Subjects in this study adopted a safer landing strategy post fatigue, hence, suggesting our study did not support the claim that athletes would be at greater risk for ACL injuries in a fatigued state.

2305 May 31 9:40 AM - 9:50 AM

Dynamic Postural Stability During Rested and Fatigued Backwards Single-Leg Jump-Landings

Colin W. Bond, Benjamin C. Noonan. *Sanford Health, Fargo, ND.*

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(No relevant relationships reported)

Poor time to stabilization (TTS) during backward single-leg jump-landing (BSLJL) is a risk factor for injury. **PURPOSE:** The purpose of this study was to assess the reliability of TTS and effect of fatigue on TTS. It was hypothesized that TTS would demonstrate adequate reliability, and that fatigue would worsen TTS. **METHODS:** Nine active subjects (4 F, 5 M, 24.8 ± 3.4 y, 1.77 ± 0.08 m, 74.7 ± 15.3 kg) performed BSLJL on the dominant (D) and non-dominant (ND) leg. BSLJL was performed barefoot by jumping backwards on the test leg over a 0.15 m hurdle, landing on the test leg on a force plate with hands on the hips, and stabilizing as quickly as possible. During session 1, subjects performed 10 trials without familiarization. During session 2, subjects performed 3 trials (PRE), rested for 5 minutes, and re-performed 3 trials (POST). During session 3, subjects completed a 5 to 7 minute fatigue protocol consisting of step-ups, L-drills, vertical jumps, and agility ladder drills between PRE and POST instead of resting. Sessions 2 and 3 were completed in a randomized order. TTS was quantified as time from initial contact to when vertical ground reaction force remained within 5% of the subject's body mass for 1 s. RMANOVA and paired t-tests were used to compare TTS, and typical error (TE) was used to quantify reliability. Significance was set to $p \leq 0.05$. **RESULTS:** During session 1, BSLJL TTS did not improve over 10 trials on D ($p = 0.18$) or ND ($p = 0.49$). During session 2, TTS was similar PRE and POST on D (1.12 ± 0.47 vs 1.17 ± 0.40 s, $p = 0.81$) and ND (1.27 ± 0.53 vs 1.05 ± 0.57 s, $p = 0.09$), and had a within-day TE of 0.02 and 0.16 s, respectively. During session 3, TTS was similar PRE and POST on D (1.21 ± 0.32 vs 1.60 ± 1.05 s, $p = 0.22$), but greater at POST compared to PRE on ND (1.21 ± 0.51 vs 1.60 ± 0.58 s, $p = 0.04$). The between-day TE assessed using PRE TTS from session 2 and 3 was 0.36 s on D and ND. **CONCLUSION:** BSLJL learning effects are negligible, although familiarization trials are likely needed. Between-day reliability does not appear adequate. Using TTS to longitudinally monitor injury risk may be inappropriate. Fatigue appears to degrade TTS, but does not affect all subjects equally, and effects may be masked by large inter-subject variation in TTS. Identifying factors related to susceptibility to fatigue induced decrements may improve injury prevention measures.

2306 May 31 9:50 AM - 10:00 AM

Fatigue Increases Center of Pressure Sway

Gustavo Sandri Heidner, Caitlin O'Connell, Nicholas Murray, J C. Mizelle, Patrick Rider, Zachary J. Domire. *East Carolina University, Greenville, NC.*

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(No relevant relationships reported)

Posture and stability are key components in the accurate performance of a myriad of physical tasks. Recent research suggests that fatigue may lead to an increase in center of pressure (COP) oscillation, but the conditions in which balance is impaired are unclear. **PURPOSE:** To investigate the effects of fatigue and other perturbation conditions on the sway of the COP. **METHODS:** Eighteen participants completed three trials under each condition, pre- and post-fatigue protocol. The conditions were eyes open (EO), eyes closed (EC), single leg stand (SL), subtraction of seven (SS), unstable surface (US), virtual reality baseline (VB) and virtual reality perturbation (V2). The x- and y-axis COP coordinates were measured using a Bertec force plate. After the first 21 trials, the participants walked on a treadmill at a RPE of 14 for 30 minutes while carrying a 25 kg weighted backpack. Anterior-posterior (APd) and medio-lateral (MLd) displacement of COP were calculated. Results are presented in millimeters (Mean \pm SD). A two-factor mixed-design ANOVA was used to test for statistically significant differences ($\alpha = .05$). **RESULTS:** APd increased under EC

(12.79 \pm 2.91, $p < .001$), SS (17.01 \pm 5.63, $p = .004$), and V2 (9.80 \pm 2.78, $p = .001$). MLD increased under SL (11.76 \pm 5.82, $p = .050$) and SS (14.54 \pm 5.74, $p = .015$). There were no differences in COP sway when vision remained unimpaired, even on unstable surface. **CONCLUSION:** Fatigue appears to increase COP sway only when other mechanical or cognitive perturbations are present. Supported by: the Office of Naval Research (N00014-17-1-272).

2307 May 31 10:00 AM - 10:10 AM

Effect of Sex on Neural Excitability and Central Fatigue for a Submaximal Elbow Extensor Task

Alexandra F. Yacyshyn, Chris J. McNeil. *The University of British Columbia, Kelowna, BC, Canada.* (Sponsor: Charles L. Rice, FACSM)

(No relevant relationships reported)

Compared to other muscle groups (e.g., elbow flexors), few studies (two) have investigated the role of sex on muscle fatigue of the elbow extensors (EE). The greater fatigability usually seen for males compared to females was not observed, so the EE warrant further study. **PURPOSE:** To investigate the effect of sex on peripheral, motoneuronal, and cortical excitability as well as central fatigue with a submaximal EE task. **METHODS:** To date, 13 participants (7 females) have performed a 15min sustained isometric EE contraction at the level of electromyographic activity (EMG) recorded at 15% of maximal torque, followed by recovery contractions over 5min. Pre- and post-fatigue as well as at the end of each minute, evoked potentials were recorded from triceps brachii in response to transcranial magnetic stimulation of the motor cortex (TMS; motor evoked potentials, MEPs), cervicomedullary stimulation (cervicomedullary motor evoked potentials, CMEPs) and brachial plexus stimulation (maximal M-wave; Mmax). MEPs and CMEPs were elicited 100ms after a conditioning TMS pulse. To assess central fatigue, voluntary activation (VA) was calculated pre- and post-fatigue using superimposed and resting tetani evoked via trains of 5 stimuli (100Hz) delivered over triceps brachii. **RESULTS:** During fatigue, Mmax area did not change. The CMEP (normalized to Mmax) was reduced to 46.9 \pm 15.6% and 50.1 \pm 36.9% of the control ratio in females and males, respectively. The MEP (normalized to CMEP) was facilitated to 153.8 \pm 95.8% in females and 260.9 \pm 195.1% in males. At 5min of recovery, the normalized CMEP remained depressed in females and males (57.1 \pm 31.8% and 47.6 \pm 34.0%, respectively), whereas the normalized MEP remained facilitated at 220.1 \pm 106.4% in females and 184.5 \pm 101.3% in males. VA decreased from 97.0 \pm 1.8% to 84.3 \pm 18.0% in females and 95.5 \pm 3.4% to 76.7 \pm 21.0% in males at task termination, and showed incomplete recovery at 5min (89.0 \pm 6.9% females and 84.6 \pm 13.0% males). **CONCLUSIONS:** Apart from a trend toward greater central fatigue in males, the preliminary results support published findings, which show negligible sex differences with isometric fatigue of the EE. Additional research is needed to ascertain why the EE differ from other muscle groups in this regard. Supported by NSERC, CFI, and BCKDF

2308 May 31 10:10 AM - 10:20 AM

The Impact of Mental Fatigue on Force and Motor Unit Firing Variability in Young Adults

Katie L. Kowalski, Anita D. Christie. *University of Western Ontario, London, ON, Canada.* Email: kkwals7@uwo.ca

(No relevant relationships reported)

Mental fatigue leads to declines in performance of tasks such as cycling time trial performance and skill-based outcomes such as soccer shot accuracy. The neuromuscular mechanisms leading to these declines are not well understood. Although force variability has been shown to increase under dual-task conditions, it is not known if these results extend to conditions of mental fatigue. **PURPOSE:** The purpose of this study was to assess the impact of mental fatigue on variability in motor output in healthy, young individuals. Specifically, we sought to determine if a task that induces mental fatigue has effects on force and motor unit firing variability. **METHODS:** Nineteen participants (10 female, 9 male) performed 10-s isometric contractions at 20 and 50% maximum voluntary contraction (MVC) before, during, and after completing 20 min of the psychomotor vigilance task (PVT). The PVT is a sustained attention task that induces mental fatigue, as indicated by increases in reaction time (RT) to visual stimuli. Force and indwelling motor unit (MU) firings were measured prior to and immediately following performance of the PVT (single task), and within the first and final minutes of PVT performance (dual task). Subjective ratings of fatigue were also obtained using a 10-point Likert scale before and after the PVT. **RESULTS:** Reaction time increased by 14% from the beginning of the PVT (276.14 \pm 31.54 ms) to the end (314.15 \pm 37.74 ms, $p < 0.001$). Subjects also subjectively reported greater levels of fatigue following the PVT (4.95 \pm 1.84) compared to before (3.00 \pm 1.20, $p < 0.001$), indicating successful induction of mental fatigue. For the coefficient of variation (CV) of force there was no significant main effect of time ($p = 0.14$) or contraction intensity ($p = 0.33$), and no significant interaction

($p = 0.51$). For the CV of the MU interspike interval there was a main effect of contraction intensity with a greater CV of the interspike interval during the 50% MVC (19.51 \pm 3.84%) than the 20% MVC (14.87 \pm 3.59%, $p < 0.001$) contractions. However, there was no significant main effect of time ($p = 0.83$) and no significant interaction ($p = 0.23$).

CONCLUSION: Inducing mental fatigue did not lead to changes in the variability of force production or motor unit firing during isometric contractions at 20 and 50% MVC as a single-task or during a concurrent cognitive task.

2309 May 31 10:20 AM - 10:30 AM

Impact Mechanics in Female Runners with Single and Multiple Stress Fractures Following Fatigue

Jerome Outerleys¹, Kristin L. Popp², Sara E. G. Rudolph³, Signe Caska³, Kathryn E. Ackerman, FACSM², Mary L. Boussein², Irene S. Davis, FACSM¹. ¹Spaulding National Running Center, Harvard Medical School, Cambridge, MA. ²Harvard Medical School, Cambridge, MA. ³Massachusetts General Hospital, Boston, MA. (Sponsor: Dr. Irene Davis, FACSM)

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(No relevant relationships reported)

Stress fractures are common injuries in runners and military recruits, with females at greater risk than their male counterparts. Impact variables including peak axial tibial shock and vertical average load rate during running have been shown to be higher in females with a history of tibial stress fractures and increase with fatigue. However, the relationship between mechanics and injury in those with multiple lower extremity stress fractures has not been examined. **PURPOSE:** To investigate whether impacts increase with fatigue in runners with no history of stress fractures (CON), one (1SFX), and 3 or more (3SFX) stress fractures. **METHODS:** Impact variables were calculated for 43 females (14 CON, 14 1SFX, and 15 3SFX) at a speed of 2.67 m/s before and after a fatigue run. Variables included peak axial and resultant tibial shock (VTA, RTA) and vertical average and instantaneous loading rates (VALR, VILR). The fatigue run was performed at a 5 km predicted pace and stopped when a RPE reached ≥ 18 . Absolute change comparisons were made using one-way ANOVAs and post-hoc tests. **RESULTS:** 3SFX had larger changes (i.e. increased values) after fatigue than CON or 1SFX for all variables (Table 1), although after post-hoc tests only VILR for 3SFX was statistically higher than 1SFX ($p < 0.05$), with VALR, VTA, and RTA not reaching significance. Additionally, subjects with the largest changes in these variables exhibited a change in their foot strike towards a more posterior strike pattern. **CONCLUSION:** Females with multiple stress fractures showed larger changes in load rates after fatigue, compared to those with history of one stress fracture. Change in foot strike pattern greatly influences impact mechanics before and after fatigue. Supported by U.S. Department of Defense, Defense Health Program, and Joint Program Committee W81XWH-16-1-0652. The views expressed are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government

Table 1. Mean (SD) of impact variables. *significantly different from 1SFX.

	CON	1SFX	3SFX	p (ANOVA)
n	14	14	15	
dVTA(g)	0.41 (2.45)	-0.32 (1.03)	1.30 (3.14)	0.201
dRTA (g)	-0.05 (3.53)	-0.39 (1.44)	1.80 (2.64)	0.070
dVALR (BW/s)	-0.09 (14.40)	-3.06 (7.79)	11.62 (22.46)	0.046
dVILR (BW/s)	-0.41 (15.77)	-5.27 (8.41)	10.31 (22.09)*	0.044

2310 May 31 10:30 AM - 10:40 AM

The Effects Of Running Form On Hip Kinetics During Running Fatigue On An Instrumented Treadmill

Michael Bohne, Tamarie Wagstaff, Kainalu Nitta, Kirsten Howe, Kristen Terry, Jason Thomas. *Utah Valley University, Orem, UT.* (Sponsor: Scott Drum, FACSM)

Email: michael.bohne@uvu.edu

(No relevant relationships reported)

PURPOSE: The purpose of this study was to assess movements and forces applied to the hip and pelvis to determine its relationship to running form. **METHODS:** 23 participants (11 male, 12 female; ages 18-39) were organized into 3 groups and by gender. They participated in a two day data collection. Day one consisted of a standardized VO2max protocol obtained using a Cosmed K5 portable metabolic cart system (Cosmed Inc., Albano Laziale, Italy) and a Bertec instrumented treadmill (Bertec, Inc., Columbus, Ohio). Participants were given a day between test days and were required to not engage in any form of exercise. On the second day, participants ran at 80% of their recorded VO2max scores until fatigued. Each participant ran with

reflective markers that were used by high speed motion capture cameras (Vicon, Inc., Oxford, UK) to record kinematic data. All data was analyzed statistically using a MANOVA ($\alpha=0.05$).

RESULTS: Significance for the medial-lateral GRF was found when analyzed between gender ($F(1,14)=6.682$, $p=0.022$; Female mean = 0.043 BW (Body weight), Male mean=0.024 BW). Significance for the anterior-posterior GRF was found between times ($F=13.208$, $p=0.001$): start (0.214 BW) and end (0.248 BW; $p=0.002$). The vertical GRF showed significance between start (2.236 BW) when compared to end (2.499 BW; $p=0.034$). Lateral pelvic ROM significant differences were found between start (7.813 degrees) and end (9.267 degrees; $p=0.010$). Data analysis for pelvic rotation ROM showed significant differences between gender (Female=11.299 and Male=6.726; $p<0.001$) and time: start (8.153 degrees) and end (9.695 degrees; $p=0.026$).

CONCLUSIONS: Results showed significant changes in ground reaction forces between beginning of steady state running and a fatigued state during the selected running protocol, but no significant changes in hip joint moments. Thus, the data suggests fatigue influenced a change in form, as evidenced by the significant changes in ground reaction forces. However, the lack of significant changes in hip joint moments suggest that additional compensation is happening with the running form. Further research is needed to examine segmental kinematics and muscle EMG around the hip to fully understand the relationship between the compensation during fatigued running form and hip/pelvic kinematics and kinetics.

E-29 Free Communication/Poster - Performance

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2337 Board #1 May 31 9:30 AM - 11:00 AM Mild Dehydration Protocol Impairs Lightweight Rowing Performance: Exploring Differences in Dehydration Technique

Dayton J. Kelly, Liana E. Brown. *Trent University, Peterborough, ON, Canada.*
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(No relevant relationships reported)

Dehydration is an acute weight loss technique used by lightweight rowers to become eligible for competition. While rowing allows a two-hour window between weigh-ins and racing that athletes can use to rehydrate, it is unclear what effect this procedure may have on performance. **PURPOSE:** To determine whether mild dehydration with rehydration, as a weight reduction strategy for lightweight rowers, compromises rowing performance. **METHODS:** Experienced rowers ($N=14$) twice performed a 2000 m rowing ergometer time trial and visuomotor battery: once euhydrated and once after mild dehydration (mean $-1.68 \pm .23\%$ body mass reduction). Weight loss was achieved through a combination of 12-hour fluid restriction and subsequent sauna exposure. **RESULTS:** Participants were significantly slower on the 2000 m rowing trial in the dehydration condition than in the euhydrated condition (2.44 ± 4.5 s, $p<0.05$). Hierarchical linear regression analyses revealed that these rowing performance decrements were better explained by dehydration achieved through fluid restriction ($r^2=.504$, $p<0.01$) than by dehydration achieved in the sauna or total dehydration magnitude ($r^2=.025$, n.s.). Hierarchical regression revealed that dehydration-related changes in visuomotor function were also explained by dehydration by fluid abstinence but not sauna exposure and were predictive of dehydration-related rowing performance decrements ($r^2=.310$, $p<0.01$). **CONCLUSION:** These findings suggest that rowing time-trial performance can be negatively affected by relatively small changes in hydration status and that the technique by which dehydration is achieved is important. Performance losses were associated with fluid abstinence and not with sauna dehydration. Reduced motor control may explain resulting declines in performance following dehydration and rehydration.

2338 Board #2 May 31 9:30 AM - 11:00 AM Progression of World Records in Master Swimming

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(No relevant relationships reported)

Master sports is increasingly popular and arguably becoming more competitive worldwide. Engagement in master sports has a positive impact on athlete's health &

fitness. Master swimming is a good proxy of overall master sports as it is deemed to have one of the highest number of competitive participants. Several fitness components are performance determinants in master swim. However, it is unknown the progression of World Records (WRs) in master swim over time. It can provide insight on the overall trend of master swimmers' fitness level and competitiveness over the past decades. **PURPOSE:** To analyze the progression of WRs in master swim in the past decades. **METHODS:** The WRs in all men's freestyle events (50m, 100m, 200m, 400m, 800m and 1500m) in all age-groups (from 25-29 to 100-104 years-old) between 1984 and 2016 were extracted from FINA database. To enable comparisons across events, WRs were converted into swim speed. For each event and age-group the percentage of change in the swim speed between Olympic cycles was calculated. Then, it was computed the relative variability within-cycle and within-event. Small, moderate and large worthwhile effects of time between Olympic cycles were calculated as well. Finally, the chance that time (i.e. Olympic cycle) and events had a substantial effect on the WRs progression was computed. **RESULTS:** The within-cycle variability was moderate-high ($15.98<CV<148.46\%$; 1996-2000 and 1984-1988, respectively); whereas the within-events variability was high ($33.93<CV<128.38\%$; 400m and 800m events, respectively). Small, moderate and large worthwhile effects between-cycles were 0.16%, 0.47% and 0.93%, respectively. Chances that time had a substantial effect on the WRs progression ranged between 97.5% (in the 50m events) and 100% (800m). Chances that event had a substantial effect ranged from 80.9% (in 2012-2016) and 100% (in 1984-1988 and 1992-1996). **CONCLUSIONS:** Master swim WRs showed largest progressions in the first Olympic cycles than recently. Middle- and long-distance events denoted higher percentage of change than sprints. Supported by: Portuguese Foundation for Science and Technology (UID/DTP/04045/2013); European Fund for regional development (FEDER)-COMPETE 2020 (POCI-01-0145-FEDER-006969).

2339 Board #3 May 31 9:30 AM - 11:00 AM

Are Changes in Physical Work Capacity Related to Changes in Associated Physiologic Measures?

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(No relevant relationships reported)

High intensity functional training (HIFT) is a novel exercise intervention that may test body systems in a balanced and integrated fashion through challenging individuals' abilities to complete mechanical work; however, research has not determined if work capacity (WC) is a unique measure of fitness. **PURPOSE:** To determine if change in WC is related to change in the underlying physiologic measures. **METHODS:** Twenty-five healthy men ($n=13$; age = 22.6 ± 3.5 ; body mass = 86.1 ± 13.9 kg; height = 182.8 ± 8.1 cm) and women ($n=12$; age = 21.0 ± 1.5 ; body mass = 70.5 ± 11.3 kg; height = 165.6 ± 5.7 cm) completed a six-week (5 days/week) HIFT intervention with WC and various physiologic measures of fitness assessed pre- and post-intervention. Physiologic variables assessed included aerobic capacity ($\dot{V}O_{2max}$); one-repetition maximums for back squat, shoulder press, and deadlift exercises; peak power and fatigue index from a 30-second Wingate bout; and WC (i.e., the maximal amount of mechanical work performed in a given time domain). **RESULTS:** At baseline, all physiologic measures of fitness were significantly associated with WC and this relationship was even stronger at post-intervention assessment (all $p < 0.05$). Further, there were significant improvements across these measures in response to the HIFT intervention (all $p < 0.05$). However, a multiple regression model using the change in these measures did not significantly predict the change in WC induced by HIFT ($F = 0.330$; Sum of Squares = 637.3; $df = 5$; $p = 0.908$; $R^2 = 0.141$). In addition, no single measure of fitness was significantly associated with the change in WC (Table 1). **CONCLUSION:** HIFT may be a unique challenge to individuals' fitness beyond traditional exercise programs; as evidenced by the independence of changes in WC from changes in the associated physiologic components. Elucidating the translational impact of increasing WC via HIFT may be of great interest to health and fitness practitioners.

2340 Board #4 May 31 9:30 AM - 11:00 AM

Athletic Profile Of Elite Alpine Skier Racers: A Systematic Review And Meta-analysis

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(No relevant relationships reported)

ACSM Abstract

PURPOSE

The purpose of this study was to review all anthropometric and physical test results performed on alpine ski racers that were published in the scientific literature to build an athletic profile specific to the skier's sex and level as well as to quantify the effect size of presented factors on alpine ski racing performance.

METHODS

Four electronic databases were systematically searched using the following key words: *alpine skiing physiology*. The manual search was performed through the reference list of all suitable publications, the author's personal collection and the proceedings of the *International Congresses on Science and Skiing*.

SUMMARY OF RESULTS

The search and selection strategy permitted to gather data from 28 peer reviewed publications that was collected on a total of 1107 skiers coming from 11 different countries to build the athletic profile as well as 6 peer-reviewed publications that presented suitable correlations for the meta-analysis. Results of this study present the athletic profile, review the different testing protocols, present correlations between physiological factors and alpine ski racing performance and combine them to present the overall effect size of these factors on alpine ski racing performance. Findings show that men generally present higher tests result than woman, that higher level ski racers generally present higher test results than lower level ski racers and that age, weight, body fat % and lower limb power presented significant effects on alpine ski racing performance (-0.52 [95% IC : -0.73; -0.31] ($p < 0.0001$); -0.57 [95% IC : -0.78; -0.36] ($p < 0.0001$); -0.25 [95% IC : -0.43; -0.07] ($p = 0.0055$) and 0.8 [95% IC : 0.44; 1.17] ($p < 0.0001$) respectively).

CONCLUSION

The present review should serve as guidelines for professionals working with alpine ski racers since some of the factors presented in the athletic profile have been shown to be related with performance. Further research should include more details on the testing protocols used, be directed towards female athletes, present results from groups of athletes of the same sex and clearly identified as established at a certain level and be directed on the effect of physiological factors on alpine ski racing performance. These measures could help support further theoretical investigations.

2341 Board #5 May 31 9:30 AM - 11:00 AM Are Conditional Abilities Related to ATP Rank in Tennis Players?

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(No relevant relationships reported)

PURPOSE: The purpose of this research was to explore for associations between a group of conditional abilities and the position in the ATP ranking in adult tennis players.

METHODS: Thirteen Argentine male tennis players were studied (Age = 27.7 ± 4.1 yr, BMI = 23.3 ± 1.2 kg·m⁻²; mean \pm SD). The participants ranked from 26th to 462nd in the ATP ranking at the time of being tested. A set of physical fitness tests was carried out: Handgrip strength (HAST), Abalakov jump (ABJ), Maximal oxygen uptake ($\dot{V}O_{2max}$), Sit and reach flexibility (SARF), Simple and Complex reaction time of hands and feet to visual stimuli (Simple eye-hand reaction time (SEHRT), Complex eye-hand reaction time (CEHRT), Simple eye-foot reaction time (SEFRT) and Complex eye-foot reaction time (CEFRT)), and Peripheral vision reaction time (PVRT). The Spearman's rank correlation coefficient (r_s) was employed to test associations between the performances in the physical fitness tests and the ATP rank. Additionally, the relationships among the conditional abilities were analyzed, by means of the Pearson's product-moment correlation coefficient (r). The statistical significance level was set at $p < 0.05$.

RESULTS: A moderate but significant negative correlation was found between PVRT and ATP rank ($r_s = -0.58$; $p = 0.047$). And among the conditional abilities, a marked positive correlation was found between $\dot{V}O_{2max}$ and SARF ($r = 0.64$; $p = 0.02$). The mean and SD values of HAST, ABJ, $\dot{V}O_{2max}$ and SARF were, respectively: 47.3 ± 7.0 kgf, 47.1 ± 4.4 cm, 58.1 ± 4.2 ml·kg⁻¹·min⁻¹ and 13.0 ± 5.0 cm. And the mean and SD values corresponding to the eye-motor reaction time tests were (in ms): 206 ± 16 for SEHRT, 313 ± 48 for CEHRT, 487 ± 36 for SEFRT, 603 ± 60 for CEFRT and 982 ± 168 for PVRT.

CONCLUSIONS: Tennis level as measured by the ATP ranking showed to be significantly correlated to Peripheral vision reaction time. The sign of this correlation indicates that the players with higher ATP ranks tended to show lower performances in Peripheral vision reaction time.

2342 Board #6 May 31 9:30 AM - 11:00 AM The Influence of Bout Duration and Rule Modification in Small-Sided Games

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(No relevant relationships reported)

PURPOSE: Small-sided games (SSG) are an established training method to develop aerobic capacity in team sports (1). However, there is still a lack of knowledge about

the variety of variables that influence the outcomes of SSG (2). Therefore, the present study was designed to investigate the influence of changes in bout durations and rules on physiological and technical parameters in men's lacrosse.

METHODS: Data of 12 elite male Austrian lacrosse athletes were collected. Prior to the intervention athletes maximum heart rate (HR) and aerobic capacity was evaluated. According to results athletes were assigned to 4 even strength teams. Each team participated in 8 SSG training sessions. SSG consisted of 3 vs. 3 self-regulated match-play on a basketball field with small goals at the end lines. Each team performed two sessions of two different bout (3x6 and 6x3-minute) and rule modification (body/non-body contact) regimes. %HRmax for total session time, time spent in 4 different HRzones, rating of perceived exertion (RPE), and technical actions were collected. Statistical significance was set at $p \leq 0.05$ and for an estimate of effects Cohen's ES was calculated.

RESULTS: Physical and technical parameters showed no difference nor effect between different bout regimes (BR). On the other hand, non-contact regimes (NCR) had lower RPE (15.8 ± 0.3 ; $p = 0.01$; $d = 2.04 \pm 1.56$) values, but didn't show difference in %HRmax for total sessions. NCR spent more time in HRzone 2 (128.0 ± 26.5 ; $p = 0.04$; $d = 1.37 \pm 1.32$) and 3 (245.4 ± 77.0 ; $p = 0.05$; $d = 1.41 \pm 1.56$) compared to the contact regime (CR). Similarly, number of total events (761.5 ± 56.3 ; $p = 0.00$; $d = 2.92 \pm 1.74$), passes (254.3 ± 26.7 ; $p = 0.00$; $d = 2.39 \pm 1.34$), and shots (47.3 ± 9.0 ; $p = 0.04$; $d = 1.51 \pm 1.62$) were higher in NCR.

CONCLUSION: The findings show no influence on technical and physical parameters between different BR. Further, rule modifications show effects on intensity and technical actions in SSG. Results indicate less intensity (time spent in HRzones and RPE) and more technical actions when no-body contact is allowed. According to the findings, we recommend to implement NCR into sport specific lacrosse training programs to change the outcome of SSG sessions.

REFERENCES:

- 1) Halouani et al. (2014). J Strength Cond Res, 28(12), 3594-3618.
- 2) Hauer et al. (2018). PLoS ONE 13(10): e0203832

2343 Board #7 May 31 9:30 AM - 11:00 AM Training Level Does Not Affect The Negative Effect Of Mental Fatigue On Visuomotor Performance.

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(No relevant relationships reported)

PURPOSE: Mental fatigue has been shown to impair multiple visuomotor related skills in sport-specific and non-sport-specific settings. Further, it has recently been reported that professional road cyclists have superior inhibitory control and resistance to mental fatigue than recreational cyclists. We sought to assess whether badminton players also have superior executive functions and whether they are more resistant to mental fatigue than controls on an open-skill visuomotor task.

METHODS: Eleven untrained healthy controls (mean \pm SD; age: 25 ± 4 y; 6 females, 5 males) and nine healthy badminton players (age: 23 ± 3 y; 4 females, 5 males) performed two experimental trials in a randomized crossover order. Participants completed a baseline visuomotor task (~6min30sec), followed by a Flanker task. Next, they performed either a mentally fatiguing task (90 minutes Stroop task; MF) or watched a documentary for 90 minutes (CON). Immediately thereafter again the Flanker task and the visuomotor task were completed. Accuracy and reaction time were followed up in all tasks but the documentary. Multiple physiological and psychological measures were assessed during the protocol.

RESULTS: Badminton players' and controls' accuracy during the Stroop task dropped over time ($p = 0.023$). Subjectively, both groups perceived the Stroop task as more mentally demanding than the documentary ($p < 0.001$). In addition, higher mental fatigue was perceived in MF compared to CON, independently from group ($p = 0.029$). In the visuomotor task, controls as well as badminton players reacted significantly slower on the complex stimuli when mentally fatigued (~7%; $p < 0.001$). Badminton players (1109 ± 251 ms) outperformed controls (1299 ± 227 ms; $p = 0.022$) in the visuomotor task.

CONCLUSIONS: Mental fatigue ensued in both badminton players and controls after a 90 minutes Stroop task and impaired open skill-visuomotor performance in both groups. More specifically participants responded on average 7% slower when mentally fatigued. Firstly, this shows that athletes are indeed not immune to mental fatigue. Secondly the present results substantiate mental fatigue does not only impair endurance performance, but also impairs open skill-visuomotor performance.

- 2344** Board #8 May 31 9:30 AM - 11:00 AM
Physiological Determinants of Peak Power Output in Elite Cyclists
 Glyn Howatson, FACSM¹, Mehdi Kordi¹, Stuart Goodall¹, Nicos Haralabidis², Tejal Patel², Tom Maden-Wilkinson³, Jonathan Folland, FACSM⁴. ¹Northumbria University, Newcastle-upon-Tyne, United Kingdom. ²University of Bath, Bath, United Kingdom. ³Sheffield Hallam University, Sheffield, United Kingdom. ⁴Loughborough University, Loughborough, United Kingdom.
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Despite the importance of peak power output (PPO) to many cycling disciplines, particularly in sprint events, little is known about the structural and functional determinants of PPO in elite cyclists. **PURPOSE:** To determine the relationship and contribution, in elite cyclists spanning a range of disciplines, of putative neuromuscular determinants with cycling PPO during sprint cycling. **METHODS:** Thirty-five elite male cyclists volunteered to take part in the study (mean \pm SD age, 22 ± 4 yr; stature, 179.1 ± 5.9 cm; mass, 77.4 ± 11.3 kg) and conducted a series of isovelocity sprints to assess PPO on two separate occasions. Surface EMG (sEMG) of the gluteal, hamstring and quadriceps muscles were recorded during the PPO test. Muscle volume was assessed and quantified using MRI and muscle architecture of the vastus lateralis (pennation angle [PO_{VL}] and fascicle length [FL]) were assessed with ultrasound. Bivariate correlation analyses were conducted to assess relationships; significant correlations were included in a step-wise regression to predict PPO performance. **RESULTS:** Positive bivariate relationships were found for quadriceps volume ($r = 0.87$; $P < 0.001$), hamstring volume ($r = 0.71$; $P < 0.001$) and PO_{VL} ($r = 0.81$; $P < 0.001$) with PPO. The remaining measures (FL, and sEMG) were unrelated to PPO. A step-wise multiple regression analysis was conducted with the three predictor variables; 87% of the variability in PPO between cyclists ($P < 0.001$) was explained by two variables, quadriceps volume (76%) and PO_{VL} (11%). **CONCLUSION:** These data provide valuable information on the characteristics of elite cyclists. Importantly, determinants of PPO in this elite population have been identified as muscle volume of the quadriceps and pennation angle of the VL. These data provide a basis that allows coaches and practitioners to understand the contributing factors to cycling PPO performance. Consequently, it is recommended that athletes, coaches and practitioners use this information to target these physical qualities to inform training programme design of elite cyclists to maximise pennation angle and quadriceps volume.

- 2345** Board #9 May 31 9:30 AM - 11:00 AM
The Influence of Fatiguing Exercise on Power Output
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 (No relevant relationships reported)

Physical fatigue impairs performance during high power, short duration activities. As technological developments permit new methods of measuring this effect, it is important to validate existing paradigms. **PURPOSE:** To determine if kinetic measurements from vertical jump (VJ) tests are influenced by fatigue based on explosive power outputs. **METHODS:** A sample of athletes (9 men, 26 women) from a Division I NCAA sports program completed testing. To establish baseline VJ kinetics, athletes performed a controlled warm-up and then completed 6 jumps on a SpartaTrac force plate, each separated by 15s rest. Sparta software computed 3 outputs: Load, Explode, and Drive. After baseline VJ calculation, all athletes performed an anaerobic fatigue protocol on a mechanically-braked cycle ergometer: 3 sprints lasting 15s separated by 10s rest. Peak and mean power were recorded from the cycle trials. Subjects then repeated the VJ protocol. This pattern was repeated until 6 sets of VJ were recorded. Repeated measures ANOVA tested differences between successive VJ performances. **RESULTS:** Male athletes were 20.8 ± 1.5 years old, weighed 175.8 ± 14.0 lbs, had a baseline VJ of 46.9 ± 3.6 cm, Load of 53.6 ± 13.3 , Explode of 49.4 ± 6.6 , and Drive of 49.4 ± 11.9 . Female athletes were 20.2 ± 1.2 years old, weighed 142.3 ± 13.2 lbs, had a baseline VJ of 32.7 ± 4.3 cm, Load of 49.8 ± 46.1 , Explode of 40.7 ± 8.0 , and Drive of 63.1 ± 49.7 . The only differences between men and women were weight ($p < 0.001$), VJ ($p < 0.001$), and Explode ($p = 0.006$). ANOVA found VJ height to decrease between baseline and trial 2 ($p < 0.001$); there was no difference between men and women ($p = 0.210$); between trials 2 and 6, VJ height was consistent ($p > 0.400$). Load was not affected by the fatigue protocol across the total sample ($p = 0.418$) or by sex ($p = 0.239$). Explode was not affected by fatigue across the sample ($p = 0.233$) or by sex ($p = 0.406$). Drive was affected by fatigue ($p = 0.040$), decreasing in successive trials; there was no interaction with sex ($p = 0.742$). **CONCLUSION:** VJ is more sensitive to fatigue than SpartaTrac force plate calculations. An initial fatiguing insult was sufficient to compromise performance, whereas accumulated fatigue did not have an additive effect. Drive was the only variable in SpartaTrac outputs that was affected by fatigue.

- 2346** Board #10 May 31 9:30 AM - 11:00 AM
Variations in Athletic Profiles Between Division I All-Girl and Co-Ed Competition Cheerleaders
 Nia Y. Hicks, Michelle L. Eisenman, Emily L. Langford, Barry Munkasy, Ronald L. Snarr, Greg A. Ryan. *Georgia Southern University, Statesboro, GA.*
 (No relevant relationships reported)

On a Co-Ed cheer team, a female's primary role is a flyer. In contrast, an All-Girl team allows females to be either a flyer, base, or back spot. Although strength, power, and proprioception are required of all positions, these metrics, in addition to individual anthropometrics, may influence a coach's decision on squad placement. **PURPOSE:** The purpose was to compare anthropometric and performance variables between All-Girl (AG) and Co-Ed (CE) Division-I female cheerleaders. **METHODS:** Thirty-three (AG: $n = 24$; CE: $n = 9$) cheerleaders were assessed for: height (H), weight (W), body composition (BF%), vertical jump (VJ), upper body power (UP), and dominant (DHG) and non-dominant (NDHG) hand-grip strength. The greater of two trials for VJ, UP, NDHG, and DHG were used for statistical analysis. BF% was determined via air displacement plethysmography on the same visit to the laboratory. Due to unequal group sizes, non-parametric Mann-Whitney U Tests were run comparing the athletic profile between AG and CE. **RESULTS:** Significant differences were noted in: H (median: AG: 63.5in, CE: 61.0in; $p < 0.01$); W (AG: 135.0lb, CE: 121.0lb; $p < 0.01$); UP (AG: 89.5in, CE: 80.0in; $p = 0.02$); DHG (AG: 25.5kg, CE: 20.0kg; $p = 0.04$); and NDHG (AG: 24.0kg, CE: 18.0kg; $p = 0.04$). No significant differences were present in BF% ($p = 0.14$) or VJ ($p = 0.42$). **CONCLUSION:** In addition to being taller and heavier, the AG team cheerleaders demonstrated greater upper body strength and power when compared to females on the CE team. These differences may be attributed to the variety and physical demand of positions available for females on the AG team. This information may be particularly useful to coaches when assigning squad placement or when designing training programs.

- 2347** Board #11 May 31 9:30 AM - 11:00 AM
Relationship Between Bone Mineral Density and Vertical Jump Performance in Collegiate Athletes
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 (No relevant relationships reported)

Resistance training has been shown to increase bone mineral density (BMD) in athletes due to the increased repetitive loading and stress applied to bone as compared to the general population. Furthermore, plyometric training, a common strength and conditioning modality in most sports, may enhance this loading and stressor effect on bone formation. **PURPOSE:** To compare the relationship between BMD and lower body power, via vertical jump performance, in collegiate male and female athletes. **METHODS:** Seventy-eight (males: $n = 45$, females: $n = 33$) Division-I collegiate athletes, from various sports, performed two trials of squat (SJ) and countermovement (CMJ) akimbo jumps, with the best effort included for analysis. BMD was collected via whole body dual-energy x-ray absorptiometry. Pearson correlations were conducted to determine the relationship between BMD and vertical jump performances (i.e., SJ and CMJ) as a group and within each gender. **RESULTS:** For the entire group, a significant, positive, moderate correlation existed between BMD and SJ ($r = 0.58$, $p < 0.01$), as well as between BMD and CMJ ($r = 0.64$, $p < 0.01$). When factored by gender, there was no significant correlation between BMD and vertical jump for males (SJ: $r = 0.17$, $p = 0.27$; CMJ: $r = 0.28$, $p = 0.07$). However, females retained a significant, positive, low-to-moderate correlation between BMD and both jumps (SJ: $r = 0.35$, $p = 0.04$; CMJ: $r = 0.41$, $p = 0.02$). **CONCLUSION:** Lower body power appears to be positively associated to BMD in a collegiate athletic population, particularly in female athletes. Due to the diverse nature of the sports included in the analysis (e.g., basketball, swimming, cheerleading, tennis, soccer), results may not reflect specific BMD adaptations for those sports requiring increased plyometrics and vertical loading.

- 2348** Board #12 May 31 9:30 AM - 11:00 AM
Variations In Physiological Fitness Of Starters Vs Non-starters During A Collegiate Women'S Basketball Season
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Introduction: The ability to maintain strength and conditioning components related to performance throughout an entire competitive season are an important aspect of training for athletes and coaches alike. Currently little is known about the ability of

trained athletes to maintain performance components over the course of the season.

Purpose: To examine potential changes between pre-season and post-season measures of speed, agility, power, and endurance between players who averaged 20 or more minutes per game and those that averaged less. **Methods:** 14 female collegiate basketball players (average age 18.7±0.21 years) participated. Participants engaged in 2 separate testing periods (end of pre-season and end of competitive season). During each testing period speed, agility, strength, endurance, anaerobic condition, and power were tested using 40-yard dash, Pro-agility test, squat, mile run time, and beep test, respectively. Paired t-tests were used to determine significant differences between testing period 1 and 2. Athletes were also identified as being either a starter (ST), which was an indicator of playing time averaging greater than 20 minutes per game, or non-starter (NST). **Results:** Performance components were measured at the beginning and end of the basketball season. At season start, ST and NST players were statistically similar in regards to all reported tests of performance. Of the components tested at the post-season time point, only two were found to change significantly. Pro-agility scores improved over the course of the season for both ST (pre-season 5.5±0.1, post season 5.1±0.07, t(5)=2.43, p=0.04) and NST (pre-season 5.6±0.07, post season 5.2±0.07, t(5)=2.85, p=0.01) players. NST players demonstrated a significant decrease in performance on the 40-yard-dash (pre-season 5.5±0.06, post-season 5.8±0.07, t(5)=-2.8, p=0.02) while ST players had no difference. For the mile run, NST athletes demonstrated a significant increase in time (3%) when compared to the ST players (0%), with a p=0.05. **Conclusion:** These findings demonstrate the ability of female collegiate basketball athletes to maintain, and even improve upon, certain performance related components. For athletes with less playing time, some measures may suffer over the course of the season.

2349 Board #13 May 31 9:30 AM - 11:00 AM

Confirming The Coach's Bias: Power Begets Performance At The Plate

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(No relevant relationships reported)

Baseball coaches value specific traits in their batters; this is reflected in starting lineups. The success of those batters depends on their ability to produce base hits. This is a complex skill affected by many factors, but a key component is the kinematic fingerprint of the swing. **Purpose:** To test which biomechanical domains of a baseball swing predict entry into the starting lineup, and which associate with the likelihood of getting base hits. **Methods:** We enrolled 13 batters from a D1 baseball team (7 starters, 6 non-starters) and conducted 3D analyses of swing mechanics using Proteus (Boston Biomotion, USA). Each athlete performed six sets of five swings at increasing loads between 11b and 9lbs of magnetic resistance. Independent-samples t-tests measured the difference in performance between starters and non-starters, with special attention paid to mean swing power (MSP) and mean swing consistency (MSC, i.e., how accurately successive swings are replicated in 3D space). Logistic regression tested how MSP and MSC affected the odds of being in the starting lineup. Linear regressions measured the effect of MSP and MSC on the number of hits in a season and hits per at-bat. **Results:** Players in the starting lineup had 0.27 ± 0.03 hits per at-bat; non-starters had 0.17 ± 0.15 (p = 0.170). Starters exhibited a weak trend for lower consistency (p = 0.092) but generated more power (p = 0.003) and achieved greater bat speed (p = 0.009). MSP and MSC were not significant predictors of starting status: for each additional point of MSP, the odds of being a starter increased 29% (p = 0.106); for each additional point of MSC, the odds were decreased by 24% (p = 0.123). Owing to a small sample, power was not significantly different throughout the lineup, but consistency was lowest in batters 3-5 (p = 0.048). Linear regressions found each additional point of MSC to predict 2.1 fewer hits per season (p = 0.029) while each additional point of MSP predicted an increase of 0.7 hits per season (p = 0.014). When measuring these effects per at-bat, significance was lost. A post hoc power analysis revealed a need for 6 additional athletes to achieve significance. **Conclusions:** Even in a small sample, analysis of swing mechanics is helpful in determining performance. An increase in swing power associated with more hits and an increase in consistency associated with fewer.

2350 Board #14 May 31 9:30 AM - 11:00 AM

Intervention Of Cordyceps Sinensis On Exercise Fatigue

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(No relevant relationships reported)

Purpose: To investigate the intervention of Cordyceps sinensis on exercise fatigue and search for the reasons of such phenomena.

Methods: Forty 6-week SD rats were randomly divided into two groups: control group (n=15) and medicine group (n=15) treated with cordyceps sinensis (0.004g/ml).

lasted for 10 days, then all rats were trained to swim until exhaustion. Immediately after the exhaustion, test its exhausting time and some biochemical indexes, such as BUN, Blood testosterone and Lactic acid.

Results: Compared with the control group, Exhausted time of medicine group was significantly prolonged (108.23±42.12 vs. 199.05±62.18 min. p<0.001); the blood lactate level was higher (6.75±1.68 vs. 9.35±2.01 mmol/L); the blood testosterone level was higher (0.201±0.098 vs. 0.315±0.068 nmol/L, p<0.05); and the urea nitrogen level was lower (1.89±0.20 vs. 1.52±0.34 nmol/L, p<0.05).

Conclusions: Cordyceps sinensis has the ability to improve the exercise capacity of rats, increase the threshold of lactate, increase the secretion of serum testosterone, inhibit the catabolism of protein, and prevent the decline of lean body mass.

2351 Board #15 May 31 9:30 AM - 11:00 AM
No Changes in Depth Jump Height but Longer Ground Contact Times as Box Height Increases

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(No relevant relationships reported)

Depth jumps (DJ) are commonly implemented in plyometric training programs in an attempt to enhance lower extremity jump performance. However, it is unknown how different box heights affect jump height (JH) and ground contact time (GCT).

Purpose: To assess JH and GCT of depth jumps from various box heights.

Methods: College students who engaged in plyometric training (M=13, F=7; age: 22.8±2.7y, height: 175.65±11.81cm, mass: 78.32±13.50kg) performed DJs from 30cm (DJ30), 45cm (DJ45), 60cm (DJ60), 76cm (DJ76), and 91cm (DJ91). A 16 camera Vicon system was used to track reflective markers bilaterally to calculate JH (ASIS, PSIS), while a Kistler force plate was used to measure GCT. JH and GCT were compared using separate 2x5 (sex x box height) repeated measures ANOVAs.

Results: There was no interaction but there was a significant main effect for sex where both JH (M>F) and GCT (F>M) showed a significant M bias. There was no box height main effect for JH (DJ30 .4934±.1126m, DJ45 .5003±.1134m, DJ60 .4936±.1195m, DJ76 .4957±.1105m, DJ91 .4783±.1162m) but there was for GCT where DJ30 (.358±.097s), DJ45 (.360±.105s) and DJ 60 (.372±.104) were not significantly different from each other but were all less than DJ76 (.396±.116) and DJ91 (.420±.115). **Conclusion:** Increasing box height beyond 60cm increased GCT but did not affect JH. Therefore, practitioners designing plyometric training programs to increase JH that implement DJs may utilize box heights between 30 and 60cm. This would insure minimal GCT which might be vital in other power and speed events.

2352 Board #16 May 31 9:30 AM - 11:00 AM

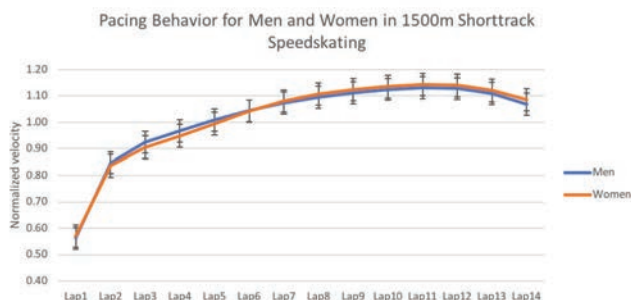
Effect of Sex on Pacing Behaviour in Elite 1500m Short-Track Speed Skating Competitions

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(No relevant relationships reported)

Purpose: The aim of this study is to examine the effect of sex on pacing behavior during elite 1500m short-track speed skating events. **Methods:** In short-track speedskating, a 1500m race is 13.5 laps. Lap times from 13805 skating performances from World Cups, World and European Championships and the Olympics in the seasons 2012/2013 up until 2017/2018 were collected from the ISU website and examined using ANOVA statistical analysis in which lap velocities were chosen as dependent variables and sex was chosen as independent variable (p<.05). In order to compare men (M) and women (W), the data were normalized by calculating individual mean velocities, and dividing those by the actual lap velocity. This gave percentage of mean velocity as outcome variable. **Results:** Pacing behavior of both sexes is shown in figure 1. The absolute velocities male short-track speed skaters achieved are significantly higher than female skaters achieved in every lap (p<.001). Examining the normalized lap velocities, significant differences occurred as well. Men demonstrated relatively higher velocities up until lap 5 (lap 1 to 5, M: 0.86 ±0.08, W: 0.85 ±0.09, p<.001). In lap 6, no significant difference in velocity was found (M: 1.04 ±0.07, W: 1.04 ±0.08, p=.109). Nonetheless, in lap 7 until the final lap 14, women demonstrated relatively higher velocities than men (for lap 7 to 14, M: 1.11 ±0.20, W: 1.12 ±0.10, p<.001). **Conclusion:** Elite men are faster than elite women in absolute velocity. Additionally, elite men and women short-track speed skaters show different pacing behavior in a 1500m race in which men start more aggressively and finish slower than women do.



2353 Board #17 May 31 9:30 AM - 11:00 AM
Quantitative Impact Of Individual Lower Limb Muscle Volumes On Athletic Performances

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Reported Relationships: X. Feng: Ownership/interest/stock; Springbok, Inc.

Lower limb skeletal muscles play an important role in athletic performances. However, due to the difficulty in obtaining detailed information of each individual muscle, their quantitative impact on performance is unknown. High resolution magnetic resonance imaging (MRI) of the muscles can be used for accurate measurements of the volumes of each muscle and study their quantitative impact on performances. **PURPOSE:** To develop an accurate muscle volume measurement tool using MRI and use it to study the quantitative impact of individual volume on performances of jump and sprint on basketball players. **METHODS:** 10 male varsity basketball players and 8 club players were recruited in this study. MRI was performed on a Siemens 3T Trio scanner using a customized sequence based on the spiral k-space sampling method. Proton-density weighted images of the entire lower limb from T12 to the ankle were acquired with multiple stacks. Manual segmentation was performed to delineate the boundary for all 35 muscles on each leg, followed by volume calculation and normalization to account for differences in body size. All subjects were instructed to perform various jump and sprint tests. Correlations between muscle volumes and each performance metric were studied on both the varsity and club groups. Feature selection was used to reduce the number of relevant muscles, followed by a linear regression model to study the quantitative impact of the selected muscles on each performance metric. **RESULTS:** Vastus medialis and semimembranosus were selected as the most important muscles for jump while adductor longus and vastus medialis were selected for sprint. Strong correlations ($r=0.833$) between the selected muscles and associated performances were found for varsity players and moderate correlations ($r=0.507$) were found for club players. **CONCLUSIONS:** MRI can provide accurate quantitative measurements of muscle volumes, which have heterogeneous impact on different athletic performances. This information can be used for an improved training scheme that targets specific muscles, especially for high level athletes.

2354 Board #18 May 31 9:30 AM - 11:00 AM
The Acute Effects of Different Squat Intensities on Vertical Jump Performance

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Post activation potentiation (PAP) is defined as a short-term improvement in performance as a result of using a resistance exercise. The phenomenon of PAP has been shown to acutely increase athletic performance with back squats as an effective modality. **PURPOSE:** This study investigated acute effects of different back squat intensities on the countermovement vertical jump (CMJ). **METHODS:** Participants were 13 to 18-yr-old healthy male ($n=8$) and female ($n=3$) who participated in regular resistance training for at least 6 months and have played in a University

Interscholastic League (UIL) within the past 6 months. One Repetition Maximum (1-RM) was measured within 4 weeks before testing and all participants abstained from strenuous exercise for 48 hours prior to testing. Each participant performed a standard warm-up for 5 minutes and measured a baseline (PRE) CMJ by a Vertec®. One minute of resting interval time was provided after PRE test. The CMJ performed by a randomized counterbalanced order with repeated measures under five different barbell back squat trials: 70, 75, 80, 85, and 90% of 1-RM. Between each barbell back squat trial and CMJ test, the participants rested for one minute. Peak power values were estimated by equation (Harman Formula): Peak power (W) = $61.9 \cdot \text{jump height (cm)} + 36.0 \cdot \text{body mass (kg)} + 1,822$. All Data were represented mean and standard deviation and analyzed by one-way ANOVA with repeated measures. **RESULTS:** There was no significant difference at 70, 85, and 90% of 1-RM. The CMJ increased significantly in 1-RM 75% (PRE: 51.3 ± 13.9 cm, 75%: 52.8 ± 13.6 cm, $p=.036$). At 1-RM 80%, increasing tendency was shown (PRE: 51.3 ± 13.9 cm, 80%: 52.8 ± 14.5 cm, $p=.069$). **CONCLUSION:** The results may indicate that barbell back squat at 75-80% of 1-RM can improve a CMJ performance acutely in adolescence who plays in UIL level.

2355 Board #19 May 31 9:30 AM - 11:00 AM
Comparison Of Exercise Intensity Between Folk Dance And Walking In Healthy Female

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(No relevant relationships reported)

Dance promotes physical health, mental health, and social health. Dance has gained popularity especially by women of all ages as an activity for health and fitness. In Japan, dance is a part of requirements in middle school PE core curriculum. Hip-hop dance, creative dance and folk dance are recommended to teach in PE. However, the research on physical aspects of folk dance is still few. **PURPOSE:** To measure the heart rate and the exercise intensity while dancing folk dance and compare those to walking. **METHODS:** Heart rate of 7 healthy female (21.1 ± 0.4 yrs) were recorded using the heart rate monitor (Polar, RC3GPS) while 1) dancing folk dance "Virginia Reel" with music (duration 7min 30sec, 116 bpm) and 2) walking for the same duration with same music in their own pace (the average speed was 83.7 ± 8.6 m/min). Exercise intensity was calculated by using maximum heart rate (%HRmax) and heart rate reserve (%HRR). Perceived exertion was measured by the Borg Rating of Perceived Exertion (RPE) 6-20 Scale. Independent t-test was performed with p value under 0.05 considered significant. **RESULTS:** The heart rate while dancing was significantly higher than that of walking (dance 118.9 ± 7.2 bpm, walking 93.9 ± 5.5 bpm, $p<.05$). %HRmax and %HRR of dance were significantly higher than those of walking (%HRmax dance $59.5 \pm 3.5\%$, walking $47.0 \pm 4.7\%$, $p<.05$; %HRR dance $39.0 \pm 4.4\%$, walking $20.2 \pm 5.5\%$, $p<.05$). RPE of dance was significantly higher than that of walking (dance 13.1 ± 1.2 , walking 10 ± 1 , $p<.05$). The maximum heart rate during trial was 153 ± 6.8 bpm in dance and 111.2 ± 26.5 bpm in walking. According to ACSM classification of exercise training intensity, intensity of dance was light to moderate (intensity moderate in %HRmax, light in %HRR, moderate in RPE) and walking intensity was light in all three measures. **CONCLUSION:** Although heart rate, %HRmax, and %HRR of dance are higher than those of walking, the exercise intensity of dance is light to moderate. Dance can be a beneficial physical activity for beginners but we need to consider the pace of dance to meet sufficient intensity.

2356 Board #20 May 31 9:30 AM - 11:00 AM
VO_{2peak} Associated With Breath Hold Capacity In Surfers

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Competitive surfing is a growing sport with evolving performance and safety demands. One particular challenge surfers face is the need to endure long breath holds following bouts of surf paddling. **PURPOSE:** The purpose of this study was to examine the association between aerobic fitness markers, such as VO_{2peak} and ventilatory thresholds, and post-paddling breath hold capacity in competitive surfers. **METHODS:** Eleven male collegiate level competitive surfers completed both a maximal graded exercise test and a simulated post-paddling breath hold challenge on a modified paddling ergometer. Associations between markers of aerobic fitness and post-paddling breath-hold capacity were tested using linear regression modeling. **RESULTS:** The overall regression model indicated a positive linear association between the assessed markers of aerobic fitness and post-paddling breath-hold capacity ($r = .828$, $r^2 = 0.686$, $p = 0.035$). This association was explained by differences in VO_{2peak} ($B = 0.975$, $p = .034$). **CONCLUSION:** These findings suggest that VO_{2peak} may be an important training target for programs aimed at improving breath hold capacity in surfers.

2357 Board #21 May 31 9:30 AM - 11:00 AM

Shoulder Range Of Motion: Comparison Between Dominant And Non-dominant Sides In Elite Young SwimmersSandra L. Prieto¹, Juan C. Mazza², Mauricio Serrato¹, Raúl R. Festa², Patricia Cosolito². ¹Colombia State University, Bogotá D.C., Colombia. ²Biosystem Institute Sports Sciences, ROSARIO, Argentina.

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(No relevant relationships reported)

The joint range of motion (ROM) is related to flexibility, constituting a physical quality that influences in technical skills and biomechanical economy of movement; however, this physical ability has been little investigated in different sport's disciplines, so they are unknown normative ranges for specialties and competition level, especially related with dominance of the athletes. The shoulder complex of swimmer is submitted to a high number of repetitions, especially overhead, to achieve propulsion and overcome aquatic drag, requiring joint's symmetry of movement, from side to side. **PURPOSE:** To describe active and passive ROM, testing shoulder complex, identifying differences between side to side, in elite young swimmers that belong to Bogotá State's Team. **METHODS:** Fifty one healthy young swimmers participated in a cross-sectional study (23 males, 28 females; age: 16.51 ± 1.10 yr; weight: 59.86 ± 7.74 kg; height: 167.32 ± 9.05 cm). We include subjects with no previous shoulder injuries. Seven tests were performed for Active and Passive ROM (flexion, abduction and extension; horizontal adduction and abduction; medial and lateral rotation). Mean and standard deviations (SD) values were calculated by dominant and non-dominant shoulder, for all ROM measurements. We applied paired t-test to determine statistical differences (sd) between dominant and non-dominant shoulder, at $p < 0.05$. **RESULTS:** Analyzing shoulder active ROM in males, we have found sd for Active medial rotation between dominant ($93.74 \pm 13.97^\circ$) and non-dominant ($99.09 \pm 16.23^\circ$) sides ($p < 0.05$); also sd for Active lateral rotation between dominant ($97.83 \pm 11.24^\circ$) and non-dominant ($91.70 \pm 6.12^\circ$) sides ($p < 0.0001$). In females, we have found sd for Active medial rotation between dominant ($87.21 \pm 13.91^\circ$) and non-dominant ($89.5 \pm 7.70^\circ$) values ($p < 0.05$); also sd for Active lateral rotation between dominant ($101.14 \pm 9.18^\circ$) and non-dominant ($97.46 \pm 9.74^\circ$) values ($p < 0.003$). No sd were found in Active and Passive ROM, for other variables measured. **CONCLUSIONS:** We found symmetrical shoulder ROM's values, side to side, for elite young swimmers, except for Active medial and lateral rotation, in both genders. Probably, this evidence does not allow load balance and should be considered as a risk factor of "swimmer's shoulder" painful.

2358 Board #22 May 31 9:30 AM - 11:00 AM

Performance Across Quarters In An International Field Hockey TournamentJohn G. Morris¹, Luke E. Hazell¹, Nick Shedd², Caroline D. Sunderland¹. ¹Nottingham Trent University, Nottingham, United Kingdom. ²USA Field Hockey, Colorado Springs, CO.

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(No relevant relationships reported)

In 2014 the structure of international field hockey matches moved from 2 x 35-minute halves to 4 x 15-minute quarters. The intention was to create a higher intensity, faster paced and more exciting game. The physical challenges presented by the new game structure are largely unknown. **PURPOSE:** This study examined the presence and extent of performance decrements across quarters in matches during an international women's field hockey tournament. **METHODS:** Twenty international, female field hockey players (mean \pm SD: age 23.0 ± 2.9 y, body mass 59.9 ± 4.9 kg, height 161.5 ± 4.8 cm) participated in the study. Seven matches from one international tournament were analysed. Based on global positioning satellite data, locomotor activities were categorised into three bands corresponding to low ($0.00 - 1.68$ m s^{-1}), moderate (1.69 m $s^{-1} - 4.18$ m s^{-1}), and high (4.19 m $s^{-1} - > 5.27$ m s^{-1}) speed running. Data were analysed using a two-level repeated measures multi-level model, with match number at level 1 and player at level 2. Model fit was assessed using the -2*loglikelihood statistic. **RESULTS:** During the tournament the total distance completed by players was 1778 (258), 1620 (229), 1613 (225), 1501 (255) m in quarters 1 to 4 respectively (mean and standard deviation). The corresponding averages for high speed running were 376 (181), 297 (146), 310 (135), 276 (125) m respectively. When controlling for position, the decrement in high-speed distance covered in quarter 2, 3 and 4 compared with quarter 1 was -78, -64 and -98 m respectively (all $P < 0.05$ compared with quarter 1). **CONCLUSIONS:** This study demonstrates that players cover their maximum total distance and high-speed distance during quarter 1, but are unable to maintain this performance level in the remaining quarters of a match during an international hockey tournament.

2359 Board #23 May 31 9:30 AM - 11:00 AM

Performance-Related Variables That Are Associated With Finish Time in an Olympic Distance TriathlonTodd Buckingham¹, Rebecca W. Moore², David P. Ferguson¹, Nicholas D. Myers¹, Karin Pfeiffer, FACSM¹. ¹Michigan State University, East Lansing, MI. ²Eastern Michigan University, Ypsilanti, MI.

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Wearable devices allow athletes to track an abundance of sports performance variables. However, the amount data can be overwhelming. Most triathletes wear these devices during training and racing. This technology could allow researchers to obtain performance-related variables during triathlon competition from the three disciplines to improve performance. **PURPOSE:** Determine if/which performance-related variables from wearable devices are associated with better in-race performance in each discipline (swim, bike, run), and overall, during an Olympic distance triathlon for amateur triathletes.

METHODS: Participants were amateur triathletes who completed an Olympic distance triathlon during 2016 or 2017 and used a Garmin multisport watch that recorded race performance. Participants completed a questionnaire and included a data file from their Garmin watch that linked to an Olympic distance triathlon race where performance-related variables could be analyzed. One variable was examined for each discipline: SWOLF, cycling cadence, and running stride length. All triathlon times were obtained from the website of the race that each participant completed. Pearson correlations assessed relationships between the performance-related variables and time in each of the three disciplines, and overall finish time. A multiple linear regression was performed to determine percent variance accounted for in overall finish time by the performance-related variables. Covariates were age and sex.

RESULTS: One-hundred thirty triathletes (37.7 ± 10.4 years, 34.6% female) submitted complete questionnaires. SWOLF ($r = 0.788$, $p < 0.01$; $r = 0.600$, $p < 0.01$), cycling cadence ($r = -0.401$, $p < 0.01$; $r = -0.477$, $p < 0.01$), and running stride length ($r = -0.871$, $p < 0.01$; $r = -0.822$, $p < 0.01$) were all significantly related to their respective discipline and overall. The multiple linear regression revealed that the three performance-related variables accounted for 71% of the variance in official finish time ($R^2 = 0.710$).

CONCLUSIONS: By determining the three performance-related variables that are most strongly correlated with individual discipline and overall Olympic distance triathlon finish time, triathletes can now focus on these variables to produce faster race times.

2360 Board #24 May 31 9:30 AM - 11:00 AM

Assessing the Differences Between a Governed and Non-Controllable Focal Point on Male Broad Jump PerformanceAndy Bosak¹, Robert Sanders², Hannah Nelson¹, Madeline Phillips¹, Branden Ziebell¹, Russell Lowell¹, Jared Feister¹. ¹Liberty University, Lynchburg, VA. ²The University of Mississippi, Oxford, MS. (Sponsor: James Schoffstall, FACSM)

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(No relevant relationships reported)

Prior studies have investigated the manipulation of a visual target (i.e. sport specific focal point, non-controllable, or governed focal point) on vertical jump performance, yet few studies have examined factors that directly impact broad jump performance. The broad jump (BJ) test is often utilized to determine how far a person can jump and is a measurement of an individual's horizontal power ability. A previous focal point broad jump study utilizing female subjects suggested that BJ performance may slightly increase when using a governed focal point. However, this has not been evaluated using a male population. **PURPOSE:** To examine the impact of a governed (i.e. set focal point) vs. non-governed (i.e. no set focal point) focal point on broad jump performance in active males. **METHODS:** Thirty-three no less than averagely fit collegiate males had their descriptive data (Ht. = 174.97 ± 6.82 cm, Wt. = 81.85 ± 10.52 kg, BF% = $15.22 \pm 5.76\%$, age = 22.00 ± 1.70 yrs) collected. Subjects completed an 8 min dynamic warmup and then received a four minute passive recovery (PR) period. Subjects then completed four familiarization broad jumps (ie. a jump series). After another four minute PR period, subjects completed two series of jumps (ie. four trials apiece with 60 seconds of PR between each jump) in a counterbalanced order with either a governed focal point (FP) or non-governed focal point (NFP) being utilized for each jump. The FP and NFP jump series were separated by 4 min of PR. The farthest jump for FP vs. NFP was compared using Paired-Samples t-Tests with significant differences occurring at $p \leq 0.05$. **RESULTS:** Significant differences ($p = 0.015$) occurred between FP (235.46 ± 21.59 cm) and NFP (233.33 ± 22.49 cm). Also, nineteen subjects highly benefited from utilizing a governed focal point with a mean jump increase of 5.26%. **CONCLUSION:** It appears that using a focal point (FP) may elicit a farther jump in no less than averagely fit males as compared to utilizing a non-controlled focal point (NFP). Further research may be required to evaluate the impact

of a sport specific focal point vs. a generic set focal point on broad jump performance with males and females who participate in sports where horizontal power is highly associated with improved sport performance.

2361 Board #25 May 31 9:30 AM - 11:00 AM
Relationship of Lumbopelvic-hip Stability on Ball Speed in Female Windmill Softball Pitchers

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(No relevant relationships reported)

The dynamic movement of the windmill softball pitch requires the body acting as a kinetic chain working in a proximal to distal manner. Optimal energy transfer from the lower to upper extremity requires the stability of the lumbopelvic-hip complex (LPHC). **PURPOSE:** To examine the differences in knee valgus between LPHC stability groups, defined by knee valgus while performing a single leg squat (SLS), and if knee valgus could predict ball speed during the windmill softball pitch. **METHODS:** Eleven right-handed softball pitchers (13.7 ± 2.1 yrs; 163.8 ± 8.0 cm; 66.3 ± 11.0 kg; 48.4 ± 5.1 mph) volunteered to participate. Kinematic data were collected via an electromagnetic tracking system. Participants performed a SLS on their stride leg (left leg) and threw 3 fastballs for strikes to a catcher (43 ft). Stride leg knee valgus was assessed at 45° of knee flexion during the SLS and top of back swing (TOB), foot contact (FC), and ball release (BR). **RESULTS:** There was no statistical differences in knee valgus between groups (stable vs unstable) at the pitching events of TOB ($F_{(1,10)}=0.03$; $p=0.86$); FC ($F_{(1,10)}=0.01$; $p=0.91$); and BR ($F_{(1,10)}=0.23$; $p=0.64$). Examining knee valgus at the pitching events as a predictor of ball speed revealed no significance ($F_{(3,7)}=0.64$, $p=0.62$, $R=0.46$, $R^2=0.21$). **CONCLUSION:** In this study, there was no difference in knee valgus between LPHC stability groups as determined in the SLS. Overall knee valgus, at the pitching events, did not predict ball speed. As knee valgus is an outcome of an unstable LPHC, the authors postulated that having less knee valgus during the pitching cycle would have assisted in energy transfer and thus increased ball speed in windmill softball pitching. Limitations to this study include the small sample size used. Future studies should consider a multivariable model to determine LPHC stability and examine the influence of the trunk at events within the windmill softball pitching cycle to determine their effect on increasing ball speed.

Mean and standard deviations of knee valgus (in degrees) and ball speed (mph)		
LPHC stability	Pitching events	Mean(SD)
Stable	TOB	-4.15(10.5)
	FC	-3.53(10.6)
	BR	2.35(6.2)
Unstable	TOB	-5.17(5.5)
	FC	-4.21(5.3)
	BR	0.27(8.2)
Ball speed	Stable	50.4(3.1)
	Unstable	44.7(6.3)

Knee valgus (-); knee varus (+); n=11;

2362 Board #26 May 31 9:30 AM - 11:00 AM
Effects of Optimizing the Respiratory Pump on Performance During a Simulated Ice Hockey Period

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Ice hockey requires high-intensity activity during shifts with inactive recovery between shifts. During recovery periods, blood may pool in the legs, reducing central blood volume and the ability to clear lactic acid. Impedance threshold devices (ITD) were developed to treat conditions of central hypovolemia, such as hemorrhage. By creating a negative intrathoracic pressure, venous return is enhanced, increasing stroke volume and cardiac output. **PURPOSE:** To determine the effects of breathing with an ITD during recovery periods between simulated ice hockey shifts. **METHODS:** Five male collegiate ice hockey players skated a course, the Peterson On-Ice Repeated Sprint Test, eight times (shifts) with 90 s recovery between each shift. Each athlete completed two test sessions separated by 48 hr, one while breathing freely during the recovery periods (control condition) and one while breathing with the ITD during the recovery periods. **RESULTS:** Performance, measured as time to skate the course, was similar between conditions ($p > .05$). Average time to complete each shift was 22.10 ± 0.74 s (SEM) and increased with successive shifts. After shift 4, lactate was 12.0 ± 0.8 mM

(control) and 11.0 ± 2.0 mM (ITD). After skating eight shifts, lactate continued to increase during the control condition (14.0 ± 0.4 mM) and was 28% higher than the ITD condition (10.9 ± 1.5 mM). Ratings of perceived exertion increased from shift 1 to shift 8 with the average slope of increase greater for the control condition (0.87, 95% CI 0.80-0.94) than the ITD condition (0.65, 95% CI 0.60-0.70, $Z = -7.54$, $p < .001$). **CONCLUSIONS:** Breathing with the ITD during recovery periods did not affect skating performance measured as time to complete each shift, but lactate was lower after shift 8 and athletes rated their exertion lower during the ITD condition. Thus, use of an ITD has potential to enhance recovery during repeated bouts of high-intensity, intermittent exercise.

2363 Board #27 May 31 9:30 AM - 11:00 AM
Influence of Loaded Lunge Performance on Functional Movement Screen Deep Squat Performance in Physically Active Individuals

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The Functional Movement Screen Deep Squat (DS) is used to assess the quality of fundamental movement patterns. Specifically, the DS assesses musculoskeletal stability and mobility at the ankle, knee, and hip. The DS score is added to a composite score to identify individuals at risk for musculoskeletal injury. **PURPOSE:** To examine the influence of ankle range of motion (ROM), as measured during a weight bearing lunge, on the individual scoring criteria and overall score for the DS. **METHODS:** Twenty-two college aged, physically active subjects (11 M, 11 F, 20.3 ± 1.0 yo) were recruited and completed testing. Bilateral peak weight bearing ankle dorsiflexion ROM was measured with a digital inclinometer during the loaded lunge test, with the lower bilateral scores being retained. Participants performed three trials of the DS with their feet flat and three trials with their heels elevated on a 2x6 block. Standard FMS scoring criteria were applied to assign a score of 3, 2, or 1. Successful completion of the DS requires: 1. torso to be parallel with the tibia or toward vertical, 2. femur to be parallel with the floor or below, 3. knees to track over the toes, & 4. dowel cannot move beyond the toes. A one-way ANOVA with a Bonferroni post hoc test and independent t-tests were used to determine significance ($p \leq 0.05$) for the influence of ankle dorsiflexion ROM on DS scores and the presence of the four individual DS dysfunctions respectively. **RESULTS:** There was a significant difference in ankle dorsiflexion for DS scores [$F(2, 19) = 5.20$, $p=0.016$]. Post hoc testing revealed a significant difference in dorsiflexion ROM between a score of 3 ($51.4^\circ \pm 9.7^\circ$) and a score of 1 ($39.5^\circ \pm 5.6^\circ$). There was a significant difference ($p=0.001$) in ankle dorsiflexion for participants that met the torso/tibia criteria ($51.0^\circ \pm 7.6^\circ$) compared to participants that did not meet the criteria ($40.1^\circ \pm 5.0^\circ$), and for participants that met the dowel position criteria ($50.5^\circ \pm 5.0^\circ$) compared to those that did not meet the criteria ($41.5^\circ \pm 6.3^\circ$) ($p=0.016$). **CONCLUSION:** Participants with limited weight bearing ankle dorsiflexion ROM are more likely to score a 1 and exhibit a forward lean and bar position during the DS. This information will guide a clinician's corrective exercise approach for individuals that exhibit these DS dysfunctions.

2364 Board #28 May 31 9:30 AM - 11:00 AM
Could Hip Joint Position Induce Different Metabolic and Muscular Responses After Knee Extension?

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(No relevant relationships reported)

The positioning of the back of the seated knee extension exercise alters hip joint position, which in turn modifies the muscle length of the rectus femoris. The increase the angle between the seat and the back of the chair allows a greater stretching of the rectus femoris a condition that theoretically may have an influence on knee extensors force production and consequently may have an impact on muscle metabolic response. It has been hypothesized that acute muscle thickness (MT) swelling in response to exercise may occur due to an increase in intracellular osmotic concentration secondary and byproduct accumulation. Thus, hip angle position may also have an impact on knee extensors metabolic responses. **PURPOSE:** This study investigated the acute effects of two different hip joint position during seated knee extension training on MT swelling and torque production in young individuals. **METHODS:** Seven healthy men (25 ± 4 yrs) underwent two sessions of isokinetic training in different hip joint positions (0° and 90° , 0° full extension). Participants performed 5 sets of 10 repetition of concentric isokinetic exercise at $60^\circ/\text{s}$; with 1-minute rest between sets. Sessions were 72h apart. Muscle thickness (MT) were measured by ultrasound before and after the exercises session. **RESULTS:** Paired t-test showed no significant differences for the PT at 90° hip position (252.81 ± 21.32 N.m) and 0° (251.38 ± 17.18 N.m). There was no significant difference ($p>0.05$) on MT of rectus femoris and vastus

lateralis between positions. Rectus femoris MT increased from 31.08 ± 3.09 mm to 35.74 ± 2.78 mm at 90° , and from 29.76 ± 3.48 mm to 34.46 ± 2.40 mm at 0° . Vastus lateralis MT increased from 31.37 ± 6.05 mm to 33.35 ± 7.04 mm at 90° , and from 31.45 ± 6.32 mm to 32.72 ± 6.14 mm at 0° . **CONCLUSION:** Resistance trained men experience same metabolic and muscular responses of the knee extensors following the two different hip joint positions exercises. Thus, the practice of using different hip positions in an attempt to maximize metabolic responses may be discontinued.

2365 Board #29 May 31 9:30 AM - 11:00 AM

Cardiorespiratory Assessment of Professional Brazilian Surfers

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Surfing demands multifactorial physical fitness and continuing interaction with environmental variables. Sports specific assessment is mandatory in elite athletes and should focus on fitness variables such as cardiorespiratory, muscle strength, power and balance.

PURPOSE: The purpose of this study was to evaluate 10 elite Brazilian surfers for cardiorespiratory fitness during a specific sport protocol.

METHODS: 9 elite surfers (19±4 years) were evaluated for cardiorespiratory fitness using a portable metabolic analyzer (K4b²- COSMED®) for $\dot{V}O_{2\max}$ on a pool. The protocol was structured to increase load every 2 minutes with different elastic rubber bands (8 bands with different increasing elastic capacity each) fixed on athletes surfing board, and the test was considered maximum within voluntary fatigue (BORG scale) or $\dot{V}O_2$ plateau or $RQ > 1.1$. Values were expressed as Mean ± standard deviation.

RESULTS: Mean values for $\dot{V}O_{2\max}$ were 47 ± 9 mL/kg.min⁻¹ (43 - 59 mL/kg.min⁻¹). None of the athletes reported clinical symptoms of cardiovascular considerations.

CONCLUSIONS: Surfers athletic performance should be focused on a multifactorial matter, and fitness evaluation should consider specific demands. For $\dot{V}O_2$ analyses, this specific protocol would be considered feasible and should be encouraged.



E-30 Free Communication/Poster - Recovery

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2366 Board #30 May 31 9:30 AM - 11:00 AM

Effective Stretching Position for the Tightness of Posterior Shoulder Capsule Determined by Shear Wave Elastography

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PURPOSE: Stretching is often used to treat and prevent the posterior shoulder capsule tightness; however, effective stretching positions remain unclear. We aimed to identify stretching positions that applied greatest passive force on the posterior shoulder capsule by evaluating elastic characteristics in various stretching positions via ultrasound shear wave elastography (SWE). **METHODS:** Nine fresh-frozen shoulders (age 86.6 ± 7.7 years) without osteoarthritis or rotator cuff tears were investigated. All posterior shoulder tissues including muscle and skin were preserved intact. The shear elastic moduli of the middle and inferior posterior shoulder capsules were evaluated via SWE. Shear elastic modulus measurements were performed in 9 stretching positions using a combination of several shoulder elevation planes (frontal, sagittal, scapular) and elevation angles (-30° , 0° , 30° , 60°). Torque of 4 Nm for shoulder internal rotation or horizontal adduction was applied in each stretching position. Shear elastic moduli were measured in resting positions at 0° of elevation with neutral shoulder internal/external rotation. The shear elastic moduli in all stretching and resting positions were compared using one-way repeated-measures analysis of variance ($p < .05$). **RESULTS:** Shear elastic modulus values for middle posterior capsules in internal rotation at 30° in scapular plane elevation (86.1 ± 43.0 kPa, $p = .01$) and horizontal adduction at 60° of elevation (93.2 ± 39.3 kPa, $p < .001$) were significantly higher than the values in the resting position (33.1 ± 21.9 kPa). Additionally, the shear elastic modulus value for the inferior posterior capsule in internal rotation at 30° of flexion was significantly higher than the value in the resting position (117.1 ± 51.9 vs. 46.1 ± 41.6 kPa, respectively; $p = .004$). **CONCLUSION:** We demonstrated that effective middle posterior shoulder capsule stretching positions were shoulder internal rotation at 30° of scapular plane elevation and horizontal adduction at 60° of elevation. Shoulder internal rotation at 30° of flexion was the most effective position for the inferior posterior shoulder capsule. Stretching in these positions to relieve tightness of posterior shoulder capsules could contribute to treatment and prevention of throwing shoulder injuries.

2367 Board #31 May 31 9:30 AM - 11:00 AM
Phase Change Material Cooling Reduces Indices of Muscle Damage and Does Not Inhibit Acute Adaptation

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Phase change material (PCM) cooling has been shown to decrease muscle damage and accelerate recovery. However, the effects of cryotherapy on the adaptive response to exercise are not well understood. The repeated bout effect (RBE) is a protective adaptation to an initial bout of eccentric exercise and serves as a model to examine acute adaptation.

PURPOSE: To examine (1) the effect of PCM cooling on muscle damaging eccentric exercise, and (2) whether application of PCM cooling blunts the adaptive RBE response.

METHODS: Twenty males (24±5 yo) performed 120 eccentric quadriceps contractions on each leg at 90% of isometric strength and were randomized to receive PCM packs frozen at 15°C (treatment) or melted packs (control) worn inside shorts for 6 h post exercise. Prior to exercise, and on each of the subsequent 3 days, pain, strength, creatine kinase activity (CK) and high sensitivity C-reactive protein (hsCRP) were measured. The protocol was repeated 2 weeks later with all subjects receiving melted PCMs after the repeated exercise bout. Treatment and RBE were assessed using treatment and/or bout x time ANOVA.

RESULTS: The exercise caused pain in both groups ($P = 0.0001$) with less pain in the PCM group ($P = 0.021$). There was an RBE for pain ($P = 0.0001$) with no difference between treatments ($P = 0.38$). There was an increase in strength in the PCM group ($P = 0.001$; treatment x time effect $P = 0.035$) with no strength loss in the control group ($P = 0.90$). The RBE for strength differed between treatments ($P = 0.005$); strength increased after the initial bout in the PCM group but not after the repeated bout ($P = 0.006$), while strength was unchanged in the control group ($P = 0.55$). CK was elevated in both groups ($P < 0.01$) with no difference between groups ($P = 0.46$). There was a RBE for CK ($P = 0.0001$) with no difference between groups ($P = 0.84$). The exercise did not elevate hs-CRP ($P = 0.49$) with no difference between groups ($P = 0.94$).

CONCLUSIONS: PCM cooling reduced pain following damaging exercise. While the protocol was insufficient to cause strength loss, it is notable that PCM cooling elevated strength on the days after eccentric exercise. Importantly, the RBE was not compromised by PCM cooling.

2368 Board #32 May 31 9:30 AM - 11:00 AM
Effects Of Photobiomodulation Therapy On Fatigue And Muscle Damage In Judo Athletes

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PURPOSE: Photobiomodulation therapy (PBMT) has emerged as an effective non-invasive strategy to attenuate fatigue and muscle damage when applied before different types of exercises; however, there is no evidence regarding PBMT effects on fatigue and muscle damage in judo athletes. Thus, the aim of our study was to investigate the PBMT effect on fatigue and muscle damage in judo athletes.

METHODS: This was a randomized, triple-blind, placebo-controlled trial study. Sixteen judo athletes (four purple, five brown and seven black belts; 23.1±3.8 years, body mass 77.9±14.9 kg, height 173.1±8.9 cm, 17.5±7.3% of body fat, and 12.9±5.0 time of practice) had their preferred and non-preferred lower limbs randomized for PBMT, while the contralateral limb received placebo at knee extensors, flexors, and plantar flexors muscles (total dose=450J). They performed a protocol of 10 sets of 10 reps (1 min rest) of maximal countermovement jumps (CMJ) to induce muscle fatigue and damage. Rectus femoris echo intensity (EI_{RF}), unilateral CMJ, and muscle soreness were assessed for each lower limb in different time points: before, during (5th set), post (immediately after), and 24 and 48 h after the protocol, as presented in Table 1. Two-way ANOVA repeated measures compared treatment-time interaction with Bonferroni post hoc when appropriate ($p < 0.05$).

RESULTS: There was no treatment-time interaction for any of the investigated variables ($F = 0.690$, $p > 0.262$), while time effect was observed ($F = 15.009$, $p < 0.001$). Table 1 shows the mean and standard deviation and depicts time differences.

Variables	Treatment	Baseline	5 th set	Post	24h	48h
CMJ _{IMPULSE} (N.s)	Placebo	136±20 ^A	121±18 ^B	115±20 ^B	130±24 ^C	126±33 ^C
	PBMT	141±27 ^A	120±20 ^B	117±25 ^B	137±18 ^C	134±28 ^C
EI_{RF} (a.u.)	Placebo	124±11 ^A	-	-	151±19 ^B	149±20 ^B
	PBMT	127±12 ^A	-	-	148±15 ^B	152±16 ^B
Muscle soreness (a.u.)	Placebo	0.0±0.0 ^A	-	2.1±2.3 ^B	4.2±2.4 ^C	3.6±1.6 ^C
	PBMT	0.0±0.0 ^A	-	1.8±1.9 ^B	4.2±2.4 ^C	3.5±1.7 ^C

Different letters within the same line are significantly different ($p < 0.05$).

CONCLUSIONS: The fatigue protocol (10 sets of 10 reps CMJ) was efficient to induce fatigue and muscle damage immediately after, 24h, and 48h. However, the adopted PBMT parameters applied before exercise has no effect to attenuate lower limbs fatigue, muscle damage, and soreness in judo athletes.

2369 Board #33 May 31 9:30 AM - 11:00 AM
Heart Rate Recovery Assessment in Elderly and Young Men: a Comparison Between Types of Exercise

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(No relevant relationships reported)

Post-exercise heart rate (HR) recovery (HRR) is considered a potential marker of cardiac health. Cardiorespiratory fitness, aging effect and, specifically, the type of physical exercise are able to exert an influence on HRR. However, is not clear the behavior of the HRR in the resistance exercise (RE). **PURPOSE:** To analyze HRR after RE and non-resistance exercise (NRE) in healthy male subjects. **METHODS:** Twenty-two subjects were evaluated and divided in two groups: Young (GY, $n = 11$), 26.0 ± 4.4 ys and Elderly (GE, $n = 11$), 66.5 ± 5.0 ys. A symptom-limited cardiopulmonary exercise test on a cycle ergometer and a symptom-limited resistance test at 70% of 1RM on a Leg Press 45° device were performed as NRE and RE, respectively. HR was recorded after exercise using a cardiofrequencimeter (Polar s810). HRR indices were calculated by subtracting the first (HRR-1), second (HRR-2) and third-minute (HRR-3) HR from the maximal value achieved in both exercises. An ANOVA Two Way test was performed ($p < 0.05$). **RESULTS:** The analysis revealed no interaction between age and exercise factors on HRR. However, independent of exercise, an age effect with faster recovery was observed for GY (higher HRR values were found in the 1st and 2nd minutes of recovery). Besides, an effect of age and exercise was observed for NRE (higher values for GY after NRE in the 3rd minute of recovery) (Table 1). **CONCLUSION:** Cardiovascular adjustments investigated through HRR are attenuated in the elderly after RE and NRE. These results provide an interesting insight into a deeper understanding of CV restoration after different exercise modalities and age; Regardless of the type of exercise, the effect of aging prevails in determining the individual's HRR response to exercise.

Table 1. Interaction between group (Elderly vs. Young) and type of exercise (CEPT vs. load at 70% 1 RM).

	Elderly		Young		Age	Type	Interaction
	NRE	RE	NRE	RE			
HRR-1 min	24.36 ± 12.6	17.73 ± 13.07	32.64 ± 6.65	35.82 ± 21.51	*	NS	NS
HRR-2 min	42.18 ± 11.2	28.36 ± 16.85	52.64 ± 8.3	50.45 ± 20.51	*	NS	NS
HRR-3 min	48.82 ± 11.5	31.64 ± 18.07	61.36 ± 10.88	59.27 ± 20.52	*	*	NS

Mean ± standard deviation. NRE: non-resistance exercise; RE: resistance exercise; HRR: heart rate recovery. * $p < 0.05$. NS: Not Significant.

2370 Board #34 May 31 9:30 AM - 11:00 AM

The Effects of Sport Massage and Foam Rolling on Running Efficiency in Female Collegiate Distance RunnersKent D. Johnson, FACSM, Avery Franklin, Rebecca Robertson, Kade Hinkle. *Lipscomb University, Nashville, TN.*
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Foam Rolling and Sport Massage techniques have become increasingly popular methods to help athletes prepare for and recover from bouts of intense exercise. Distance runners in particular use Foam Rolling prior to and after strenuous workouts potentially to improve athletic performance and flexibility, reduce workout-related soreness and decrease recovery time. While these activities are common in intercollegiate athletics (especially distance running circles), there is equivocal evidence that supports the effectiveness of either method, especially when used prior to exercise. **PURPOSE:** To compare running efficiency following a bout of Sport Massage and Foam Rolling in female Collegiate distance runners. **METHODOLOGY:** Nine healthy NCAA D-1 female Cross Country runners volunteered for the study (age=20.89±1.97yrs; WT=54.25±7.15kg; HT=163.02±5.67cm; Percent Fat=15.29±5.72; BMI=20.26±2.01). Volunteers reported to the laboratory and completed an initial $\dot{V}O_{2max}$ test (7.0mph with a 3% grade increase every 3 minutes until exhaustion; $\dot{V}O_{2max}$ =55.73±2.11 ml/kg/min). Subjects then performed three separate randomized treadmill runs (7.0mph at 3% grade for 10 minutes) following either no intervention (NI), Sport Massage (SM) or a Foam Rolling (FR) session. To estimate running efficiency, heart rate (HR), rate of perceived exertion (RPE) and lactate samples were taken every two minutes throughout the three 10-minute steady state runs. **RESULTS:** Results showed there were no significant differences ($p>0.05$) between NI, SM or FR for RPE (NI=10.25±2.31; SM=10.50±2.67; FR=10.63±2.56) or lactate (NI=2.7±1.23; SM=2.84±0.90; FR=2.90±0.97). However, there was a significant difference ($p=0.028$) for HR between NI (149.88±15.33) and FR (144.75±13.79). SM (147.50±14.43) was not significantly different ($p>0.05$) from NI or FR for HR. **CONCLUSION:** These results indicate that FR prior to a steady state submaximal run may have a beneficial cardiovascular effect (improved efficiency) in well trained female distance runners.

2371 Board #35 May 31 9:30 AM - 11:00 AM

Accelerated Recovery of Muscle Function in Baseball Pitchers Using Post-Game Phase Change Material CoolingMichael J. Mullaney¹, Susan Y. Kwiecien¹, Andrew Fink², Malachy P. McHugh, FACSM¹. ¹Nicholas Institute of Sports Medicine and Athletic Trauma, Lenox Hill Hospital, New York, NY. ²Mullaney & Associates Physical Therapy, Matawan, NJ. (Sponsor: Malachy P. McHugh, FACSM)
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PURPOSE: No studies have documented recovery of strength in baseball pitchers nor interventions to accelerate strength recovery on the days after a pitching performance. The objectives of this study were to (1) document indices of recovery following a pitching performance, and (2) determine if recovery can be accelerated by providing prolonged post-game phase change material (PCM) cooling to the shoulder.

METHODS: Shoulder strength, pain and plasma creatine kinase (CK) levels were measured in 11 college baseball pitchers 48 h prior to a game, and 12 h and 36 h afterwards. Players were randomized to wearing PCM cooling packs (15°C) within a compression shirt for 3 h post game (PCM treatment), versus no treatment (control) and received the opposite post-game treatment one week later (randomized crossover design). Strength in internal rotation (IR), external rotation (ER) and empty can test (EC) was assessed using a hand-held dynamometer. Pitchers threw 45 pitches on each occasion. Effect of PCM cooling on strength, pain and CK was assessed with repeated measures analysis of variance.

RESULTS: There was IR strength loss in the control condition (18% at 12 h, 11% at 36 h, $P<0.01$) but no strength loss in the PCM condition ($<1\%$ at 12 h and 36 h; Treatment effect $P=.06$, Treatment by Time $P=.03$). Similarly, there was ER strength loss in the control condition (14% at 12 h, 11% at 36 h, $P<0.01$) but less strength loss in the PCM condition (8% at 12 h, 7% at 36 h; Treatment effect $P<0.01$, Treatment by Time $P=.58$). Pitching had no effect on EC strength (Time effect $P=.97$). CK and pain were elevated on the days after the game (Time effects $P<0.01$) with no difference between treatments (Treatment effect: CK $P=.79$, pain $P=.73$; Time by Treatment: CK $P=.92$; pain $P=.70$).

CONCLUSIONS: Strength loss, pain and elevated CK were evident 12-36 h post game. PCM cooling protected against strength loss but not pain or CK. Pain (peak 3 out of 10) may have been too low to have been affected by the intervention. This is the first study to document impairments in muscle function on the days after a baseball pitching performance. PCM cooling packs provides a practical means of delivering prolonged post-game cooling after pitchers have departed the training room.

2372 Board #36 May 31 9:30 AM - 11:00 AM

Sports Compression Garments Enhance Recovery Hemodynamics and Subsequent Time-Trial PerformanceDaniel Chi Wo Lee. *The Chinese University of Hong Kong, Hong Kong, Hong Kong.*

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(No relevant relationships reported)

Sports compression garments (CG) has been proposed to accelerate post-exercise recovery by enhancing blood metabolite clearance and reducing muscle soreness. However, limited information exists on CG-induced hemodynamic responses during recovery and their potential impact on subsequent time-trial (TT) performance.

Purpose: We examined the effect of wearing thigh-high sports CG 1) on hemodynamic responses, during passive recovery between exercise using Doppler ultrasound (USCOM®), 2) on subsequent TT performance and 3) to investigate any associated perceptual and affective responses in physically active healthy individuals. **Methods:** Thirteen physically active healthy males (age=20.9±1.4 years; weight=65.9±7.8 kg; height=173.3±4.8 cm) underwent two cycling trials separated by one week. Each trial consisted of a 20-min fatiguing preload cycling followed by 60-min of passive recovery whilst wearing either thigh-high sports CG or gymnastic pants (CON). A 5-min TT was subsequently conducted and power output and cadence were recorded. Cardiac output (CO) and stroke volume (SV) were measured using Doppler ultrasound (USCOM®); heart rate (HR), blood lactate (BLA), ratings of perceived exertion (RPE), leg muscle soreness (LMS), non-invasive blood pressure (MAP), and systemic vascular resistance (SVR) were monitored at 5, 15, 30, 45, 60 min during passive recovery. **Results:** CG exerted a lower body pressure of 28.6±9.4 mmHg in a semi-reclined position. During the subsequent 5-min TT, power output (215.2±24.0 vs. 210.8±21.5 W, CG vs. CON) and cadence (72.5±3.8 vs. 71.2±4.8 rpm, CG vs. CON) were significantly higher in CG than CON ($P<0.05$). SV was higher at 15, 30 and 45 min ($P<0.05$), CO was higher at 5 and 45 min ($P<0.05$), HR was lower at 15 and 30 min ($P<0.05$), BLA was lower at 5 and 15 min ($P<0.05$) during passive recovery with CG, and LMS was lower at all timepoints ($P<0.05$), compared to CON. **Conclusion:** Thigh-high sports CG improves subsequent TT performance by enhancing hemodynamic responses and attenuating perceived muscle soreness during passive recovery in physically active healthy males.

2373 Board #37 May 31 9:30 AM - 11:00 AM

Exercise Recovery with Cold and Thermoneutral Water Immersion and Performance in AthletesHana Marmura, Matthew Palmer. *St. Francis Xavier University, Antigonish, NS, Canada.*

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(No relevant relationships reported)

Cold water immersion (CWI) is commonly used to expedite recovery from strenuous exercise. However, it is unclear whether recovery with CWI confers any added performance or perceptual benefits during subsequent exercise vs. thermoneutral water immersion (TWI). **PURPOSE:** To investigate the potential for CWI and TWI in recovery from strenuous exercise to improve subsequent performance in athletes. **METHODS:** Ten varsity athletes (age 22 ± 2 yrs; height 177.9 ± 10.5 cm; weight 70.6 ± 9.6 kg; $\dot{V}O_{2max}$ 53.9 ± 6.8 ml/kg/min) performed pre-recovery (PRE) and post-recovery (POST) exercise protocols. The 20 min recovery period involved 10 min of either CWI (14.7 ± 0.3 °C), TWI (34.8 ± 0.8 °C) or room air control (CON) (28.7 ± 0.8 °C) in a randomized, crossover design. The exercise protocols required participants to cycle for 20 min at 57 ± 1% $\dot{V}O_{2max}$ (WARM) and immediately complete a 10 min work-based time trial (TT) at ~75% $\dot{V}O_{2max}$ in heat (30 ± 0.1 °C, 59 ± 0.3% r.h.). This was followed by performance tests of upper and lower body reaction time, maximal countermovement jump height (CMJ), maximum voluntary isometric contraction (MVIC) of the knee flexors, and questionnaires outlining mood states and belief score. Heart rate (HR) and ratings of perceived exertion (RPE) were recorded every 1 min during the TTs and in recovery. **RESULTS:** No differences between groups were observed for any PRE variable. Mean workloads were higher for every min of the POST TT in the CWI trial compared to TWI and CON trials. There was a trend for CWI to minimize the % change in mean TT workload vs. TWI and CON (-1.1 ± 1.9 vs. -4.6 ± 1.4 and -7.2 ± 2.3%, $p = 0.11$). Mean POST-WARM $\dot{V}O_{2max}$ did not differ between CWI, TWI or CON trials (2.2 ± 0.2, 2.2 ± 0.2 and 2.2 ± 0.1 L/min). However, mean POST-WARM HR was significantly lower in the CWI trial vs. TWI and CON trials (151 ± 3 vs. 159 ± 3 and 159 ± 4 bpm, $p < 0.05$). Mean increase in TT RPE was blunted in the CWI trial vs. TWI and CON trials (0 ± 1 vs. 1 ± 1 and 1 ± 1, $p < 0.05$). Belief score correlated with the change in TT workload in the CWI trial only ($R^2 = 0.35$, $p < 0.05$). No significant differences in CMJ or MVIC were observed between trials. **CONCLUSION:** Ten minutes of CWI in recovery from intense exercise in the heat reduced mean HR and RPE during a post-recovery exercise test, which may have contributed to the trend of a higher mean workload in the post-recovery TT vs. TWI or CON.

- 2374** Board #38 May 31 9:30 AM - 11:00 AM
Effect Of Electromagnetic Treated Water Combined With Infrared Radiation On Post-exercise Recovery Of Elite Gymnasts
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Gymnasts are required to complete a series of highly difficult routines that need excellent physical condition and plenty of training time, the post-exercise recovery is crucial. Electromagnetic Treated Water (ETW) is very small water molecule clusters caused by the electromagnetic field which can benefit human body in different ways. Infrared radiation (IR) is commonly used in the recovery period of training.

Purpose: The aim of the study is to assess the effect of ETW combined with IR on post-exercise recovery.

Methods: Twenty gymnasts from China men's national gymnastics team were randomized to the experimental group (EG, N=10) or the control group (CG, N=10). The CG continued with their daily training, the EG received 3-dimensional IR in a specific cabin for 30 minutes after training and drank no less than 1500 mL ETW per day for 12 weeks. Both groups followed the same training plan, diet and nutritional supplements. Blood parameters, including Routine Blood Test (RBT), Creatine Kinase (CK), Blood Urea Nitrogen (BUN), Dopamine (DA), Serotonin (5-HT) and Blood Lactate Acid (BLA), were detected before (t1), after (t2) and 1 hour later (t3) of training at D1, D42 and D84. In addition, Athlete Burnout Questionnaire (ABQ) and Pittsburgh Sleep Quality Index (PSQI) were collected.

Results: Comparing with CG, BLA(t3) and 5-HT(t3) was significantly decreased at D1 (0.73±0.26 vs. 1.21±0.34 mmol/L, 160.36±26.96 vs. 189.27±40.24 ng/mL, $p<0.01$, respectively), BUN(t1) was lower at D84 (4.22±0.98 vs. 5.88±1.07 mmol/L, $p<0.01$), as were Physical/Emotional Exhaustion (9.4±2.80 vs. 13.0±2.49, $p<0.01$) and Sport Devaluation (9.3±2.75 vs. 12.1±2.02, $p<0.05$). PSQI was significantly improved at D42 (5.0±1.33 vs. 6.9±2.38, $p<0.05$) and D84 (3.5±1.65 vs. 6.6±2.55, $p<0.01$). BLA(t3) were significantly decreased compared with BLA(t2) in EG at D1, D42, D84 (0.73±0.26 vs. 2.50±0.83, 2.40±1.26 vs. 8.21±5.09, 2.05±0.63 vs. 3.46±1.33 mmol/L, $p<0.01$, respectively).

Conclusion: The result of the present prospective study confirmed that ETW combined with IR can eliminate the BLA efficiently, reduce fatigue accumulation, improve sleep quality and decrease athlete burnout, that all can promote the post-exercise recovery.

- 2375** Board #39 May 31 9:30 AM - 11:00 AM
Impact of a Chronic Foam Rolling Protocol on Bunkie Test Scores
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 (No relevant relationships reported)

The role of fascial tissue relative to muscle function and performance has garnered increased interest in recent years. Foam rolling (FR) has become a very popular form of self-myofascial release; however, the impact of chronic FR on the fascia is not well established. **PURPOSE:** To examine the impact of a FR protocol on myofascial function assessed via the Bunkie test (BT). **METHODS:** Participants were randomly assigned to a control group (CG; n = 17) or foam rolling group (FRG; n = 17). FRG completed a 14-day FR protocol. CG subjects were instructed not to FR. Participants completed the BT at baseline and following the 14 days. The BT consists of 5 plank positions held bilaterally to assess myofascial function. Positions include the anterior power line (APL), lateral stabilizing line (LSL), posterior power line (PPL), posterior stabilizing line (PSL), and medial stabilizing line (MSL). Positions were held for as long as possible with proper form and the time recorded. **RESULTS:** Factorial MANOVAs with repeated measures were utilized to examine how BT Scores changed across time (pre/post), between side of body (left and right) and treatment group (FRG, CG). Two MANOVAs were performed, one for power (APL and PPL) and the other for stabilization (MSL, LSL, and PSL). A significant time by treatment interaction was found ($\lambda = .74$, $p < .01$, $\eta^2 = .26$) and a significant side effect was found ($\lambda = .81$, $p < .04$, $\eta^2 = .19$) for power. Univariate analyses for the time by treatment interaction revealed that the APL was significant ($F(1,32) = 7.14$, $p = .01$, $\eta^2 = .18$). No significant differences existed for FRG from pre to post test. The CG group had significantly higher scores at pretest (37.82 ± 3.62) than post test (30.95 ± 3.49). For the significant main effect of side, PPL was significant. The right side (22.15 ± 2.48) was significantly less than the left side (24.59 ± 2.53). For MSL, LSL, and PSL, no significant interactions or differences existed for group, time and side. **CONCLUSION:** The

14-day FR protocol did not have an influence on BT scores, possibly indicating chronic FR does not influence myofascial function. Given that the results do not appear to identify consistent trends, the efficacy of the BT to assess myofascial dysfunction should be explored further.

CONCLUSIONS:

- 2376** Board #40 May 31 9:30 AM - 11:00 AM
Recovery From Unaccustomed Strenuous Exercise In Young And Older Endurance-trained Adults
 Koichiro Hayashi¹, Miriam E. Leary², Stephen J. Roy², Jitanan Laosiripisan², Evan P. Pasha², Hirofumi Tanaka, FACSM². ¹Kokugakuin University, Yokohama, Japan. ²The University of Texas at Austin, Austin, TX. (Sponsor: Hirofumi Tanaka, FACSM)
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 (No relevant relationships reported)

There is a well-conceived notion that rate of recovery from strenuous exercise gets slower with advancing age. It is not clear whether older adults who exercise habitually and are apparently healthy demonstrate slower rates of recovery from unaccustomed eccentric exercise. **Purpose:** The aim of the present study was to determine if older adults who are physically active demonstrate slower rates of recovery from unaccustomed strenuous eccentric exercise compared with younger peers. **Methods:** A total of 39 apparently healthy men and women were studied; young sedentary (n=10, 28±2 years), young endurance-trained (n=15, 27±2 years), and older endurance-trained (n=14, 58±2 years) groups. Subjects performed 45 min (15 min x 3 times with 5 min resting periods) of downhill running (at -16% gradient) at a speed corresponding with 65% of their maximal oxygen consumption. Visual analog pain scale, isometric muscular strength, joint range of motion (ROM), and serum myoglobin concentration were measured at baseline as well as 24h, 48h, and 72h after the downhill running protocol. **Results:** Compared with baseline, pain scores of each muscle group were greater at 24h, 48h, and 72h in all 3 groups ($p<0.05$). Isometric muscular strengths decreased following downhill running ($p<0.05$), but the pattern of this response and recovery did not differ among the three groups. The ROM for hip extension decreased after downhill running ($p<0.05$), with the most pronounced decline seen in the young sedentary group. ROM gradually increased to baseline levels in all 3 groups. Serum myoglobin concentrations increased at 24h and returned to baseline values at 48h in both the young and older trained groups. **Conclusion:** The present findings are not consistent with the prevailing notion that older trained adults have a slower rate of recovery from strenuous exercise compared with young adults.

- 2377** Board #41 May 31 9:30 AM - 11:00 AM
Enhanced Recovery of Cycling Performance with High Compression Garment Wear
 Ewan R. Williams¹, James McKendry², Leigh Breen². ¹University of Georgia, Athens, GA. ²University of Birmingham, Birmingham, United Kingdom. (Sponsor: Dr Ellen Evans, FACSM)
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 (No relevant relationships reported)

PURPOSE: The use of compression garments during exercise to enhance performance has been endorsed by many athletes. The aim of this study was to determine if compression garments would improve consecutive-day exercise performance in a dose-dependent manner in young athletes.

METHODS: A single-blind crossover design with three experimental conditions [loose-fitting gym attire (CON), low compression (LOW-CG) and high compression (HIGH-CG)] was employed. Recreationally active male cyclists (n=10; 21±2 yo) underwent preliminary baseline testing for linear factor calculation followed by counter-balanced conditions using a multi-day cycle ergometer protocol [Day 1 = severe intensity sprint cycle protocol followed by 24-h of controlled rest and experimental condition (CON, LOW-CG or HIGH-CG); Day 2 = 8km time trial]. Prior to each exercise bout, subjective discomfort and muscle soreness were assessed via questionnaire and blood pressure was measured. During the sprint and time trial conditions a) power output (LEM software), oxygen uptake (metabolic cart; Vynut CPX) and heart rate (HR; Polar) were assessed continuously. Venopuncture blood samples were drawn pre-, at the end of exercise, and 15, 30 and 60 min post-exercise during rest to determine plasma lactate, creatine kinase (CK), and myoglobin using a Cobus 6000 e-modul. Data was analysed using repeated measures ANOVA.

RESULTS: Plasma lactate was lower at 30 and 60 min post-exercise on Day 1 in HIGH-CG compared with CON group (HIGH-CG: 8.4±2.5mmol; 3.8±1.4mmol vs. CON: 13.4±5.13, 6.5±2.6mmol, $p=.25$ and $p=.15$, respectively with no other significant interactions observed. Compared to Day 1, diastolic (CON: 1±10%; LOW-CG: 1±9%; HIGH-CG: -12±4%) and mean arterial pressure (CON: -4±5.1%; LOW-CG: -3±8.1%; HIGH-CG: -5.5±3.4%) decreased on Day 2 in HIGH-CG only ($p<0.05$). Time trial completion was decreased ($p<0.05$) during HIGH-CG (948±304s) compared

to both LOW-CG (988±319s) and CON (1010±364s). HR at 30s of exercise was lower in HIGH-CG compared to CON (120±11 vs. 132±16 bpm; $p<.038$). No differences occurred for oxygen uptake kinetics, CK, or subjective outcomes on Day 1 or 2.

CONCLUSIONS: These results suggests that degree of pressure influences the effectiveness of compression garments for both multi-day cycling and performance recovery in young males.

2378 Board #42 May 31 9:30 AM - 11:00 AM

Assessing the Impact of Passive Vs. Active Recovery on Broad Jump Performance in Collegiate Females

Madeline Phillips, Branden Ziebell, Moroni de Moors, Abraham Frech, Hannah Nelson, Russell Lowell, Anna Blackley, Andy Bosak. *Liberty University, Lynchburg, VA.* (Sponsor: Dr. James Schoffstall, FACSMT)

(No relevant relationships reported)

The broad jump test is widely utilized to assess an individual's horizontal power ability. Traditionally, the type of recovery between subsequent broad jumps is of the passive nature, yet prior studies utilizing other modes of power assessment have evaluated the impact of active recovery on power production. However, to the best of the researchers' knowledge no prior study has evaluated the impact of passive (PR) vs. active recovery (AR) on broad jump (BJ) performance. **PURPOSE:** To investigate the potential differences between an PR vs. AR on BJ performance in no less than averagely fit college-age females. **METHODS:** After having descriptive data (Ht. = 165.07 ± 5.56, Wt. = 62.68 ± 6.78, BF% = 23.99 ± 4.96, age = 21.08 ± 1.74) recorded, 24 averagely fit college-age females participated in an 8 min dynamic warm-up. Subjects were then given a four minute passive recovery period after the warm up and then completed four familiarization jumps (ie. trials). After another four minute passive recovery period, subjects completed two series of jumps (ie. four trials apiece) in a counterbalanced order with either an PR or AR between each jump. The AR period consisted of subjects completing stepping exercises for 60 seconds utilizing a 20cm step height, while PR had subjects stand still until their next jump. The PR and AR jump series were separated by a standardized four minutes passive recovery period. Excluding the first jump of each series, the farthest jump for PR vs. AR was compared using Paired-Samples t-Tests with significant differences occurring at $p \leq 0.05$. **RESULTS:** Significant differences ($p = 0.030$) occurred between PR (178.32 ± 21.17 cm) and AR (175.74 ± 18.73 cm) with 75% of the subjects benefiting from the PR vs. AR. **CONCLUSION:** The results suggest that PR may contribute to a further jumping distance vs. AR using no less than averagely fit college-age females. Future research may be required to assess the impact of an PR vs. AR on broad jump performance using no less than averagely fit college-age males. Additional research may need to occur in order to assess the specific type of activity that occurs between an active recovery period and its potential impact on broad jump performance.

2379 Board #43 May 31 9:30 AM - 11:00 AM

The Effects of Stretching on Blood Lactate Concentration after Anaerobic Exercise

Anna Blackley, Brianna Tummons, Kaitlyn Dombrowski, Bradee Davis. *Liberty University, Lynchburg, VA.* (Sponsor: Dr. James Schoffstall, FACSMT)

(No relevant relationships reported)

Blood lactate (BLA) concentration is believed to be one of the contributing factors of muscular fatigue and muscle soreness when lactate is converted into lactic acid. Because of these decrements associated with BLA accumulation during exercise, multiple methods to remove BLA have been investigated. However, the results on the effects of stretching remain inconclusive. Although BLA returns to resting levels within 30-60 minutes after exercise, the primary focus of this study was to further explore the effects of stretching on BLA recovery. **PURPOSE:** This study aimed to assess the benefits of stretching on BLA levels (mmol/L) after performing a maximal anaerobic exercise compared to sitting down after the same anaerobic maximal exercise. **METHODS:** After measuring descriptive data (age, ht., wt., age), 15 subjects (age 22 ± 1 years; ht. 1.76 ± 0.09 m; wt. 83 ± 15 kg) performed a Wingate Cycle Ergometer Test, on two separate occasions, followed by two different 10-minute protocols in counterbalanced order: sitting or (active and passive) stretching. BLA levels were measured before and after performing the Wingate test and then 10 minutes after the test. **RESULTS:** The difference in BLA levels before ($p = 0.815$) and after ($p = 0.212$) exercise were similar and showed no significant difference ($p < 0.05$). However, there was a statistically significant difference in BLA levels between the two post 10-minute protocols ($p = 0.002$). **CONCLUSIONS:** The current results indicate that stretching after a maximal bout of anaerobic exercise can be statistically significant in lowering BLA accumulation.

2380 Board #44 May 31 9:30 AM - 11:00 AM

Comparison of Perceived Exertion and Recovery Status Scores in Collegiate Male Soccer Players and Coaches

Michelle L. Eisenman, Emily L. Langford, Ronald L. Snarr, Greg A. Ryan. *Georgia Southern University, Statesboro, GA.* (No relevant relationships reported)

Perceived Recovery Status (PRS) and Rating of Perceived Exertion (RPE) are two subjective methods coaches, athletes, and sport scientists have used to quantify training load and recovery to improve athletic performance. While these values are important to monitor, these tools are more useful if there is an agreement between coaches and players. **PURPOSE:** To assess subjective measures (PRS and RPE scores) received from athletes and coaches during the course of a preseason. **METHODS:** PRS scores prior to, and RPE scores after, each of 18 preseason practices (Pr) were collected on 26 Division I male soccer players (P) and 3 coaches (C). Athletes provided scores away from other athletes and coaches. Coaches were instructed to provide answers to PRS and RPE as to how their athletes felt. Due to the categorical nature of the data, nonparametric Mann-Whitney U Tests were run comparing P to C data for each Pr. **RESULTS:** P and C RPE were not significantly different ($p > 0.05$) for 17 of the 18 practices. The only statistically significant difference occurred in Pr8 (median P: 8.0, C: 7.0; $p = 0.04$). PRS comparisons were slightly more variably different (4 of 18) through preseason training: Pr2 (P: 7.5, C: 9.0; $p = 0.02$); Pr5 (P: 7.0, C: 9.5; $p = 0.02$); Pr14 (P: 7.0, C: 5.0; $p = 0.01$) and Pr15 (P: 4.5, C: 1.5; $p = 0.04$). **CONCLUSION:** Results indicate that perception of intensity of practice and recovery were fairly similar throughout preseason. As preseason progressed, a shift in PRS from C overestimating P recovery, to underestimating recovery, especially following scrimmages occurred. This is an important consideration for coaching and training staffs in determining practice schedules for athletes during preseason training.

2381 Board #45 May 31 9:30 AM - 11:00 AM

A Comparison of Physical Activity Behaviors and Sleep in Female NCAA Division-I Athletes versus Controls

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(No relevant relationships reported)

Physical activity behaviors and sleep patterns influence health in the general population but have not been evaluated in collegiate student athletes. For these individuals the demands of academics and athletics alter these parameters but have not been fully characterized or compared to students who are not collegiate athletes. **Purpose:** This study compared physical activity (PA) behaviors and sleep patterns of female NCAA D I student-athletes (Athletes) to recreationally active female students (Controls). **Methods:** Across three consecutive semesters, subjects were recruited for one to three weeks of monitoring. Sleep was monitored with Actiwatchers. PA was monitored using ActivPals. Forty-five females were recruited from the University of Colorado, Boulder. Athletes were recruited from the Golf (n=6) and Tennis teams (n=8). Controls were recruited from the general student body (n=31). Subjects were instructed to wear devices at all times except during competitions. Travel days and days with less than 90% waking wear time were removed from analysis. Time spent in Sedentary (SED), Low Intensity (LIT) and Moderate-Vigorous Physical Activity (MVPA) are presented as percent of waking day. **Results:** Mean days recorded per individual was: Controls 15.1; golf 10.2; and tennis 15. Compared to Controls, Athletes had higher daily step counts (12,040 ± 6498 vs 8,992 ± 5240, $p<.01$), less SED (63.5±15.0 vs 71.4±13.3, $p<.05$), higher LIT (26.4 ± 12.9 vs 21±10.8, $p<.05$) and higher MVPA (9.7 ± 3 vs 7.6 ± 3.3, $p<.01$). For both groups, weekends had higher LIT (+3.0%, $p<.01$), decreased MVPA (-.75%, $p<.05$), and a trend toward decreased SED (-2.3%, $p=.0563$) compared to weekdays. There were no differences in PA between Golf and Tennis. Sleep was not significantly different in Athletes versus Controls, including duration of sleep (07:04 ± 00:49 vs 7:32 ± 00:42, $p=.6$) and sleep midpoint. Yet, midpoint was significantly later on weekends vs. weekdays in both groups (04:35 ± 01:01 vs 04:03 ± 00:55, $p<.01$). **Conclusion:** Female Athletes had higher physical activity demands than Controls. Yet both groups, on average, slept only slightly more than the American Academy of Sleep Medicine recommended 7-hours. This may negatively impact overall health. Research is needed on how these sleep and activity behaviors influence academic and athletic outcomes.

2382 Board #46 May 31 9:30 AM - 11:00 AM

Influence of Whole-Body Vibration and Air Compression on Lactate RemovalParker B. Marson¹, William Armstrong², Megan T. Rose¹.¹Western Oregon University, Monmouth, OR. ²Western Oregon University, Tualatin, OR.

(No relevant relationships reported)

PURPOSE: The purpose of the present study was to examine potential benefits and outcomes of whole body vibration (WBV) and air-compression boot as a recovery modality from lactate-producing exercise. Previous study had demonstrated potential benefits for these modalities on lactate removal in D-II Collegiate cross-country runners. **METHOD:** Ten recreationally-active participants (6 M; 4 F; mean age = 24 ± 5 y) participated in three lactate-producing protocols (two 30-s Wingate anaerobic (WAnT) tests separated by 2-min rest) followed by 5 minutes of either WBV (at 40 Hz), air compression boot, or rest. Participants were subjected to ≤ 3 finger pricks [pre-WAnT (Pre), post-WAnT (Post-0), and post-modality (Post-Mod)] to draw a drop of blood to be analyzed for blood lactate concentration ([La]). Consent was obtained and all participants were informed that participation in the research was voluntary. WAnT measures (peak-power output, PPO; relative peak power, RPP; anaerobic fatigue, FI) were computed. Statistical analyses (t-tests and ANOVA) were performed using R Studio (www.rstudio.com) at the significance level of $\alpha < 0.05$. **RESULTS:** The work was sufficient to elevate [La] and there were no significant differences between WAnTs (PPO, RPP, FI; $p > 0.05$). [La] was significantly greater from Pre to Post-0 ($p < 0.001$). While there were no statistically significant effects for modalities, the compression boot appeared to have a slight advantage over WBV and rest. Rates of [La] removal were: compression boot (mean = 0.360 ± 0.325 mmol/min), the WBV (mean = 0.320 ± 0.525 mmol/min), and seated rest (mean = 0.167 ± 0.370). **CONCLUSION:** These data suggest that the compression boot and WBV modalities are worthy of further study and consideration as effective means of increasing the rate of [La] clearance post-training and post-competition.

2383 Board #47 May 31 9:30 AM - 11:00 AM

The Acute Effects of Yoga on Physiological and Psychological Measures of Stress in College Students

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(No relevant relationships reported)

College students commonly report high levels of stress due to academic pressures and social challenges. Subsequently, the use of yoga as a form of stress-relief has become increasingly popular among college students. **PURPOSE:** to determine the acute effects of yoga on physiological and psychological measures of stress in college students. **METHODS:** Participants ($n=20$, 16 female) were initially assessed for baseline proxy measures of psychological and physiological stress. Psychological stress was assessed via the Positive and Negative Affect Schedule (PANAS) Questionnaire. Physiological stress was assessed by outfitting each subject with a five-lead EKG Holter monitor to measure heart rate variability (HRV). HRV was determined as the time interval between R-R waves (ms). Once baseline levels of stress were recorded, participants then completed a 20 min video of a Vinyasa Flow Sun Salutation yoga practice, while supervised by a certified yoga instructor. After the conclusion of the yoga session, participants' post-baseline stress levels were re-assessed via PANAS and HRV. **RESULTS:** There was a statistically significant increase in positive affect scores from pre (26.7 ± 8.79) to post (31.0 ± 8.47), $p = 0.004$. The mean increase in positive affect scores (4.30 ± 5.9) indicated a moderate effect size, $d = 0.73$. There was a statistically significant decrease in negative affect scores from pre (15.95 ± 4.74) to post (11.35 ± 4.21), $p < 0.001$. The mean decrease in negative affect scores (4.6 ± 3.76) indicated a large effect size, $d = 1.22$. —There was a statistically significant increase in HRV scores from pre (665.5 ± 104.36 ms) to post (924.3 ± 122.98 ms), $p < 0.001$. The mean increase in HRV score (258.8 ± 102.32 ms) indicated a large effect size, $d = 2.52$. **CONCLUSIONS:** The results of this study indicated that a 20 min yoga practice resulted in a significant improvement in positive affect scores (16%), a significant decrease in negative affect scores (29%), and a significant improvement in HRV (39%), all indicative of a reduction in psychological and physiological measures of stress levels.

2384 Board #48 May 31 9:30 AM - 11:00 AM

Effects of Moderate versus Variable High Intensity Cycling on Metabolic Responses During Recovery.

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PURPOSE: Examine oxygen consumption (VO₂), energy expenditure and respiratory exchange ratio (RER) during recovery following moderate-intensity exercise (MIE) and variable high-intensity exercise (VIE) in healthy adults ($n=5$; age = 20.2 ± 5.7 yrs). **METHODS:** Two experimental conditions (MIE and VIE) were randomized and performed on separate days in the fasted state. Both conditions commenced with a 15-min seated rest, followed by the assigned exercise. MIE consisted of continuous moderate-intensity exercise at 40% of WRmax. VIE consisted of sixteen 10-sec supramaximal sprints (120% WRmax), sixteen 20-sec high intensity bouts (60% WRmax) and low-intensity recovery (20% WRmax) interspersed throughout the exercise. Total duration and total work were matched between conditions. Following exercise, there was 75 minutes of seated recovery. Resting VO₂ was averaged over the final 10 min of rest. VO₂ and respiratory exchange ratio (RER) were recorded during exercise and every 15-minutes of recovery. NetVO₂ was calculated as the VO₂ above resting VO₂. Energy expenditure (EE) and fat oxidation rate (FatOx) were calculated. VO₂ and RER responses between conditions were compared using a 2-way repeated measure ANOVAs and EE and FatOx between conditions were compared using paired t-tests. Significance was established if $p < 0.05$. **RESULTS:** During recovery, net VO₂ decreased in both conditions from exercise (VIE = 1184.2 ± 247.0 ml·min⁻¹; MIE = 1005.8 ± 222.1 ml·min⁻¹) to 75 minutes (VIE = 40.3 ml·min⁻¹ ± 23.6 ; MIE = 16.1 ± 10.2 ml·min⁻¹). There were no differences in net VO₂ between conditions during recovery. Net EE during recovery from VIE and MIE were 10.8 ± 6.7 kcals and 5.5 ± 3.9 kcals, respectively ($p = 0.13$). During VIE and MIE, RER was 1.02 ± 0.4 and 0.96 ± 0.06 , respectively ($P = 0.06$). During recovery, RER was lower in VIE compared to MIE at 30 (0.81 ± 0.07 vs. 0.89 ± 0.07) and 45 minutes (0.85 ± 0.11 vs. 0.95 ± 0.09) but was similar at 15 and 60 minutes. At the end of recovery, RER for VIE and MIE were 0.89 ± 0.08 and 0.95 ± 0.09 , respectively ($p = 0.08$). FatOx at the end of recovery was significantly greater in VIE (0.05 ± 0.04 g·min⁻¹) than MIE (0.01 ± 0.03 g·min⁻¹). **CONCLUSION:** Although, NetVO₂ and EE were similar during recovery, VIE appears to alter fuel utilization patterns during recovery towards a lower RER and greater fat oxidation.

2385 Board #49 May 31 9:30 AM - 11:00 AM

Subconcussive Impacts in Youth Players and Their Possible Impairment in Cognitive FunctionsLuis R. Lopez-Roman¹, Yarimar I. Diaz-Rodriguez².¹Universidad del Sagrado Corazon, San Juan, PR. ²Universidad Maimónides, Buenos Aires, Argentina.

(No relevant relationships reported)

In United States at least 2.5 million children under 14 years old play soccer (1 million under 10 years; 1.5 million between 10 and 14 years old). At his age they receive at least one subconcussive impact when heading the ball at different game situations. Subconcussive impacts are impacts to the head or body that cannot be diagnosed as a concussion on clinical grounds or with neuroimaging studies (MRI, CT-Scan or PET Scan). A subconcussive impact may alter cognitive functions such rapid processing without any recognizable trace. Processing speed is the ability to perform automatic thinking tasks while maintaining focused attention especially when pressured. Processing speed is related to phonetic recognition, hearing comprehension and interpretation, rapid naming, respond to environment changes and knowledge application. Accelerometers can measure the magnitude of a blow to the head live in the field. The ImPACT Pediatric® is a neurocognitive test that provide pre and post information of cognitive changes. **PURPOSE:** To identify the relationship between subconcussive impact magnitude (G) and rapid processing score difference after at least one blow to the head in youth soccer players. **METHODS:** A group of 15 youth male soccer athletes between 9 to 11 years old (9.9 ± 0.6 years) wear a head accelerometer in a specialize headband. Each participant was encouraged to perform normally in the game. Descriptive statistics was used to assess subconcussive impacts. T-test was used for the neurocognitive pre and post-test to assess differences in rapid processing. **RESULTS:** Range of acceleration was from 16 g to 60g (Ave = 23.8 ± 9.1 g). T-Test showed differences in rapid processing for males ($p = 0.01$). However, although there is a significant difference between the pre-test and the post-test, there is no relationship between the difference in values between the pre- and post-tests of rapid processing and the magnitude of the impact received ($r = 0.04$). **CONCLUSION:** These results suggest that males that play soccer and receive a subconcussive impact can reflect significantly changes in rapid processing. However, the magnitude of the impact does not appear to be the obvious factor in creating greater differences or major changes in rapid processing.

2386 Board #50 May 31 9:30 AM - 11:00 AM**Active and Passive Recovery Following High Volume Resistance Training: Markers of Molecular Gene Expression**

Carlton D. Fox¹, Christopher G. Vann¹, Cody T. Haun², Shelby C. Osburn¹, Matthew A. Romero¹, Paul A. Roberson¹, Petey W. Mumford¹, Jordan R. Moon³, Kaelin C. Young⁴, Michael D. Roberts¹. ¹Auburn University, Auburn, AL. ²Lagrange College, LaGrange, GA. ³Impedimed, Lexington, KY. ⁴Edward Via College of Osteopathic Medicine - Auburn Campus, Auburn, AL. (No relevant relationships reported)

Purpose: Deloading is a common practice in the strength and conditioning community; however, there is a lack of data analyzing the effects of deloading on genes associated with muscle growth. **Methods:** Resistance-trained, college-aged males, (n=30; training age 5±3 yrs) completed 6 weeks of high-volume resistance training, after which the participants were split into active and passive recovery groups, with the deload period lasting 7 days. A muscle biopsy was obtained from the vastus lateralis prior to week one (PRE), after week 6 (POST), and after a week of either passive (PS) or active (AC) deloading (DL). Biopsy samples were used to evaluate messenger ribonucleic acid (mRNA) expression via real-time polymerase chain reaction (PCR) of the following markers: Atrogin-1, Muscle RING Finger Protein-1 (MURF-1), Mechano Growth Factor (MGF), Myosin Heavy Chain Ia (MHC-1), Myosin Heavy Chain IIa (MHC-IIa), Myosin Heavy Chain IIx (MHC IIx) and Myostatin. **Results:** MHC IIa exhibited a significant group ($p = 0.029$) and time effect ($p < 0.001$), and a GxT interaction was also observed ($p = 0.048$). The expression of MHC IIa was significantly higher in AC at POST and DL compared to PS. A significant time effect was observed in MURF-1, MGF, MHC I, MHC IIa, MHC IIx, and Myostatin expression ($p < 0.05$). Atrogin-1 exhibited no significant effect of time or group. **Conclusion:** Active recovery during a deloading period after the completion of a high-volume resistance training phase may increase the mRNA expression of MHC IIa, but further research into the protein expression of the MHC IIa isoform is necessary to better understand relationships between deloading, gene, and protein expression.

E-31 Free Communication/Poster - Cellular/Molecular

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2387 Board #51 May 31 9:30 AM - 11:00 AM**Post-Natal Moderate Exercise Reduces the Harms of Protein Deprivation on the Cardiac Oxidative Stress Biomarkers**

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Purpose: A maternal diet low in protein results in morphologic and functional damage to the offspring's hearts. Moderate exercise, on the other hand, is thought to improve heart metabolism and function, improving the overall health in adulthood. Thereby, we speculate that moderate exercise performed during early post-natal development could ameliorate the cardiac damage resulted from a perinatal protein deprivation. **Methods:** We used a rat model of protein restriction during gestation and lactation to assess the effect of moderate post-lactation physical exercise on oxidative stress parameters in the heart. Pregnant rats were divided into two groups: normoprotein (NP) receiving 17% casein in the diet, and low-protein (LP), receiving 8% casein. At 30 days of age, the male offspring born to each group were further subdivided into control (NP and LP) and exercised (ENP and ELP) groups. At 55 days of age, the rats were sacrificed and blood and heart were collected for biochemical analysis. The data were analyzed using the ANOVA two-way followed by the Tukey's multiple comparisons test. **Results:** We observed significant increases in the lipid (NP: 33.27 ± 5.01 vs. LP: 67.13 ± 5.68 μ M/mg prot; $p < 0.0001$) and protein oxidation (NP: 3.01 ± 0.48 vs. LP: 6.32 ± 0.26 μ M/mg prot; $p < 0.0001$) with concomitant reduction in the enzymatic anti-oxidant systems, superoxide dismutase (NP: 11.51 ± 0.03 vs. 9.46 ± 0.48 U/mg protein; $p < 0.01$), and catalase (NP: 9.53 ± 0.34 vs. LP: 7.79 ± 0.36 U/mg prot; $p < 0.01$) in the un-exercised rats on LP group. Application of moderate exercise to this group, however, resulted in significant > 2-fold reductions in both lipid (LP: 67.13 ± 5.68 vs. ELP: $26.5 \pm$

1.6 μ M/mg prot; $p < 0.0001$), and protein oxidation (LP: 6.32 ± 0.26 vs. ELP: 1.65 ± 0.19 μ M/mg prot; $p < 0.0001$) that correlated with an increase in non-enzymatic antioxidant defense (LP: 11.12 ± 1.13 vs. ELP: 28.19 ± 5.14 Redox status; $p < 0.001$), and a significant decrease in serum triglycerides (LP: 202.58 ± 19.25 vs. ELP: 122.11 ± 11.57 mg/dL; $p < 0.05$). **Conclusions:** We suggest that cardiac damage occurring in children born to mothers lacking protein during early childhood development could be ameliorated to an extent with moderate physical exercise designed to improve cardiac oxidative balance.

2388 Board #52 May 31 9:30 AM - 11:00 AM**Circulating Angiogenic Cell and Microparticle Response to Prolonged Sitting**

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Prolonged sitting increases the risk for cardiovascular disease. However, markers of vascular repair and damage such as circulating angiogenic cell (CAC) populations and microparticles (MP) have not been characterized with prolonged sitting or sitting with intermittent activity. **PURPOSE:** To examine the effects of 3h of sitting with or without calf raises on CD34⁺, CD62E⁺, and CD31⁺/42b⁺ MP populations which are linked to endothelial activation, apoptosis and CAC paracrine activity, respectively, and CD14/31⁺, CD3/31⁺, and CD34⁺ CACs which are linked to endothelial repair. **METHODS:** After familiarization, sedentary subjects (n=18) sat still for 180 minutes (control condition) or sat for 180 minutes but performed 10 calf raises every 10 minutes (experimental condition) in a random order. Blood samples were obtained at baseline and at 180 minutes for analyses. CACs and MPs were isolated and analyzed using multicolor fluorescent flow cytometry. Data were analyzed with repeated measures ANOVA and are presented as mean \pm standard error. **RESULTS:** There was a main effect of sitting to decrease CD34⁺ MPs (119 ± 8 vs. 106 ± 7 events/ μ L, $p < 0.01$) and CD62E⁺ MPs (53 ± 6 vs. 34 ± 4 events/ μ L, $p < 0.001$) regardless of condition. There were no significant differences in CD31⁺/42b⁺ MPs (50 ± 7 vs. 38 ± 12 events/ μ L), CD14/31⁺ cell frequency (85 ± 3 vs. 87 ± 2 % of parent), CD34⁺ cell frequency (704 ± 169 vs. 560 ± 122 per 500,000 events) or CD3/31⁺ cell frequency (52 ± 3 vs. 50 ± 2 % of parent) after sitting or between conditions. **CONCLUSION:** Contrary to our hypothesis, a three-hour bout of sitting with or without calf raises was not sufficient to affect CAC numbers. Furthermore, sitting decreased MP markers linked to endothelial activation and CAC paracrine activity, and calf raises did not ameliorate these changes. Future studies assessing longer durations of sitting with a more potent stimulus (e.g., intermittent walking) should be done to further understand the effects of sitting on the CAC and MP response.

2389 Board #53 May 31 9:30 AM - 11:00 AM**Differences in CD31+ Circulating Angiogenic Cell Subtypes Between Endurance Trained and Sedentary Younger Adults**

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Circulating angiogenic cells expressing the CD31 surface marker promote neoangiogenesis and vascular repair. Additional surface markers present on CD31⁺ cells may dictate the physiological function of these cells and their ability to contribute to vascular repair. **PURPOSE:** To determine if regular endurance exercise influences the composition of CD31⁺ cells by comparing total CD31⁺ number and subtypes in endurance trained and sedentary younger adults. **METHODS:** Fasted blood was obtained from healthy endurance exercise trained (n=12) and sedentary men (n=11) 18-39 years old. Peripheral blood mononuclear cells were isolated, FcR blocked and immunostained with antibodies specific to CD31-BB515, CD14-PECy5, CD11b-Pacific Blue, CD3-APC and CD34-Alexa Fluor700 and fixed in paraformaldehyde. The forward-side-scatter plot was used to identify the lymphocyte and monocyte gates from a total of 100,000 events/sample using a LSR II flow cytometer. Total CD31⁺ cells and the number of events with positive co-expression of CD31 and CD14, CD3, CD11b, or CD34 surface markers were quantified. **RESULTS:** No significant differences between groups were observed in total CD31⁺ number in both mono-lymphocytic (P=0.09) and lymphocytic (P= 0.1) populations. Within the mono-lymphocytic population, CD31⁺/CD3⁺ cells were 52% higher in the endurance trained compared to the sedentary individuals (P= 0.04). No differences between groups were

observed in the CD31+/CD14+ (P=0.3), CD31+/CD11b+ (P=0.5) or CD31+/CD34+ (P=0.17) subtypes. In the lymphocytic population, 48% more CD31+/CD34+ cells were observed in the endurance trained compared to the sedentary group (P=0.03). CD31+/CD34+ cell number was 60% higher in the endurance trained group compared to the sedentary group (P=0.06) and a trend was also observed for higher CD31+/CD14+ cells in the endurance trained compared to the sedentary group (88% higher, P=0.07). No differences in CD31+/CD11b+ were observed between groups (P=0.7). **CONCLUSION:** Despite no significant differences in total CD31+ cell number, a higher proportion of CD31+ cells from endurance trained men were found to have pro-angiogenic markers compared to sedentary men which may improve their functional capacity and angiogenic potential. Supported by NIH T32-HL007698 and the Baltimore VA GRECC

2390 Board #54 May 31 9:30 AM - 11:00 AM

Differential Cardiovascular and Mitochondrial Adaptations in Humanized P53 R72P Knock-In Mice

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(No relevant relationships reported)

We previously demonstrated that tumor suppressor p53 plays a crucial role in mitochondrial biogenesis and mtDNA quality control by transcriptional regulation of mitochondrial transcription factor A (TFAM) gene. Human P53 gene contains a common polymorphism at codon 72 (p53R72P), which has been shown to be associated with mitochondrial integrity and their function. **PURPOSE:** Here, we investigate whether p53Arg72Pro is associated with exercise response with respect to cardiovascular and mitochondrial functions using humanized p53 knock-in mouse model. **METHODS:** Humanized P53 Knock-In mice (HUPKI) containing either the human version of P53R72 or P53P72 genes were randomly assigned to sedentary or a 9-week voluntary wheel running exercise (VW) group. Angiotensin II (1 mg/kg/day) was infused for 4 weeks before mice were euthanized. Maximal aerobic capacity was measured by a motorized treadmill running test. Blood pressure was measured using a radio-telemetry apparatus. Muscle mtDNA copy number was measured by qPCR. Muscle capillary density was measured by immunostaining. **RESULTS:** Aerobic exercise capacity was similar between R72 HUPKI vs P72 HUPKI in sedentary group. However, R72 HUPKI showed greater aerobic exercise capacity compared to P72 HUPKI mice in VW group compared to the R72 HUPKI (R72, 2584.2±536.0 vs. P72, 2015.3±359.4, sec, p=0.004). In the skeletal muscle, mtDNA content (P72, 0.98±0.28 vs. R72, 1.49±0.18, p=0.007) and capillary density (R72, 4.2±0.3 vs P72, 3.4±0.4, p=0.006) were significantly higher in R72 HUPKI compared to P72 HUPKI in VW group (p<0.05). In addition, R72 HUPKI showed significantly greater reduction in blood pressure after VW compared to P72 HUPKI (MAP, R72: 114.9±9.5 vs. P72: 128.5±17.9, mmHg, p=0.006). **CONCLUSION:** Data suggest that p53 codon 72 arginine allele may have a greater cardiovascular and mitochondrial adaptations to aerobic exercise training. Supported by NIH Grant R01 HL126952

2391 Board #55 May 31 9:30 AM - 11:00 AM

Origin of Extracellular Vesicles Released During Exercise

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Physical activity triggers a wide range of multi-systemic adaptations that promote mental and physical health. Adaptation requires a massive cellular cross-talk between organs and extracellular vesicles (EVs) have been proposed as contributors to exercise-associated adaptive systemic signaling. Recent work demonstrated that exercise triggers the release of EVs into the circulation, but the subtype and the origin of EVs remained unknown.

PURPOSE: To apply detailed EV-phenotyping analysis exploring the cellular origin and subtypes of EVs released by exercise.

METHODS: 21 healthy male participants were subjected to an incremental cycling test until exhaustion and blood was drawn before, at a respiratory exchange ratio of 0.9 (RER 0.9), and immediately after the test. Different EV-subtypes were isolated from plasma by immunobead-based purification separately directed against the three EV-associated tetraspanins (CD9, CD63, CD81) and by size exclusion chromatography.

Analysis of EV-count was done by nano-particle tracking analysis followed by EV-subtype surface analysis by western-blotting and by multiplexed flow cytometry analysis.

RESULTS: Average load at RER 0.9 was 206 Watt and maximal load was 330 Watt. Markers found with significant fold-change increases were highly congruent between CD9⁻, CD63⁻ and CD81⁺EVs suggesting that the contributing cells release EVs containing all three tetraspanins. Strongest exercise related increases were obtained for CD81⁺EVs for platelet specific markers CD41b 2-fold; CD42a 2.2-fold, CD62P 2.9-fold, lymphocyte markers CD4 9.6-fold, CD8 1.8-fold, MHC-I 2.9-fold, markers specifying antigen-presenting cells MHCII 3.4-fold, CD40 2.9-fold, and endothelial markers CD31 2.5-fold, CD105 4.3-fold, CD146 3.3-fold. Overall, markers exhibited a trend to increase at RER 0.9 - probably indicating the onset of EV-release - with the endothelial marker CD105 on CD81⁺EVs as the only significantly 1.4-fold (95% CI: 1.1-1.9; p<0.05) elevated candidate following only 15min of aerobic exercise.

CONCLUSIONS: EVs released during exercise originate from a diverse group of cell types that are in direct contact with the blood stream and may preferentially contribute to signaling mechanisms affecting angiogenesis, coagulation, adaptive immunity and tissue repair.

2392 Board #56 May 31 9:30 AM - 11:00 AM

Ablating The Rab-GTPase Activating Protein TBC1D1 Predisposes Rats To High Fat Diet-Induced Cardiomyopathy

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(No relevant relationships reported)

While the pathogenesis of diabetic cardiomyopathy is poorly understood, impaired insulin signalling within the heart is thought to contribute to the development of this pathology. TBC1D1, a Rab-GTPase activating protein, is involved in glucose homeostasis and substrate metabolism within skeletal muscle, however, the function of TBC1D1 within the heart is relatively unknown.

PURPOSE: To examine the role of TBC1D1 in overall cardiac morphology and substrate utilization using a rat knock-out (KO) model.

METHODS: 7 weeks of high-fat feeding was provided as a metabolic perturbation to further elucidate the interaction between TBC1D1 and diet-induced cardiac contractile function. Experiments were conducted at 12 weeks of age, with the exception of cardiomyocyte isolation, which was conducted at 7 weeks of age. Animals were anaesthetized with 2.5% isoflurane before assessments of cardiac function, or surgical removal of the left ventricle. The left ventricle was immediately utilized for bioenergetics assessments, fixed for histology or immediately frozen in liquid nitrogen for Western blotting.

RESULTS: In chow-fed animals, TBC1D1 ablation increased plasma membrane GLUT4 content and glucose uptake, as well as plasma membrane FABPpm content and palmitate oxidation, consistent with activating cellular trafficking through the ablation of TBC1D1. While echocardiograms suggested indices of cardiac function were unaltered in chow fed KO animals, when challenged with a 7 week high-fat diet, TBC1D1 KO rats displayed a 4-fold increase in fibrosis in association with attenuated stroke volume, cardiac output and end diastolic volume, suggesting a predisposition to diet-induced cardiomyopathy. Mitochondrial respiratory capacity and substrate sensitivity to pyruvate and ADP were not altered by diet or TBC1D1 ablation, nor were rates of mitochondrial hydrogen peroxide emission, or markers of oxidative stress.

CONCLUSIONS: Altogether, ablation of TBC1D1 improves indices of cardiovascular function in rats fed a standard diet, but increases fibrosis and compromises indices of cardiac function in rats consuming a high-fat diet. Therefore, TBC1D1 may exert cardioprotective effects in the development of diabetic cardiomyopathy. This research is supported by NSERC funding.

E-32 Free Communication/Poster - Respiratory

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2393 Board #57 May 31 9:30 AM - 11:00 AM

The "Syringe Potentiometer": A Low-cost Solution For Accurate and Precise Calibration Of Pneumotachographs

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Pneumotachographs typically display highly nonlinear "pressure-flow" behavior. As such, a constant calibration factor (K) is inadequate for these devices, and a nonlinear K curve is preferred. Two methods have been described to produce nonlinear K curves for pneumotachographs: the weighted averaging method described by Yeh *et al.* (*J Appl Physiol*, 53: p280, 1982); and the polynomial approach forwarded by Tang *et al.* (*J Appl Physiol*, 95: p571, 2003). These methods, however, do not incorporate measurements of a flow "reference" and, subsequently, a direct measure of their flow accuracy and precision has not yet been provided.

PURPOSE: To modify a standard 3-L calibration syringe to provide a valid reference flow signal.

METHODS: A standard 3-L syringe was modified to incorporate a 3D-printed linear-slide mechanism affixed to the plunger. A string potentiometer was attached to a fixation point on the linear-slide-plunger assembly which provided a voltage signal in proportion to the plunger length and, consequently, volume. The first derivative of this signal provided a "reference" flow. Nonlinear K curves were obtained via the weighted averaging (WA) and polynomial (POLY) approaches, and from dividing the "reference" flow by the analog signal from the pneumotachograph (REF). The flow accuracy (average error) and precision (standard deviation of errors) of each method were compared over low ($<1 \text{ L}\cdot\text{s}^{-1}$), medium ($\geq 1\text{-}3.0 \text{ L}\cdot\text{s}^{-1}$), high ($\geq 3.0\text{-}6.0 \text{ L}\cdot\text{s}^{-1}$) and very high ($\geq 6.0\text{-}16.0 \text{ L}\cdot\text{s}^{-1}$) flow rates. Over 180 strokes were recorded from the syringe.

RESULTS: The accuracy of the WA, POLY, and REF methods displayed high accuracy ($<\pm 25 \text{ ml}\cdot\text{s}^{-1}$) over the low, medium and high flow ranges. However, the WA and POLY methods yielded modest underestimates of flow ($75\text{-}100 \text{ ml}\cdot\text{s}^{-1}$) in the very high flow range, while the REF method remained within $\pm 25 \text{ ml}\cdot\text{s}^{-1}$. The precision of each method was $<25 \text{ ml}\cdot\text{s}^{-1}$ for low to high flow rates. At very high flows, the REF method displayed the best precision ($60 \text{ ml}\cdot\text{s}^{-1}$) compared with the POLY ($80 \text{ ml}\cdot\text{s}^{-1}$) and WA ($>120 \text{ ml}\cdot\text{s}^{-1}$) methods.

CONCLUSIONS: While all 3 calibration methods displayed comparable performance up to $6.0 \text{ L}\cdot\text{s}^{-1}$, the "syringe potentiometer" and, by extension, the REF method provided the best accuracy/precision at very high flow rates (i.e., $\geq 6.0\text{-}16.0 \text{ L}\cdot\text{s}^{-1}$).

2394 Board #58 May 31 9:30 AM - 11:00 AM
Inspiratory Muscle Strength And Diaphragm Thickness In Elderly Women

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(No relevant relationships reported)

Pulmonary function and inspiratory muscle strength decrease with advancing age. In healthy young subjects, it has been reported that there is a positive correlation between maximal inspiratory pressure (P_{imax}) as an index of inspiratory muscle strength and diaphragm thickness (T_{di}), which is assessed by ultrasonography. Therefore, we hypothesized that T_{di} in elderly subjects would be thinner than in young subjects, accompanied by a reduction of P_{imax}. **PURPOSE:** The aim of this study was to characterize the inspiratory muscle strength and diaphragm thickness in elderly women. **METHODS:** Nine healthy elderly females (67.6 \pm 1.2 yrs) and fourteen young females (18.9 \pm 0.3 yrs) volunteered for this study. Pulmonary function (vital capacity, forced vital capacity and maximal voluntary ventilation) and P_{imax} were determined using computerized spirometry system with a hand-held mouth pressure meter. T_{di} was monitored at functional residual capacity (FRC) and total lung capacity (TLC) by B-mode ultrasound: the probe was held between the 7th, 8th, or 9th intercostal spaces on the right side. **RESULTS:** Pulmonary function and P_{imax} were significantly lower in the elderly than those in young individuals. There were no significant differences in T_{di} at FRC (elderly women: 2.8 \pm 0.3 mm, young women: 2.5 \pm 0.1 mm) and TLC (elderly women: 4.9 \pm 0.2 mm, young women: 4.5 \pm 0.2 mm) between the two groups. Additionally, no significant correlation was found between P_{imax} and T_{di}.

CONCLUSIONS: These results suggest that inspiratory muscle strength in women reduces with advancing age, which is not accompanied by a decrease in diaphragm thickness.

2395 Board #59 May 31 9:30 AM - 11:00 AM
Utility of Exhaled Breath Condensate for Determination of Airway Inflammation After Eucapnic Voluntary Hyperventilation

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PURPOSE: Previous research indicates the importance of cysteinyl leukotrienes (cyst-LTs) in the pathogenesis of exercise-induced bronchoconstriction (EIB) and asthma. As a result of airway hyperresponsiveness, mast cells, airway epithelial cells, and other inflammatory cells produce cyst-LTs which leads to airway inflammation and subsequent bronchoconstriction. Urine analysis of cyst-LTs is a common noninvasive technique but has poor repeatability among studies. Exhaled breath condensate (EBC) has been suggested as an alternative, more reliable measurement of cyst-LTs. Therefore, the aim of this study was to determine if EBC is an accurate method for detecting changes in cyst-LT production following a eucapnic voluntary hyperventilation (EVH) challenge. **METHODS:** Twenty-two subjects [age (mean \pm SD) = 20.1 \pm 2 yr; 6 men, 16 women] with physician diagnosed asthma (mild- to moderate-) and established EIB participated in this study. All subjects experienced a $>10\%$ drop in FEV₁ following an EVH challenge. Subjects then completed baseline pulmonary function tests at rest followed by 10 mins of baseline EBC collection. Subjects then performed an EVH challenge and pulmonary function was administered at 5, 10, 15, and 20min post-EVH. EBC was collected from 0-10 mins post-EVH and urine samples were collected pre- and 60 min post-EVH challenge. **RESULTS:** The concentration of cyst-LTs in EBC increased significantly ($p<0.01$) post-EVH challenge, resulting in a 97% increase from baseline. In addition, urinary cyst-LT concentrations were significantly different pre- and post-EVH challenge ($p=0.04$) increasing 21% from baseline. A significant correlation was found between EBC and urine concentrations of cyst-LTs both pre- and post-EVH. However, no significant correlation ($p>0.05$) was discovered between the change in cyst-LT concentration pre- to post-EBC and urine. **CONCLUSIONS:** The present study suggests that EBC is a sensitive, non-invasive method for assessing changes in cyst-LTs and the inflammation status of the airways following an EVH challenge.

2396 Board #60 May 31 11:00 AM - 12:30 PM
Influence of Ultraendurance Event Distance on Lung Health

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Ultraendurance events induce prolonged physiological stress that can cause perturbations in heart and lung function due to the elevated workloads. Variations in race distance and environmental conditions alter the length of time this stress is experienced, which when long enough, can also result in sleep deprivation. Beyond spirometry, whether the duration of this stress affects the degree of change in lung health remains somewhat unknown. **Purpose:** To evaluate the effects of moderate altitude (course range: 1000-2800m) ultraendurance trail running and the influence of distance on pulmonary function, lung mechanics and respiratory muscle strength. **Methods:** Spirometry, force oscillation and maximal inspiratory and expiratory pressures (MIP/MEP) assessments were performed 24-72hrs prior and 1-3hrs post-completion of either a 100km (CCC; $n=9$, 2 females, age= 43 \pm 12, finishing time= 21 \pm 4h) or 171.5km (UTMB; $n=9$, 2 females, age= 40 \pm 8y, finishing time= 38 \pm 9h) trail running race. **Results:** Pulmonary function was significantly reduced from baseline after both CCC and UTMB, but the magnitude of decline was not different between races (CCC vs. UTMB: $\Delta\text{FVC} = -158\pm 331$ vs. $-257\pm 463 \text{ mL}$; $\Delta\text{FEV}_1 = -245\pm 240$ vs. $-302\pm 398 \text{ mL}$; $\Delta\text{PEF} = -981\pm 976$ vs. -803 L/min ; $\Delta\text{FEF}_{25-75} = -493\pm 1140$ vs. $-484\pm 669 \text{ mL/s}$; $\Delta\text{VC} = -204\pm 478$ vs. $-500\pm 910 \text{ mL}$, $p<0.05$ different from zero for all, $p>0.05$ CCC vs. UTMB respectively for all). Efficiency of ventilation (reactance= X_{rs}) decreased at all frequencies (5-11-19Hz), whereas as obstruction (resistance= R_{rs}) in

the peripheral lung (5Hz) increased following both the CCC and UTMB ($\Delta Xrs5insp = -0.14 \pm 0.33$ vs. $-0.43 \pm 0.38 \text{ mL O}_2/\text{L/s}$; $\Delta Rrs5insp = 0.23 \pm 0.53$ vs. $0.78 \pm 1.32 \text{ mL O}_2/\text{L/s}$). Neither MIP nor MEP was reduced relative to baseline following CCC and UTMB.

Conclusions: Participation in an ultraendurance trail race resulted in acute reductions in lung function and lung mechanics without a reduction in respiratory muscle strength. Further, these changes in lung health were not aggravated by a longer race distance and stress duration.

2397 Board #61 May 31 9:30 AM - 11:00 AM

Muscular Strength, Exercise Capacity and Body Composition of Alpha-1 Antitrypsin Deficient COPD Patients

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(No relevant relationships reported)

PURPOSE: Alpha-1 antitrypsin deficiency (AATD) is the most common genetic disorder affecting people of European descent. The condition often results in the development of emphysema, leading to chronic obstructive pulmonary disease (COPD) in the third/fourth decade of life. Breathlessness, resultant deconditioning and exercise intolerance are often the most troublesome symptoms reported by patients with COPD and are linked to poor quality of life (QoL). Typically, patients with AATD COPD are assessed by pulmonary function test (PFT). However, exercise capacity (EC) cannot be reliably predicted from PFTs. Deconditioning is associated with reduced EC and QoL. The current study examines differences in PFTs, body composition, muscular strength, EC and QoL between AATD COPD patients (ZZ) and alpha-1 antitrypsin replete COPD patients (MM). **METHODS:** 29 ZZ patients, (m/f 20/9, age 60 ± 7 yr, FEV1/FVC: 0.47 ± 0.12 , FEV1%pred. 51 ± 22 , DLCO%pred. 73 ± 21) were recruited from the National Centre of Expertise for AATD in Beaumont Hospital, Ireland. Patients performed spirometry and diffusing capacity for carbon monoxide (DLCO) was assessed. Body mass index (BMI) and waist:hip (W:H) ratio were calculated. QoL and symptom perception were examined using the SF-36 questionnaire (SF-36) and St. George's Respiratory Questionnaire (SGRQ), respectively. EC was assessed via 6 minute walk test (6MWT), upper body strength via handgrip dynamometer (HG) and lower body strength via 30 sec sit to stand test (30STS). 9 MM patients (m/f 2/7, age 65 ± 5 yr, FEV1/FVC: 0.47 ± 0.15 , FEV1%pred. 58 ± 29 , DLCO%pred. 72 ± 17) completed the same protocol. Continuous data are presented as mean \pm SD. Mean group differences were compared using an independent t-test. **RESULTS:** There was a significant group difference for handgrip strength (ZZ 38 ± 10 vs MM 29 ± 7 p=0.009) and SGRQ scores for Symptoms (ZZ 41.2 ± 20.9 vs MM 60.0 ± 13.8 p=0.023), Impacts (ZZ 24.4 ± 17.4 vs MM 43.2 ± 20.8 p=0.014), and Total (ZZ 35.6 ± 18.2 vs MM 54.5 ± 14.5 p=0.011). SF-36 Vitality score was higher in ZZ than MM (58.2 ± 21.5 vs 40.5 ± 19.6 p=0.035). **CONCLUSIONS:** For the same level of COPD and similar body composition, fitness and upper body strength, ZZ patients present with significantly lower SGRQ scores and significantly higher SF-36 scores than MM patients.

2398 Board #62 May 31 9:30 AM - 11:00 AM

Observations of Late-Onset Exercise Oscillatory Ventilation

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(No relevant relationships reported)

Exercise oscillatory ventilation (EOV) is characterized by regular waxing and waning of ventilation without apnea during exercise. In patients with heart failure (HF) development of EOV is a robust predictor of mortality. EOV is typically reported during the early stages of exercise and dissipates during the later stages of exercise. We have recently identified a cohort of diagnostically diverse patients that present EOV during the late stages of exercise. This late-onset pattern is contradictory to the common pattern of EOV, thus we termed it late-onset EOV.

Purpose: To retrospectively analyze clinical characteristics, demographics and breathing patterns of patients who presented with late-onset EOV.

Methods: The medical records of eleven patients (6M/5F, 53 ± 19 yrs, BMI: $29 \pm 12 \text{ kg/m}^2$) demonstrating late-onset EOV during clinically indicated cardiopulmonary exercise testing were retrospectively analyzed. The amplitude of cycles were calculated as peak \dot{V}_E minus nadir \dot{V}_E during each cycle. The period of each cycle was calculated measuring the time from nadir to nadir. \dot{V}_E/VCO_2 slope was calculated as $(\dot{V}_{E_{\text{peak}}} - \dot{V}_{E_{\text{rest}}})/(\text{VCO}_{2_{\text{peak}}} - \text{VCO}_{2_{\text{rest}}})$. Late-onset EOV was defined as ≥ 3 amplitudes of $\geq 25\%$ of the average \dot{V}_E for 3 consecutive cycles with the EOV originating $\geq 50\%$ \dot{V}_{O_2} peak.

Results: Diagnoses included heart failure (n=6), diabetes (n=4), exercise induced arrhythmia (n=7), hypertension (n=4) and hyperlipidemia (n=4) and medications included beta-blockers (n=7), aspirin (n=6), diuretics (n=5) and statins (n=5); however, no diagnosis or medication were common across all patients. The \dot{V}_{O_2} peak was

$20 \pm 7 \text{ mL/kg/min}$ ($72 \pm 28\%$ predicted \dot{V}_{O_2} peak). None of the patients demonstrated oscillatory ventilation at rest, while all of the patients exhibited EOV at $>50\%$ \dot{V}_{O_2} peak (amplitude of mean $\dot{V}_E = 44.7\%$, period=40.4s). \dot{V}_E/VCO_2 slope had a positive correlation with EOV amplitude ($r=0.74$, $p=0.01$). The % predicted \dot{V}_{O_2} peak had a negative relationship with EOV period ($r=-0.64$, $p=0.04$).

Conclusion: Our data demonstrate, in a diverse patient population, that the onset of EOV can occur during late stages of exercise and is related to metrics of exercise intolerance. No clear diagnosis or medication was common among these patients. Additional research is required to elucidate the mechanisms contributing to late-onset EOV.

2399 Board #63 May 31 9:30 AM - 11:00 AM

Limitations to $\dot{V}_{O_{2\text{MAX}}}$ In Competitive Swimmers

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(No relevant relationships reported)

PURPOSE: Literature containing $\dot{V}_{O_{2\text{MAX}}}$ values for competitive swimmers is sparse and has generally reported modest values for competitive swimmers when compared with other endurance athletes. The purpose of this investigation was 1) to pool the findings of previous research to provide a reference value for the $\dot{V}_{O_{2\text{MAX}}}$ of competitive swimmers and 2) to examine primary data to suggest a basis for the modest values reported to date.

METHODS: Values obtained from the literature from swimmers age 17 years or older described as "trained," "highly-trained," "collegiate," "national-level," "international-level," or "elite," and completing incremental, open-flow, indirect calorimetry swimming protocols were included in the analysis. A mean and 95% CI were calculated for each sex using a random-effects model. Additionally, in our laboratory, swimming $\dot{V}_{O_{2\text{MAX}}}$ data were collected on national- and international-level women and men swimmers in a swimming flume using a continuous, incremental weight-loading protocol at a constant speed. These data were compared to $\dot{V}_{O_{2\text{MAX}}}$ data from national-level runners (7 men) who completed an incremental grade increase treadmill protocol in our lab.

RESULTS: Eight articles utilizing swimming protocols ($k=9$, $n=70$ women; $k=13$, $n=121$ men) were analyzed. The relative $\dot{V}_{O_{2\text{MAX}}}$ ($\text{mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$; mean \pm 95% CI) was 50.2 ± 1.3 for women and 54.9 ± 0.5 for men. Our $\dot{V}_{O_{2\text{MAX}}}$ data (4 women; 10 men) agree with the literature values (mean \pm SD; 51.0 ± 5.0 women; 53.6 ± 4.7 men). There was a strong ($r=0.75$) and significant ($p=0.01$) correlation between breathing frequency (f_b ; breaths $\cdot \text{min}^{-1}$) at max and relative $\dot{V}_{O_{2\text{MAX}}}$ in the men swimmers that was not evident in the running cohort ($r=-0.41$; $p=0.34$). Relative $\dot{V}_{O_{2\text{MAX}}}$ minute ventilation ($\dot{V}_{E_{\text{BTPS}}}$; $\text{L} \cdot \text{min}^{-1}$), and f_b at max were significantly different ($p < 0.01$; $p < 0.01$; $p=0.01$) between men swimmers ($\dot{V}_{E_{\text{BTPS}}} = 135.7 \pm 16.1$; $f_b = 47.1 \pm 9.1$) and runners ($\dot{V}_{O_{2\text{MAX}}} = 73.9 \pm 3.5$; $\dot{V}_{E_{\text{BTPS}}} = 169.7 \pm 16.6$; $f_b = 58.6 \pm 7.6$).

CONCLUSIONS: The relationship between f_b and $\dot{V}_{O_{2\text{MAX}}}$ in swimmers suggests that $\dot{V}_{O_{2\text{MAX}}}$ for competitive swimmers could be compromised at least in part by f_b and presumably \dot{V}_E by extension. The absence of this same relationship in runners suggests that this could be due to constraints specific to swimming, such as phase-locked breathing.

2400 Board #64 May 31 9:30 AM - 11:00 AM

The Effects of Cold Water and Cold Sports Drink Consumption on Resting Lung Function

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(No relevant relationships reported)

Resting pulmonary function (PFT) is known to have important effects on ventilation, gas exchange and breathing mechanics during and after exercise. Previous research has shown that consumption of 1L of cold water affects resting lung function, but no other beverages have been examined. Because athletes frequently consume cold water or sports drink, it is important to understand the effects of these beverages on pulmonary function. **PURPOSE:** Therefore, the purpose of this study was to determine whether cold water or cold sports drink would decrease resting PFTs in healthy individuals.

METHODS: Nine healthy (6 men, 3 women), individuals (age 22 ± 1 yrs) visited the laboratory on two separate occasions to complete an experimental trial consisting of either 1L of cold water (-4°C) or 1L cold sports drink (-4°C). PFTs were performed before and at 5, 10, and 15 min after beverage ingestion. Data were analysed using paired t-tests.

RESULTS: The cold water significantly reduced forced vital capacity (FVC) from pre- to post- ingestion by 3.7% ($4.96 \pm 1.17 \text{ L}$ to $4.78 \pm 1.12 \text{ L}$) ($p=0.002$). Similarly, the cold sports drink significantly reduced FVC from pre- to post-ingestion by 3.7% ($5.09 \pm 1.17 \text{ L}$ to $4.93 \pm 1.24 \text{ L}$) ($p=0.02$). Maximum drop in FVC was not significantly different between water and sports drink ($p=0.99$). Forced expiratory volume in 1 second (FEV₁) significantly decreased by 3.5% from pre- to post- water ingestion

(4.35 ± 1.05 L/min to 4.22 ± 0.96 L/min) ($p = 0.04$). Sports drink also significantly decreased FEV₁ by 5.0% from pre- to post ingestion (4.34 ± 1.09 L/min to 4.16 ± 1.08 L/min) ($p = 0.015$). There was no significant difference in maximum drop FEV₁ from pre- to post-ingestion between water and sports drink ($p = 0.29$). **CONCLUSIONS:** The ingestion of cold water and cold sports drink decreased pulmonary function in healthy individuals, but changes in PFTs were not different between the two beverages. This suggests that cold fluid intake can influence PFT measurement and could be an important consideration for individuals planning fluid intake strategies pre-, during, and post-exercise.

2401 Board #65 May 31 9:30 AM - 11:00 AM
Peripheral Chemosensitivity To Hypoxia And Hypercapnia Is Not Attenuated In Symptomatic Concussed Athletes

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(No relevant relationships reported)

Central chemosensitivity to hypercapnia is attenuated in symptomatic concussed athletes (CA) compared to healthy controls (HC). Activation of the peripheral chemoreceptors is needed to elicit the full ventilatory response to hypercapnia. However, it is unknown if peripheral chemosensitivity (PCS) is attenuated in CA. **Purpose:** We tested the hypothesis that PCS is lower in symptomatic CA versus HC. **Methods:** PCS to hypoxia (PCS_{O₂}) and hypercapnia (PCS_{CO₂}) were assessed in 7 symptomatic CA (4 females, age: 20 ± 2 y) and 10 HC (3 females, age: 23 ± 2 y). CA were tested within 5 ± 2 days of injury. Ventilation (V_E), heart rate (HR), mean arterial pressure (MAP), arterial oxygen saturation (%S_{O₂}), and the partial pressure of end tidal CO₂ (PETCO₂) were recorded continuously. For PCS_{O₂}, participants inhaled 2-6 breaths of 100% N₂, followed by 3 min of room air breathing, 10 separate times. For PCS_{CO₂}, participants inhaled 1 breath of 13% CO₂, 21% O₂, and 66% N₂, followed by 3 min of room air breathing, 10 separate times. We determined the mean of the three highest consecutive V_E values, the peak HR and MAP, the nadir %S_{O₂}, and the peak PETCO₂ within 2 min following each hypoxic or hypercapnic administration. The PCS_{O₂} and PCS_{CO₂} data are reported as the slope of the linear regression line of V_E vs. %S_{O₂} or PETCO₂, respectively. The peak HR and MAP responses following hypoxia were also plotted against the nadir %S_{O₂} and the slope of the resulting linear regression lines represented the cardiovascular responses (PCS_{HR} and PCS_{MAP}, respectively) to hypoxia mediated by the PCS. **Results:** Baseline HR (59 ± 14 vs. 66 ± 7 bpm; $P = 0.10$), MAP (97 ± 15 vs. 89 ± 10 mmHg; $P = 0.09$), DBP (74 ± 13 vs. 69 ± 4 mmHg; $P = 0.16$), PETCO₂ (44 ± 2 vs. 45 ± 2 mmHg; $P = 0.11$), and %SpO₂ (98 ± 3 vs. 97 ± 1 %; $P = 0.27$) did not differ between CA and HC, respectively. Baseline SBP was higher in CA (129 ± 19 vs. 117 ± 8 mmHg; $P = 0.05$). There were no differences in PCS_{O₂} (0.40 ± 0.21 vs. 0.38 ± 0.36 L/min/%S_{O₂}; $P = 0.45$), PCS_{MAP} (0.58 ± 0.38 vs. 0.67 ± 0.52 mmHg/%S_{O₂}; $P = 0.35$), PCS_{HR} (0.88 ± 0.73 vs. 1.34 ± 1.53 bpm/%S_{O₂}; $P = 0.24$), or PCS_{CO₂} (0.07 ± 0.11 vs. 0.07 ± 0.04 L/min/mmHg; $P = 0.44$) between CA and HC, respectively. **Conclusions:** These data indicate that PCS is not lower in symptomatic CA vs. HC. It is unlikely that the peripheral chemoreceptors contribute to the reduced ventilatory response to hypercapnia in CA.

2402 Board #66 May 31 9:30 AM - 11:00 AM
Do Faster Ultra-endurance Runners Have A Pulmonary Phenotype?

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 (No relevant relationships reported)

Purpose: The cardiopulmonary system of ultramarathon runners is exposed to prolonged periods of increased cardiac output and ventilation during exercise, which can stress the alveolar-capillary membrane. In order to determine if an adaptive pulmonary phenotype exists in ultramarathon runners, we tested the hypothesis that individuals who can sustain a faster race pace have superior pulmonary function and lung diffusing capacity. **Methods:** Twenty-seven runners were assessed prior to a 100km ultramarathon at two different races (Hong Kong 100, N=19, CCC, N=8). Forced vital capacity (FVC) and forced expiratory volume in 1s (FEV₁) were assessed via spirometry. Lung diffusing capacity for carbon monoxide (DLCO) and nitric oxide (DLNO) were measured using a single-breath technique at rest and during 3 stages of low level exercise. The DLNO/DLCO was calculated to assess the relative contribution of membrane conductance to capillary blood volume. The cohort was split into a faster group with an average finish time under 15 hours and a slower group with an average finish time above 21 hours to compare differences in pulmonary function. **Results:** Baseline FVC and FEV₁ were not different in the faster runners (FVC= 5.2 ± 0.5 L;

FEV₁= 4.2 ± 0.5 L) compared to the slower runners (FVC= 5.2 ± 1.1 L; FEV₁= 4.1 ± 0.8 L), and did not differ from normative values, with overall percent predicted FVC and FEV₁ at 105% and 92%, respectively. DLCO and DLNO did not differ between groups (fast, DLCO= 33.2 ± 6.0 mmHg, DLNO= 160.2 ± 26.0 mmHg; slow, DLCO= 30.2 ± 5.5 mmHg, DLNO= 155.2 ± 27.6 mmHg), however the ratio of DLNO/DLCO was lower in the faster group at rest (4.9 vs. 5.2 , $p = 0.018$) and during exercise (stage3: 4.9 ± 0.2 vs. 5.3 ± 0.4 , $p < 0.01$). **Conclusions:** Resting lung function was not enhanced in faster runners, however the altered DLNO/DLCO ratio with light exercise suggests a greater relative contribution of capillary blood volume to membrane conductance might be associated with ultraendurance performance.

E-33 Free Communication/Poster - Translational Research

Friday, May 31, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

2403 Board #67 May 31 9:30 AM - 11:00 AM
The Effects of Single versus Multiple Sets of Leg Presses on Myocardial Energy Expenditure

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(No relevant relationships reported)

A popular trend in exercise regimes is to maximize the amount of work done in a minimum amount of time or maximize work by minimizing rest intervals. It is hoped that reduced rest time will result in dramatic fitness gains. To date, however, no differences in total energy expenditures have been found between high and low rest interval protocols. Unfortunately, total energy expenditures do reflect the metabolic strain experienced by the cardiac tissue. Rather, the rate pressure product [RPP = Systolic blood pressure \times heart rate/1,000] has been recommended as a good index to assess cardiovascular metabolic stress, and to help determine the intensity and duration of exercise in developing fitness. **PURPOSE:** To determine if cardiac energy expenditure (i.e. RPP) differs between high rest (multiple sets) and low rest (single set) exercise protocols. **METHODS:** 14 untrained college students (5 male, 9 female; Age: 21.1 ± 0.2 years) participated in the study. Exercise intervention consisted of 2 days of multiple sets (4 sets, 10 reps @ 150% body weight, 3 min intersets rest) and 2 days of single set (40 reps @ 150% body weight) leg presses, randomly assigned in a balanced crossover order. At least 2 days separated each session and all sets were completed as fast as possible. HR and SBP were obtained on the right arm with an automated blood pressure machine at both pre-exercise and immediate post set completion. A paired T-test was used to compare the difference between the average final post set RPP of two trials of each exercise type. **RESULTS:** Multiple sets RPP (13.7 ± 0.8) was significantly less ($t = 6.5 \times 10^{-5}$, $p < 0.05$) than the single set RPP (17.5 ± 0.8). **CONCLUSION:** Contrary to total body energy expenditure research, a single set of exercise exerts more metabolic stress on the cardiovascular system than doing the same work with several rest intervals. Thus, single set of exercise could be used to train when attempting to train cardiac tissue, but multiple sets of exercise is recommended for people with compromised cardiovascular systems.

2404 Board #68 May 31 9:30 AM - 11:00 AM
Associations between Time Spent in Sedentary Behaviors and Cardiometabolic Disease Risk Factors in Young Adults

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(No relevant relationships reported)

Research suggests that sedentary behavior is associated with cardiometabolic disease (CMD) risk factors but much of this research has relied on self-report measures of sedentary time. **PURPOSE:** To determine the associations between sedentary time and CMD risk factors in young adults. **METHODS:** Undergraduate students ($n = 95$; age 20.4 ± 1.3 y; BMI 23.9 ± 2.9 kg.m⁻²) wore an accelerometer during waking hours for 7 consecutive days to measure sedentary time (< 150 counts/min) and moderate-to-vigorous physical activity (MVPA, $\geq 2,690$ counts/min). Body composition, waist circumference, blood pressure (BP), and fasting glucose, triglycerides, high-density lipoprotein (HDL), and low-density lipoprotein (LDL) were measured and lipid accumulation product (LAP) was calculated. Multiple regression analyses were used to assess associations among variables, while controlling for sex, race/ethnicity, smoking, family history of diabetes, study time, and MVPA. Analysis of covariance was used to compare CMD risk factors across tertiles of sedentary time. **RESULTS:** On average,

students spent 8.4 ± 1.5 h·d⁻¹ in sedentary behaviors. Sedentary time was associated with diastolic BP ($R^2=0.22$, $\beta=0.35$, $p=0.001$), fat mass ($R^2=0.39$, $\beta=0.22$, $p=0.02$), triglycerides ($R^2=0.11$, $\beta=0.24$, $p=0.04$), waist circumference ($R^2=0.15$, $\beta=0.23$, $p=0.04$), and LAP ($R^2=0.17$, $\beta=0.30$, $p=0.008$) independent of all covariates. There were no associations between sedentary time and systolic BP, glucose, HDL, or LDL ($p \geq 0.05$). Waist circumference was different across tertiles of sedentary time (tertile 1: 79.8 ± 14.3 cm vs. tertile 3: 85.2 ± 14.5 cm, $p=0.02$). Further, diastolic BP ($p=0.007$), LDL ($p=0.002$), fat mass ($p=0.04$) and LAP ($p=0.01$) were significantly different across tertiles of sedentary time with less favorable outcomes as sedentary time increased. **CONCLUSIONS:** Our findings suggest that sedentary time is independently associated with markers of CMD in young adults. Further, those who engage in 8 hours or more of sedentary behavior per day have significantly less favorable outcomes across a range of CMD risk factors. These findings support the need to develop public health recommendations regarding minimizing sedentary behaviors, particularly in young adults. Supported by CTR-IN Clinical Translational Research Infrastructure Network

2405 Board #69 May 31 9:30 AM - 11:00 AM
Translationally Designed HIIT Protocol Improves Peak VO₂ In A Preclinical HCM Model Without Adverse Events

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 (No relevant relationships reported)

Exercise training improves cardiorespiratory capacity (peak or pVO_2) in healthy and cardiac disease states. High Intensity Interval Training (HIIT) is a prominent strategy in cardiac rehab do to superior pVO_2 improvements. Reduced pVO_2 in patients w/hypertrophic cardiomyopathy (HCM) powerfully predicts adverse outcomes, including mortality and heart transplant. Participation in vigorous exercise, however, is controversial in HCM patients given concerns of sudden cardiac death even though recent data suggests risks are much lower than previously thought. **PURPOSE:** Evaluate the effects of HIIT on pVO_2 in a preclinical transgenic cardiac troponin T delta160E (TG) HCM mouse model. **METHODS:** C57Bl/6 non-transgenic (NTG) ($n=6$ F, $n=5$ M) and TG ($n=4$ F, $n=8$ M) mice (13-16mos) underwent a translationally parallel cardiac rehab HIIT protocol. One treadmill training bout included 4-4min high intensity intervals (~85% pVO_2) interspersed by 5-3min recovery intervals (~50% pVO_2) for 31 total mins. Bouts were repeated 3 times/wk for 10wks. Compliance was measured as % of total training time completed. Randomized pre and post pVO_2 (metabolic treadmill testing) and body composition (NMR) were measured by a blinded technician. Unpaired and paired t-tests were used for data analysis. **RESULTS:** Training compliance b/w TG and NTG did not differ (921.90 ± 4.24 , 99.13% vs 928.95 ± 1.05 , 99.90% ; $p=0.14$). Pre and post HIIT pVO_2 were significantly lower in TG mice than NTG (pre: 102.36 mL/kg/min ± 2.04 vs. 119.20 mL/kg/min ± 5.57 , $p<0.01$; post: 120.89 mL/kg/min ± 4.19 vs 140.03 mL/kg/min ± 4.18 , $p<0.01$). Paired analysis detected a significant increase in pVO_2 following HIIT training in both TG and NTG groups ($p<0.01$). TG mice had significantly greater pre and post % lean mass (pre: $69.96\% \pm 1.11$ vs $66.46\% \pm 1.09$, $p<0.05$; post: $70.73\% \pm 0.56$ vs $68.47\% \pm 0.79$, $p<0.05$), and significantly less pre and post % fat mass (pre: $11.89\% \pm 1.12$ vs $15.22\% \pm 1.08$, $p<0.05$; post: $11.74\% \pm 0.52$ vs $13.86\% \pm 0.76$, $p<0.05$). Post-HIIT 24hr ambulatory activity did not differ b/w groups (TG: 334.5 beam crosses ± 33.3 vs. NTG: 534.8 beam crosses ± 101.8 , $p=0.070$). **CONCLUSION:** HIIT training increased pVO_2 in a HCM mouse model without adverse consequences, providing the rationale to explore exercise as a positive disease modifier in HCM patients.

E-34 Free Communication/Poster - Vascular Function

Friday, May 31, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

2406 Board #70 May 31 11:00 AM - 12:30 PM
High Blood Flow Restriction Pressure is Necessary to Induce Vascular Adaptations with Very Low-Load Training

Kevin T. Mattocks¹, J Grant Mouser², Matthew B. Jessee³, Scott J. Dankel⁴, Samuel L. Buckner⁵, Zachary W. Bell⁴, Takashi Abe⁴, John P. Bentley⁴, Jeremy P. Loenneke⁴. ¹Lindenwood University - Belleville, Belleville, IL. ²Troy University, Troy, AL. ³University of Southern Mississippi, Hattiesburg, MS. ⁴University of Mississippi, University, MS. ⁵University of South Florida, Tampa, FL.
 (No relevant relationships reported)

Vascular conductance is increased to a similar extent following low load (30% of one repetition maximum (1RM)) resistance training with and without blood flow restriction (BFR). It is unclear, however, if very low force (<30% 1RM) contractions require BFR to produce this effect. It is also relatively unknown if or how the venous system changes following chronic BFR as this type of training causes blood to dam up in the veins during BFR.

Purpose: To examine the vascular responses to lifting a very low-load (15% 1RM) with and without different pressures (40 and 80% arterial occlusion pressure) and how it compares to high load (70% 1RM) training in the lower body.

Methods: Forty non-resistance trained individuals performed two of four conditions (one in each leg): 1) 15% 1RM, no BFR (15/0), 2) 15% 1RM, 40% arterial occlusion pressure (15/40), 3) 15% 1RM, 80% arterial occlusion pressure (15/80), and 4) 70% 1RM, no BFR (70/0). Participants performed 4 sets of unilateral knee extension to failure (up to 90 repetitions) with 30 (15% 1RM) or 90 (70% 1RM) seconds of rest between sets, twice a week for 8 weeks. Before and after the training protocol, vascular conductance and venous compliance were measured. Data displayed as mean change (95% CI).

Results: There was a significant time by condition interaction for vascular conductance ($p=0.04$). Conditions 15/80 [7.9 (3.4 , 12.3) flow $\cdot 10^2$ mmHg] and 70/0 [7.2 (2.7 , 11.7) flow $\cdot 10^2$ mmHg] increased vascular conductance while conditions 15/0 [-1.2 (-5.7 , 3.3) flow $\cdot 10^2$ mmHg] and 15/40 [-0.864 (-5.6 , 3.9) flow $\cdot 10^2$ mmHg] did not change. There was no interaction ($p=0.335$), nor were there main effects of condition ($p=0.684$) or time [0.001 (-0.001 , 0.004) mL/100 mL/mmHg, $p=0.204$] for venous compliance.

Conclusion: A high BFR pressure (80% arterial occlusion pressure) combined with a very low-load produces similar vascular responses to that of high load resistance training. It may be that lifting a load of 15% 1RM without BFR and that the application of a moderate pressure (40% arterial occlusion pressure) does not disrupt blood flow enough to impact vascular conductance. These results add to the hypothesis that a higher restriction pressure is necessary to induce certain peripheral adaptations when utilizing a load less than 30% 1RM.

2407 Board #71 May 31 11:00 AM - 12:30 PM
High Pressure Blood Flow Restriction Is Necessary For Peripheral Vascular Adaptations With Very Low Loads

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Low-load resistance exercise combined with blood flow restriction (BFR) has the ability to increase muscle mass following periods of training. Peripheral vascular adaptations to this type of exercise have been examined at loads commonly used [30% of one-repetition maximum (1RM)]. Vascular adaptations occur through flow-induced shear stress, mechanical compression due to muscular contraction, and circumferential strain induced by pressure waves. Loads lower than 30% 1RM (i.e. 15% 1RM) may not induce enough mechanical stress to stimulate adaptation, and higher BFR pressures may be required. **Purpose:** To examine the peripheral vascular response to eight weeks of training using very low loads combined with differing BFR pressures in the upper body. **Methods:** Forearm blood flow (FBF), vascular conductance (FVC), and venous compliance (FC_v) were measured using strain-gauge plethysmography before and following eight weeks of 2x/week resistance training of the elbow flexors

using 15% 1RM combined with either no BFR [15/0], 40% of arterial occlusion pressure (AOP) [15/40], or 80% of AOP [15/80], and were compared to high load resistance exercise at 70% 1RM [70/0] in 20 men and 20 women. Results reported as Mean (SE). **RESULTS:** FBF exhibited a condition x time interaction ($P=.043$). The training response to 15/80 and 70/0 were greater ($+0.520$ (0.22), $+0.616$ (0.22) $\text{ml}\cdot\text{min}^{-1}\cdot 100\text{ml}^{-1}$, respectively) than 15/0 and 15/40 ($+0.077$ (0.22), -0.137 (0.21) $\text{ml}\cdot\text{min}^{-1}\cdot 100\text{ml}^{-1}$, respectively). A similar interaction existed for FVC ($P=.032$), with 15/80 and 70/0 showing a greater response ($+8.286$ (2.66), $+8.595$ (2.6) $\text{ml}\cdot\text{mmHg}^{-1}$, respectively) than did 15/0 and 15/40 ($+1.813$ (2.66), -0.413 (2.6) $\text{ml}\cdot\text{mmHg}^{-1}$, respectively). FC_v displayed only a main effect of time ($P=.044$), increasing 0.003 (0.002) $\% \cdot \text{mmHg}^{-1}$. **CONCLUSIONS:** At very low loads (15% 1RM), FBF and FVC were increased only in the high pressure group in a manner not different from high load, lending support to the conclusion that circumferential strain on arterioles can lead to vascular adaptation. The lack of difference in the FC_v response implies that even very low loads affect compliance. Future research should examine the possibility of capillarization occurring following repeated exposure to high pressure BFR.

2408 Board #72 May 31 11:00 AM - 12:30 PM
Effects of Jump Rope Exercise on Adiposity & Vascular Function in Prehypertensive Adolescent Girls

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Childhood obesity is strongly associated with cardiovascular disease (CVD) development. It is necessary to combat unfavorable outcomes of obesity at a young age by utilizing effective interventions, such as exercise. **PURPOSE:** To examine the effects of a jump rope exercise program on CVD risk factors, including body composition, vasoactive substances, inflammation, and vascular function in prehypertensive adolescent girls. **METHODS:** Forty girls (age 14-16) were recruited and randomly assigned to a jump rope exercise group (EX, $n=20$) or control group (CON, $n=20$). Body composition, nitrate and nitrite levels, endothelin-1 (ET-1), c-reactive protein (CRP), systolic blood pressure and diastolic blood pressure (SBP, DBP), and arterial stiffness were measured before and after 12 weeks. **RESULTS:** There were significant group by time interactions following the 12-week program for body composition (from 33.8 ± 3.6 to $30.2\pm 3.1\%$), central adiposity (from 86.4 ± 4 to 83.3 ± 5 cm), SBP (from 126 ± 3.3 to 120 ± 2.1 mmHg), and brachial-to-ankle pulse wave velocity (from 8.2 ± 1.0 to 7.4 ± 0.2 m/s). Nitrate/nitrite levels increased (from 54.5 ± 5.1 to 57.2 ± 5.2 μmol) along a reduction in CRP levels (from 0.5 ± 0.4 to 0.2 ± 0.1 mg/L). There were no significant changes in ET-1 ($P=.022$). **CONCLUSIONS:** These findings indicate that jump rope exercise may be an effective intervention to improve these CVD risk factors in prehypertensive adolescent girls. Jumping rope is an easily accessible exercise modality that may have important health implications for CVD prevention in younger populations.

2409 Board #73 May 31 11:00 AM - 12:30 PM
Muscle Blood Flow is not Dependent upon Conduit Artery Diameter following Prior Vasodilation

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At the onset of exercise in humans, muscle blood flow increases to a new steady-state that closely matches the metabolic demand of the exercise. This increase has been attributed to the skeletal muscle pump and rapid vasodilatory mechanisms. Yet, most research in this area has focused on using the conduit artery as the measurement site for blood flow. It is possible that the conduit artery does not reflect the same hyperemic response as the microvascular level during exercise. **Purpose:** Therefore, we attempted to dissociate the matching of oxygen delivery and oxygen demand by administering 0.4 mg glyceryl trinitrate (GTN) prior to handgrip exercise resulting in significant vasodilation at the level of the conduit artery. **Methods:** 8 healthy males (29 ± 9 yrs) performed 2 trials of rhythmic handgrip exercise (30 contractions/min at 5% of 1RM) for 6 minutes, for each control (CON) and GTN condition. Brachial artery (BA) diameter and blood velocity were measured using Doppler ultrasonography. Central hemodynamic variables (i.e. heart rate and mean arterial pressure) were measured using finger plethysmography. **Results:** Administration of GTN resulted in a 12% increase in resting BA diameter that persisted throughout exercise (CON: 0.50 ± 0.01 cm; GTN: 0.56 ± 0.01 cm, $p < 0.05$). Resting forearm blood flow (FBF) was significantly higher following GTN administration compared to control (CON: 144.9 ± 62.4 mL/min; GTN: 212.1 ± 116.5 mL/min, $p < 0.05$); however, any differences in FBF disappeared after the onset of muscle contractions (End-exercise FBF: CON: 561.3 ± 173.1 mL/min; GTN: 525.0 ± 133.4 mL/min, $p > 0.05$). Vascular conductance

was not significantly different between CON and GTN. **Conclusion:** Our results indicate that the matching of oxygen delivery and oxygen demand is unencumbered by prior vasodilation, so that any over-perfusion is corrected at the onset of exercise. This could be attributed to a greater retrograde flow observed following GTN administration, indicating a greater resistance to blood flow downstream of the conduit artery. Thus, the results of this study provide evidence that the regulation of vascular tone within the microvasculature may be independent of that in the conduit artery and therefore, adaptations within the microcirculation function to match oxygen delivery to oxygen demand during exercise.

2410 Board #74 May 31 11:00 AM - 12:30 PM
Lower Extremity Venous Compliance in Newly Injured Individuals with Spinal Cord Injury

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Venous occlusion plethysmography (VOP) has been used as a non-invasive measure to compare lower extremity venous vascular function in individuals with chronic spinal cord injury (SCI) to healthy controls. Our group has previously reported significantly reduced lower extremity venous compliance (LEVC) in persons with SCI compared to healthy controls, which we speculate may relate to long standing paralysis and limited daily orthostatic challenge. However, to our knowledge LEVC has not yet been reported in the newly injured SCI population.

PURPOSE: The purpose of this investigation was to evaluate changes in LEVC during acute in-patient rehabilitation following SCI.

METHODS: VOP was used to determine changes in LEVC, which was assessed shortly after admission to the inpatient unit and a few days prior to discharge. VOP was acquired in the supine position at the widest calf circumference using a mercury strain gauge. Brachial blood pressure was monitored in the supine position during the VOP and a thigh cuff was inflated to 20 mmHg below the diastolic blood pressure (BP) and an ankle cuff was inflated to 100 mmHg above the systolic BP. Cuff inflation was maintained for 3 minutes and LEVC was estimated from changes in calf girth divided by thigh cuff occlusion pressure.

RESULTS: Eleven participants were enrolled, 35 ± 11 years old (range: 19-52 years), 73% ($n=8$) male with acute SCI (34 ± 17 days from injury; range 14-69 days). Injury levels ranged from C4 to T12 and 82% were motor complete. On average, participants were admitted 30 ± 17 days after injury and the average length of stay (LOS) was 46 ± 14 days. Neither calf circumference nor LEVC changed significantly over the LOS. However, the number of days between injury and the baseline VOP assessment was significantly associated with LEVC change ($r^2=0.57$; $p<0.01$) and change in LEVC differed significantly between those admitted within 30 days of injury ($-3.6\pm 2.7\%$) and those admitted 31 days or more from injury ($7.8\pm 8.7\%$; $p<0.05$).

CONCLUSION: These data suggest that LEVC continues to be lost 30 days after injury during inpatient rehabilitation hospitalization following SCI. However, capturing baseline VOP data more than 30-days after injury, likely underestimates this venous vascular adaptation to paralysis.

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2411 Board #75 May 31 11:00 AM - 12:30 PM
Prolonged Sitting Increases Arterial Stiffness in Healthy Adults

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Chronic sedentary behavior increases risk for cardiovascular disease, which is the leading cause of death globally. Sitting impairs leg vascular health. Simple perturbations to increase leg blood flow prevent impairments, however, the effects on central cardiovascular health are unknown. Arterial stiffness (AS) is an indicator of CVD, and Pulse Wave Velocity (PWV) is a non-invasive measure of arterial compliance. Pulse Wave Analysis (PWA) measures augmentation index (AIx) and central pressure provides additional information about AS. **Purpose:** To investigate the effects of prolonged sitting, with and without calf raises on aortic AS (carotid-femoral PWV) central blood pressure (CBP), and AIx. **Methods:** After familiarization, sedentary participants ($n=20$, 21.7 yrs (2.9), BMI 25.7 m/kg^2 (5.3), 70% female) sat for 180 minutes with and without performing 10 calf raises every 10 minutes in a random order. Following 20 min of supine rest, baseline vascular measures were collected. Measures of CBP and AIx were recorded at 10, 90, and 170 min of sitting. Near-infrared spectroscopy (NIRS) was used to assess total hemoglobin (tHb) concentration

in the gastrocnemius muscle (index of blood pooling). Data were analyzed with a linear mixed model and are presented as mean difference (SE). **Results:** PWV increased significantly (0.30 m/s (0.46), $p < 0.001$) while AIx significantly decreased (-9.2% (11.0), $p < 0.001$). tHb tended to increase with sitting (0.9 (1.0), $p = 0.082$) and in the control condition (2.1 (1.0), $p = 0.084$). **Conclusions:** Sitting increases aortic AS but decreases AIx, an effect which may be mediated by blood pooling in the lower leg. Intermittent calf raises are insufficient to alter AS, as PWV increased by 0.30 m/s acutely. Despite being below the clinical threshold of 1.0 m/s with chronic inactivity, the acute increases in PWV in 3 hours may increase heart burden and become meaningful over time.

2412 Board #78 May 31 11:00 AM - 12:30 PM
Acute Effects Of Oral Ascorbic Acid On The Vascular Endothelial Function Under Heat-not-burn Tobacco Smoking

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PURPOSE: Heat-not-burn (HNB) tobacco smoking has spread through the market. While it is suggested that HNB tobacco smoking reduces the vascular endothelial function and is associated with a high risk of developing cardiovascular disease, oral administration of ascorbic acid benefits the endothelial function and redox states of HNB tobacco smoking patients remains unclear. In the present study, we examined the effect of the oral administration of ascorbic acid on the endothelial function and oxidative stress markers after HNB tobacco smoking in healthy young adults.

METHODS: Eight healthy men smoked one HNB tobacco cigarette in 2 conditions: the VC trial took ascorbic acid (1000 mg) before smoking, while the P trial took a placebo before smoking. The flow-mediated dilatation (FMD) at the brachial artery and biological antioxidant potential (BAP) levels were measured 15 minutes before smoking and immediately, 60, and 120 min after smoking.

RESULTS: In the P trial, the FMD immediately after smoking ($5.0 \pm 0.7\%$) was significantly decreased in comparison to before smoking ($8.5 \pm 1.0\%$). The VC trial showed quicker recovery of the FMD after smoking than the P trial. At 60 min after smoking, a significantly difference was noted in the BAP values of the 2 trials (VC: 1920 ± 139.1 vs. P: 1833 ± 131.2 U CARR, $p < 0.05$).

CONCLUSIONS: In HNB tobacco smoking, the oral administration of ascorbic acid was associated with a significant improvement in the oxidative stress marker levels in comparison to a placebo. These findings support that ascorbic acid may be an important factors for reducing the risk of cardiovascular disease in HNB tobacco smoking.

2413 Board #77 May 31 11:00 AM - 12:30 PM
Limb Specificity And Near-infrared Spectroscopy Assessment Of Reactive Hyperemia: The Potential Impact Of Oral Capsaicin

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BACKGROUND: Cardiovascular disease (CVD) is a leading cause of morbidity and mortality in developed nations, therefore, there exists clinical importance in assessing vascular function, both causal and correlative of CVD, and in developing strategies to mitigate dysfunction. Capsaicin, the pungent ingredient in chili peppers (*Capsicum*), has been demonstrated to improve vascular function in mice through activating vascular endothelial transient receptor potential vanilloid type 1 channels (TRPV₁) increasing nitric oxide (NO), promoting vasodilation. Further, recent work has suggested Near-Infrared Spectroscopy (NIRS) provides insight into vascular function, however, whether the reperfusion slope is limb specific is unknown. **PURPOSE:** To determine if there is limb specificity (forearm vs. quadriceps), and whether acute oral capsaicin (780 mg, Cayenne Pepper extract), influences the NIRS-derived oxygen saturation (StO₂) reperfusion slope. **METHODS:** Using a counterbalanced, single-blind crossover design, total hemoglobin (HB_{tot}), oxyhemoglobin (HBO₂), muscle tissue oxygenation (saturation; StO₂%), and deoxyhemoglobin (HHb) were assessed in 14 healthy young males (21 ± 3 yrs.) using NIRS, at rest, during 5 mins of suprasystolic cuff inflation and during reactive hyperemia. The StO₂ deoxygenation and reperfusion slopes were calculated during the first 10-second window of cuff occlusion and reactive hyperemia, respectively. **RESULTS:** No significant ($p < 0.05$) differences were observed in treatment (capsaicin vs. placebo) during cuff occlusion of the quads (CQ) or forearm (CFA). However, StO₂ slope during CQ was significantly ($p < 0.05$) greater than CFA for both treatments (capsaicin: -2.32 ± 0.37 vs. -1.10 ± 0.05 %/s; placebo: -2.13 ± 0.27 vs. -1.19 ± 0.15 %/s; respectively). Similarly, only a significant ($p < 0.05$) difference between upper and lower body microvascular function was

found for StO₂ slope during cuff release (CR) (capsaicin: 0.81 ± 0.10 vs. 0.32 ± 0.03 %/s; placebo: 0.86 ± 0.11 vs. 0.26 ± 0.10 %/s; quadriceps vs. forearm; respectively). **CONCLUSION:** Capsaicin, at this dose, does not alter the StO₂ reperfusion slope in the upper or lower limbs. However, the NIRS-derived StO₂ deoxygenation and reperfusion slopes appear to be limb specific, warranting further study to elucidate the mechanisms.

2414 Board #78 May 31 11:00 AM - 12:30 PM
Changes in Arterial Adropin Levels by Age and Aerobic Training Is Related to Arterial Vasodilation

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Adropin promotes nitric oxide (NO) production via increases in endothelial NO synthase (eNOS) in endothelial cells. In a recent study, we showed that circulating adropin levels, elevated by aerobic exercise training (AT), are related to reductions in arterial stiffness via increased NO production in middle-aged and older adults. However, it is unclear whether changes in arterial adropin levels by AT are related to vasodilation via increases in arterial NO production. **PURPOSE:** This study aimed to examine whether changes in arterial adropin levels by age and AT are related to vasodilation via arterial NO production.

METHODS: Male 38-week-old senescence-accelerated mouse prone 1 (SAMP1) mice were divided into 2 groups; aged-sedentary control and aged-AT. Additionally, male 13-week-old SAMP1 mice were used as a young-sedentary control group. AT consisted in voluntary wheel running for 12 weeks. Mouse aortic rings were isolated for the evaluation of vasodilatory responses to acetylcholine (ACh, endothelium-dependent), sodium nitroprusside (SNP, endothelium-independent), adropin, and the combination of adropin with the NOS inhibitor, L-NAME, using an organ bath system. Furthermore, serum and arterial adropin, arterial nitrite/nitrate (NOx), and eNOS phosphorylation levels were measured. The expression of arterial adropin mRNA was measured using real-time RT-PCR.

RESULTS: ACh-induced vasodilation, as well as that induced by adropin were significantly impaired with aging and AT restored them both ($P < 0.05$). Moreover, adropin-induced vasodilation was significantly inhibited by the administration of L-NAME in all groups, while no significant differences in SNP-induced vasodilation between the three groups were observed. Aging was associated with reductions in serum and arterial levels of adropin, arterial adropin mRNA expression, arterial NOx level, and eNOS phosphorylation, whereas AT significantly increased these parameters ($P < 0.05$).

CONCLUSIONS: These results suggest that the changes in arterial adropin mRNA and protein levels that occur with age and AT are related to vasodilation via arterial NO production.

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2415 Board #79 May 31 11:00 AM - 12:30 PM
Nocturnal Hypertension Status and C-Reactive Protein Levels Before and After AEXT

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C-Reactive Protein (CRP) is an inflammatory biomarker linked to endothelial dysfunction, resulting hypertension, and cardiovascular events. 24-hr ambulatory blood pressure monitoring (ABPM) is the gold standard for diagnosing hypertension, with recent evidence showing a superior predictive value of asleep nighttime values, in particular, for cardiovascular outcomes. **PURPOSE:** To assess whether circulating CRP levels differ between nighttime hypertensives and normotensives and examine the ability of exercise training to affect CRP levels.

METHODS: Non-smoking, middle-to-older age, sedentary African Americans underwent an aerobic exercise training (AEXT) program for 24 weeks. Various modes of AEX were included, with intensity progressing up to 60% VO₂ max. Participants underwent 6 weeks of dietary stabilization and were required to maintain a constant weight for the study's duration. CRP and blood pressure (BP) were measured from fasted blood samples and 24-hour ABPM, respectively, before and after the AEXT program. Upon study completion, subjects were divided into groups based on average asleep ABPM values (O'Brien et al 2013) and baseline circulating CRP levels.

RESULTS: At baseline, normotensive subjects had significantly lower circulating CRP than those classified as hypertensives based on nighttime systolic BP (2.95 vs. 4.74 mg/L, $p < .01$). Although there was no difference between normotensives and hypertensives classified as at low (< 1 mg/L) or high (> 3 mg/L) risk for cardiovascular disease based on CRP levels, there was a difference in circulating CRP between groups

at average risk ($p < .05$). CRP did not significantly decrease ($p = .095$), however, after 6 months of AEXT the hypertensive group experienced a significantly greater decrease in CRP than the normotensive group ($p = .01$).

CONCLUSIONS: Our results suggests that nighttime hypertensive status may correspond to cardiovascular disease risks predicted by the classic biomarker CRP. Nocturnal SBP may be a discriminating additive factor to consider for health by those at average risk for future events by CRP levels. For both hypertensives and normotensives, AEXT may alter CRP, with hypertensives likely to see a greater effect. Supplementary studies are needed to examine the relationship between additional variables and nocturnal hypertension.

2416 Board #80 May 31 11:00 AM - 12:30 PM
Integrated Effects of Sympathetic Vasoconstriction and Local Vasodilation in Human Skeletal Muscle and Skin Microvasculature

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Both sympathetic vasoconstriction and locally-mediated vasodilation play important roles in regulation of blood flow to skeletal muscle and skin during exercise. However, the integrated effects of these two vascular regulatory mechanisms in microcirculation are unclear. **Purpose:** We aimed to investigate integration of sympathetic vasoconstriction and local vasodilation in the skeletal muscle and skin microvasculature in humans. **Methods:** In 39 healthy volunteers, we measured blood flow index of flexor carpi radialis muscle using diffuse correlation spectroscopy and monitored skin blood flow at the proximal site by laser-Doppler flowmetry, simultaneously. We examined the effects of acute sympathoexcitation by forehead cooling on relatively weak or robust vasodilatory responses during post-occlusive reactive hyperemia (PORH) induced by 70 s or 10 min arterial occlusion at upper arm, respectively. To increase sympathetic tone during PORH, forehead cooling was begun 60 s before the occlusion release and ended 60 s after the release. **Results:** The acute sympathoexcitation diminished the peak and duration of vasodilation in both skeletal muscle and skin in 70 s occlusion trials [peak skeletal muscle vascular conductance (MVC): 5.6 ± 0.4 vs. 4.1 ± 0.3 , peak cutaneous vascular conductance (CVC): 3.4 ± 0.2 vs. 2.9 ± 0.2 AU, 50 % decay time of MVC: 19 ± 0.8 vs. 13 ± 0.6 , 50 % decay time of CVC: 17 ± 1.0 vs. 14 ± 1.0 s, $p < .05$]. The sympathetic inhibition of vasodilation was blunted under robust vasodilatory stimuli produced by 10 min occlusion. This blunt of the sympathetic inhibition was greater in skeletal muscle than in skin, especially in those initial and peak vasodilation. Indeed, the sympathoexcitation reduced the peak vasodilation only in skin (peak MVC: 10.2 ± 0.9 vs. 9.7 ± 0.9 , $p > .05$, peak CVC: 7.7 ± 0.5 vs. 6.5 ± 0.5 AU, $p < .05$) while it accelerated the initial vasodilation selectively in skeletal muscle (area of MVC during first 15 s of PORH: 75.2 ± 6.5 vs. 83.0 ± 6.9 , $p < .05$, area of CVC: 51.6 ± 2.7 vs. 51.7 ± 3.4 AUs, $p > .05$). **Conclusion:** We conclude that, in humans, the integration of sympathetic vasoconstriction and local vasodilation has different effects in skeletal muscle and skin. Such different effects would be importantly involved in selective control of perfusion in microcirculation of different tissues.

2417 Board #81 May 31 11:00 AM - 12:30 PM
Influence Of Arm cranking Exercise With Electrical Stimulation On The Vascular Endothelial Function

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PURPOSE: Arm-cranking exercise may not result in reduction in ba-PWV. Electrical muscle stimulation (EMS) has been shown to be able to increase the blood flow and the peripheral circulation. Arm-cranking exercises with EMS may therefore be able to increase the arterial function. However, less is known about the effect of submaximal arm-cranking exercise with EMS on the vascular endothelial function.

METHODS: Eight healthy adult men were studied under two experimental trials (arm-cranking exercise with EMS; A+E trial, arm-cranking exercise without EMS; A trial). In the A+E trial, submaximal arm-cranking exercise at 50% $\dot{V}O_{2\max}$ with both lower leg and thigh muscles were sequentially stimulated at 4-Hz for 20min. Before and after each trial, the brachial systolic and diastolic blood pressure (SBP/DBP) were measured in the supine position. The vascular endothelial function of the right brachial artery was also assessed by flow-mediated dilation (FMD).

RESULTS: In the A+E trial, the FMD increased immediately after ($9.7 \pm 0.8\%$) and 30 min after ($8.4 \pm 0.7\%$) compared with rest ($6.0 \pm 0.7\%$). The FMD in the A trial, increased immediately after ($8.0 \pm 1.2\%$) compared with rest ($6.4 \pm 0.4\%$), however, no significant differences were found in 30min after ($6.4 \pm 1.0\%$). Immediately after and 30 min after each trial, significant differences in the FMD were found between the A+E and A trials ($p < .05$). The SBP and DBP were not significantly different between the both trials.

CONCLUSIONS: Acute arm-cranking exercise with EMS increases the vascular endothelial function. These results suggest that chronic arm-cranking with EMS might be useful for reduction the risk of cardiovascular disease.

2418 Board #82 May 31 11:00 AM - 12:30 PM
The Age-dependent Changes In Cardiovascular Risk Factors Associated With Endothelial Function In Women Of Han Nationality With Ace D/I Polymorphism In Beijing

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PURPOSE: Angiotensin converting enzyme (ACE) I/D polymorphism influences ACE activity, with the D allele associated with higher angiotensin II production, which can have adverse effects on endothelial function through the promotion of vasoconstriction. Age is an independent risk factor for endothelial dysfunction, and postmenopausal women because estrogen deficiency affects their endothelial function. The present study was to investigate the trend of cardiovascular risk factors for endothelial function with aging in Han nationality women with ACE D/I polymorphism in Beijing.

METHODS: A total of 391 females, age from 22 y to 75 y, were selected for analyzing the relationship between ACE I/D polymorphism and cardiovascular risk factors for endothelial function, (Ages 20-44: 120; Ages 45-59: 150; Ages 60-75: 121). Body composition, serum lipids metabolism, endothelial function, endothelium-derived relaxing factor and contracting factor were analyzed.

RESULTS: The distribution characteristics of ACE I genotype and D genotype in han Chinese women in Beijing were as follows: Ages 20-44: 63.74% and 36.26%; Ages 45-59: 67.33% and 32.67%; Ages 60-75: 64.34% and 35.66%. There was no age associated with differential expression. Along with the women aging, DI/II genotype had higher TG level, higher chance of hyperglycemia and lower HDL level. The percentage of body fat and visceral fat significantly increased than DD type did. FMD, blood pressure, baPWV and IMT increased earlier and DBP abnormality rate, IMT, IMT thickening rate had more severe increases than DD type. The decrease of NO and NO/ET-1 and the increase of ET-1 and AngII were more significant compared with DD type. The interaction between age and ACE gene D/I polymorphisms could remarkably affect vascular endothelial function.

CONCLUSIONS: There was no age associated with differential expression in ACE D/I polymorphism in Women of Han nationality in Beijing. The interaction between age and ACE D/I polymorphisms plays a key role in endothelial dysfunction, in which DI/II genotype is vulnerable to endothelial dysfunction and arteriosclerosis with aging.

2419 Board #83 May 31 11:00 AM - 12:30 PM
The Effects Of Pilates Training On Vascular Function In Obese Premenopausal Women With Elevated Blood Pressure

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Obesity is associated with vascular dysfunction, including an increase in blood pressure (BP), arterial stiffness (pulse wave velocity, PWV) and pressure wave reflection [augmentation index (Aix)]. Therefore, effective interventions targeting improvements in arterial function for obese individuals are critical for the prevention of hypertension (HTN) and cardiovascular events at a young age. Previous studies have shown that pilates training (PT) decreases Aix and aortic BP in young normotensive individuals. However, the possibility of PT improving arterial function in obese women with elevated BP is currently unknown. **PURPOSE:** The purpose of this study was to examine the effects of PT on BP, PWV and Aix in obese women with elevated BP. **METHODS:** Twenty-eight obese premenopausal women [age (23 ± 1 years), body mass index (34.1 ± 0.7 kg/m²), systolic BP (127 ± 2 mmHg) and diastolic BP (75 ± 2 mmHg)] were randomized to either PT (n= 14) or no-exercise control group (n= 14) for 12 weeks. PT consisted of 12 exercises per session 3 x week (approx 60 mins duration per session). Two sets of 6-10 repetitions were performed for each exercise. Supine BP, brachial to ankle PWV (baPWV), Aix, and heart rate (HR) were measured at baseline and after 12 weeks. **RESULTS:** There were significant group-by-time interactions ($P < .05$) for systolic BP, diastolic BP, baPWV and Aix. There were significant decreases ($P < .05$) in systolic BP (-5 ± 1 mmHg), diastolic BP (-4 ± 1 mmHg), baPWV (-0.6 ± 0.2 m/s), and Aix ($-4 \pm 1\%$) in the PT group compared to

no changes after control. No significant changes were observed in HR after 12 weeks for both groups. **CONCLUSIONS:** Pilates exercise led to reductions in BP, arterial stiffness and wave reflection in obese premenopausal women with elevated blood pressure and may therefore be an effective intervention in the prevention of HTN and cardiovascular events at a young age in obese women.

2420 Board #84 May 31 11:00 AM - 12:30 PM

Effects Of Acute Cycling With Electric Muscle Stimulations Of Lower Limb On The Endothelial Function

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(No relevant relationships reported)

The combination of exercise and electrical muscle stimulation (EMS) has been shown to potentially improve energy expenditure or glycogen metabolism. However, few attempts have been made to identify the effects of exercise with EMS on the arterial function. **PURPOSE:** The aim of this study was to evaluate the effects of acute endurance cycling with EMS on the vascular endothelial function determined by flow-mediated vasodilation (FMD). **METHODS:** Nine healthy adult men performed 2 experimental trial: 20 min cycling at 50W with EMS (EMS+C), and the same exercise without EMS (C). In the EMS+C trial, both lower leg and thigh muscles were sequentially stimulated at 4 Hz for 20 min during exercise. The stimulation current was at the highest intensity that did not cause discomfort. Before and after each trial, the brachial systolic and diastolic blood pressure (SBP and DBP, respectively) were measured. The FMD in the right brachial artery was obtained using a high-resolution ultrasound device, determining the percent change in the arterial diameter over the baseline value at maximum dilation during reactive hyperemia. **RESULTS:** In the EMS+C trial, the FMD was significantly elevated immediately after (12.1±0.7%) and at 30 min after EMS (11.1±0.6%) compared with rest (8.7±0.6%). However, there were no significant changes in the C trial (8.9±0.8% at rest, 9.9±0.7% immediately after the C trial, and 9.2±0.6% at 30min after the C trial). Immediately and 30min after each trial, significant differences in the FMD were found between the EMS+C and C trials ($p<0.05$). No significant changes were found in the SBP/DBP in either trial. **CONCLUSIONS:** Acute endurance cycling with EMS results in a larger improvement of the vascular endothelial function than the same exercise without EMS. These findings suggest that low-intensity cycling with EMS might be useful for reducing the risk of cardiovascular disease.

2421 Board #85 May 31 11:00 AM - 12:30 PM

Effect of Heating Duration on Brachial Artery Endothelial Function in Humans

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In humans local heat stress elicits arterial vasodilation through two known mechanisms: axon reflexes responsible for the initial rise in skin blood flow (SkBF), and heat shock protein (HSP)-mediated release of nitric oxide (NO) responsible for the prolonged plateau in SkBF. The effect of selective targeting of these mechanisms, through local heating protocols of varying durations, on endothelial function is unknown. **PURPOSE:** To determine the effect of 10 minutes (axon reflexes) vs. 30 minutes (axon reflexes + HSP-mediated NO release) of local forearm heating on brachial artery (BA) endothelial function. **METHODS:** Five young, apparently healthy, recreationally active males (21±2 years old) were recruited. In separate visits, heating was applied to the left forearm using a commercially available heating pad set to *high* for either 10 minutes (HEAT10, 41.7±0.8 °C) or 30 minutes (HEAT30, 43.5±2.0 °C). Endothelial function was measured before and after each heating intervention through a BA flow-mediated dilation (FMD) test. **RESULTS:** Allometric scaling was performed on the entire data set to account for the increased arterial diameter observed after heating in the 30-minute condition. A generalized estimating equations analysis with an exchangeable correlation structure revealed a main effect of time on BA FMD (rest: 6.4±1.3 vs. HEAT: 7.7±2.2%, $P=0.027$), suggesting that both 10-minute and 30-minute heating protocols improved endothelial function. **CONCLUSION:** These findings suggest that BA FMD is improved similarly with 10 minutes or 30 minutes of local heat stress applied to the forearm; and that the addition of local NO release to axon reflex-mediated vasodilation may not further enhance the acute endothelial function responses.

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2422 Board #86 May 31 11:00 AM - 12:30 PM

Passive Leg Movement Technique for Assessing Vascular Function: Further Defining the Distribution of Blood Flow

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PURPOSE: It has yet to be quantified how passive leg movement (PLM)-induced hyperemia, an index of vascular function, is distributed beyond the common femoral artery (CFA), into the deep femoral (DFA) and the superficial femoral (SFA) arteries, which supply blood to the thigh and lower leg, respectively. Furthermore, the impact of cuffing the lower leg, a common practice, especially with drug infusions during PLM, on the hyperemic response is, also, unknown. **METHODS:** Therefore, PLM was performed with and without cuff-induced blood flow (BF) occlusion to the lower leg in 10 healthy subjects, with BF assessed by Doppler ultrasound. **RESULTS:** In terms of BF distribution during PLM, of the 380±60 ml of BF that passed through the CFA, 266±45 ml (~70%) was directed to the DFA while only 114±18 ml (~30%) passed through the SFA. Cuff occlusion of the lower leg significantly attenuated the PLM-induced hyperemia through the SFA (~30%), which was reflected by a fall in BF through the CFA (~20%), but not through the DFA. Additionally, cuff occlusion significantly attenuated the PLM-induced peak change in BF (ΔBF_{peak}) in the SFA (324±50 to 214±36 ml/min), which was, again, reflected in the CFA (1019±138 to 833±150 ml/min), but not in the DFA. **CONCLUSIONS:** Thus, the PLM-induced hyperemia predominantly passes through the DFA. However, as a fraction of the PLM-induced hyperemia does pass through the SFA, cuffing the lower leg during PLM should be considered to emphasize the DFA specific hyperemia in the PLM assessment of vascular function.

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2423 Board #87 May 31 11:00 AM - 12:30 PM

Vasodilatory And Metabolic Capacity With Advancing Age: Evidence Of Interdependence In The Human Vasculature

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PURPOSE: Vasodilatory capacity declines with advancing age, however, the role of vascular mitochondrial function in this process is unclear. Therefore, this study sought to examine the link between vascular and mitochondrial respiratory function with advancing age. **METHODS:** Skeletal muscle feed arteries (SMFAs) were harvested from young (35±6yrs, n=9) and old (71±9yrs, n=15) subjects. Using pressure myography, vasodilation in SMFAs was assessed in response to flow-induced shear stress, acetylcholine (ACh), and sodium nitroprusside, and mitochondrial respiration was measured by respirometry in permeabilized smooth muscle fibers. Free radical production was assessed by electron paramagnetic resonance spectroscopy. **RESULTS:** Endothelium-dependent vasodilation was significantly attenuated in the old, induced by both flow (young: 92±3, old: 45±4%) and ACh (young: 92±3, old: 54±5%), while endothelium-independent vasodilation was not altered by age. Complex I and I+II, state 3 respiration was significantly lower in the old (CI young: 10.12±0.83, old: 7.02±0.37 pmol/s/mg; CI+II young: 12.34±0.64, old: 7.6±0.43 pmol/s/mg). Although state 4 respiration and mitochondrial-specific free radical production were not different between groups, both tended to be higher in the old. The respiratory control ratio (RCR), was also significantly attenuated in the old (young: 2.25±0.14, old: 1.11±0.06). State 3 (CI+II) and 4 respiration, as well as RCR, were significantly correlated ($r=0.49-0.86$) with endothelium-dependent, but not endothelium-independent capacity. Free radical levels were related to endothelium-dependent ($r=0.4$, $p=0.06$), but not endothelium-independent ($r=0.06$) vasodilation. **CONCLUSION:** The age-related decline in vasodilatory capacity is related to a concomitant attenuation in mitochondrial respiratory capacity and may be a consequence of augmented free radical production.

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2424 Board #88 May 31 11:00 AM - 12:30 PM
Comparison Of Endothelial-dependent Vasodilatory And Vasoconstrictor Responses Between Upper- And Lower-Limb Arteries In Older Adults

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Low-flow mediated constriction (L-FMC) provides important information about the acute effects of reduced shear stress on endothelial function. L-FMC has been mainly tested in upper-limb arteries, where an inverse association with $\text{VO}_{2\text{peak}}$ has been observed in younger adults. It is unclear if an L-FMC response exists in lower limb arteries, which are exposed to larger fluctuations in shear stress during traditional modes of aerobic exercise than the upper-limb. Furthermore, it is uncertain whether the same inverse relationship between L-FMC and $\text{VO}_{2\text{peak}}$ exists in older adults (OA).

PURPOSE: Based on known differences in flow-mediated dilation (FMD) between upper- and lower limbs, we tested the hypothesis that heterogeneous L-FMC responses exist between the brachial- (BA) vs. popliteal (POP) arteries. We also expected that OA with greater aerobic fitness would have larger L-FMC responses in both arteries.

METHODS: FMD and L-FMC were assessed in 47 OA (67 ± 5 yr; 30F) using high-resolution duplex ultrasonography with commercial edge-detection and wall-tracking software. L-FMC was defined as the % decrease in lumen diameter in response to 5-min of distal ischemia. FMD was calculated as the % increase in lumen diameter following a reactive hyperemia. **RESULTS:** Larger FMD responses were observed in the BA vs. POP ($4.7 \pm 1.6\%$ vs. $3.3 \pm 2.0\%$; $P < 0.001$), which were moderately correlated to each other ($r = 0.54$; $P < 0.001$). When allometrically scaled, the BA exhibited a greater L-FMC response than the POP ($-1.3 \pm 1.6\%$ vs. $-0.4 \pm 1.6\%$; $P = 0.03$). L-FMC responses in the BA vs. POP were not correlated with each other ($r = 0.22$; $P = 0.14$). As expected, $\text{VO}_{2\text{peak}}$ was associated with both BA-FMD ($r = 0.59$; $P < 0.001$) and POP-FMD ($r = 0.48$; $P = 0.001$). $\text{VO}_{2\text{peak}}$ was moderately correlated to BA L-FMC ($r = -0.52$; $P < 0.001$) but strongly correlated to POP L-FMC ($r = -0.73$; $P < 0.001$). **CONCLUSION:** The heterogeneous L-FMC responses between the BA and POP indicates that upper limb L-FMC responses do not represent a systemic measure of vasoconstrictor capacity. The stronger association between $\text{VO}_{2\text{peak}}$ and POP L-FMC suggests that larger local shear stress responses, induced by traditional lower-limb modes of aerobic exercise, may result in greater adaptations to low flow-mediated endothelial vasoconstrictor responsiveness.

2425 Board #89 May 31 11:00 AM - 12:30 PM
Physical Activity Ameliorates Endothelial NLRP3 Inflammasome in Obese Mice Aorta

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PURPOSE: The NLR family, pyrin domain-containing 3 (NLRP3) regulates a release of pro-inflammatory cytokine interleukin (IL)-1 β via caspase-1-mediated pyroptosis, thereby plays a pivotal role in vascular pathology in obesity. Physical activity ameliorates the obesity-associated inflammation and vascular dysfunction. Thus, we examined the beneficial effect of physical activity on the NLRP3 inflammasome-associated signaling pathways in high fat diet-induced obese mice aorta and its potential underlying mechanisms.

METHODS: We had four groups of male mice, C57BL/6J: (1) wild-type control with low-fat diet (LF-SED), (2) LF diet with free access to a voluntary running wheel (LF-RUN), (3) high-fat diet (HF-SED; 45% of calories from fat), and (4) HF-RUN. We determined the effects of voluntary running on the NLRP3, caspase-1, IL-1 β , adiponectin, nitric oxide (NO), and oxidative stress in the obese mice aorta using RT-qPCR and immunohistochemistry.

RESULTS: Voluntary running decreased cleaved caspase-1 and IL-1 β expression in aortic endothelium of obese mice. Physical activity restored a high fat diet-induced decrease in endothelial adiponectin expression and NO production. Intracellular superoxide production in the aorta was significantly higher in HF-SED compared to LF-SED and LF-RUN while it was lower in HF-RUN.

CONCLUSIONS: Our findings indicate that physical activity rescues high fat diet-induced overexpression of NLRP3 inflammasome/oxidative stress and downregulation of adiponectin/NO in mice aorta.

2426 Board #90 May 31 11:00 AM - 12:30 PM
Exploring the Associations Between Habitual Sedentary Behavior and Endothelial Cell Health

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Accumulating evidence indicates that prolonged sedentary time (SED) is associated with cardiovascular disease (CVD) morbidity and mortality, potentially independent of moderate- to vigorous-intensity physical activity (MVPA). However, the mechanisms underlying the SED-CVD link have yet to be fully elucidated. Endothelial dysfunction, an early pathogenic process underlying atherosclerosis, is purported to be a contributing factor based on findings from acute lab-based studies. However, few studies have examined whether habitual SED (indicative of more chronic exposure to SED) is linked to endothelial dysfunction.

PURPOSE: To examine the association of accelerometer-derived habitual SED with markers of endothelial cell health. **METHODS:** Apparently healthy adults ($n = 83$; 43% male; 25.5 ± 5.8 yrs) residing in New York City were examined. SED and MVPA were measured for 7 days using a thigh-mounted accelerometer/inclinometer. Endothelial function measures included endothelium-dependent vasodilation [reactive hyperemia index (RHI)], endothelial microparticles (EMPs) [CD62E+ and CD31+/CD42- surface markers], and endothelial progenitor cells (EPCs) [CD34+/CD133+/KDR+ surface markers], all collected under fasting conditions. Participants were categorized into high (≥ 9.8 h/day) or low SED (< 9.8 h/day) groups by median split. **RESULTS:** No significant differences between the high and low SED groups were detected for any of the endothelial cell markers including RHI (high: 2.38 ± 0.14 vs. low: 2.47 ± 0.14 ; $p = 0.68$), CD62E+ EMPs (high: 699.9 ± 48.3 vs. low: 826.3 ± 57.0 counts/ μL ; $p = 0.12$), CD31+/CD42- EMPs (high: 486.9 ± 37.5 vs. low: 533.3 ± 41.6 counts/ μL ; $p = 0.44$), CD34+/KDR+ EPCs (high: 100.8 ± 0.1 vs. low: 79.4 ± 0.1 %; $p = 0.37$), and CD34+/CD133+/KDR+ EPCs (high: 2.4 ± 0.0 vs. low: 2.0 ± 0.0 %; $p = 0.75$) after adjustment for age, sex, race, ethnicity, education, and MVPA. **CONCLUSION:** Among healthy adults, habitual SED was not associated with markers of endothelial cell health. Mechanisms other than endothelial dysfunction should be explored as a potential link between prolonged SED and CVD.

2427 Board #91 May 31 11:00 AM - 12:30 PM
Short-term Cycling Restores Endothelial Dysfunction After Resistance Exercise

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PURPOSE: Resistance exercise impairs endothelial function. Therefore, it is of paramount importance to devise an effective strategy for restoring endothelial function after resistance exercise. Herein, we tested the hypothesis that resistance exercise-induced endothelial dysfunction would be restored by short-term cycling.

METHODS: Seventeen young healthy subjects completed two randomized experimental trials: 1) resistance exercise (RE) only trial; 2) cycling after the RE trial (RE + C). Following baseline brachial artery flow-mediated dilation (FMD), subjects performed the resistance exercise. Following the resistance exercise, subjects were asked to rest in the supine position for the assessments of FMD. Subjects in the RE only trial maintained this supine position for 60 min, whereas those in the RE + C trial performed 10 min of self-paced cycling (67.0 ± 1.7 % HRmax) after the resistance exercise. Subjects were again asked to rest in the supine position after cycling. FMD was then repeated at 30 and 60 min after the resistance exercise in both trials.

RESULTS: In the RE only trial, the significant increased blood flow relative to baseline ($P < 0.05$) was disappeared after 30 min of resting in the supine position (54.2 ± 8.1 ml/min, 150.6 ± 30.0 ml/min, 94.2 ± 17.0 ml/min, 72.1 ± 12.9 ml/min at baseline, 10, 30 and 60 min after the resistance exercise, respectively), but were maintained at 30 min after the resistance exercise in the RE + C trial due to subsequent cycling (47.0 ± 7.4 ml/min, 139.5 ± 24.4 ml/min, 112.0 ± 17.9 ml/min, 55.9 ± 9.0 ml/min at baseline, 10, 30 and 60 min after the resistance exercise, respectively). Both trials caused a significant impairment in FMD at 10 min after the resistance exercise (6.5 ± 0.3 % vs. 3.5 ± 0.5 % in the RE only trial, 6.5 ± 0.2 % vs. 2.9 ± 0.5 % in the RE + C trial, $P < 0.05$). This decline was sustained for 60 min in the RE only trial (3.8 ± 0.6 % and 4.3 ± 0.3 % at 30 and 60 min after the resistance exercise, $P < 0.05$ vs. baseline). However, the impaired FMD was restored in the RE + C trial (7.2 ± 0.7 % and 7.0 ± 0.6 % at 30 and 60 min after the RE, $P > 0.05$ vs. baseline).

CONCLUSIONS: In conclusion, impaired endothelial function after the resistance exercise can be restored by 10 min of cycling.

2428 Board #92 May 31 11:00 AM - 12:30 PM
Application Of A Tourniquet During Venous Blood Collection From The Forearm Reduces Plasma Nitrite Concentration

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Dietary nitrate (NO_3^-) supplementation increases nitric oxide (NO) availability and can reduce blood pressure and improve exercise performance. While plasma nitrite [NO_2^-] provides the best marker of NO availability, the use of a tourniquet during blood collection may be problematic due to the established effects of hypoxia on NO metabolism. **PURPOSE:** This study compared measurements of plasma NO_2^- and NO_3^- where blood was collected via venepuncture and from an indwelling intravenous cannula. **METHODS:** Fifteen participants (mean \pm standard deviation: age 27 ± 4 years, body mass 71 ± 11 kg) completed two experimental trials in a randomized order. In one trial, participants ingested 140 ml of NO_3^- -rich beetroot juice (BR; ~ 8.4 mmol NO_3^-) 2.5 h prior to sample collection. No supplementation was given in the other (CON). In both trials, a blood sample was collected from a forearm vein using a venepuncture needle 40 s after the application of a tourniquet to the upper arm. Simultaneously, a blood sample was collected from the opposite arm via an indwelling intravenous cannula with no restriction to blood flow. A second blood sample was collected from the cannula 40 s after a tourniquet was attached to the upper arm. Near-infrared spectroscopy was used to assess deoxygenation of the flexor muscles through changes in total (tHb), deoxy- (HHb), and oxy- (HbO₂) haemoglobin. Samples of plasma were analyzed for [NO_2^-] and [NO_3^-] using gas-phase chemiluminescence. **RESULTS:** The application of a tourniquet increased tHb, HHb, and HbO₂ suggesting deoxygenation of the local forearm muscles (all $P < 0.05$). Plasma [NO_2^-] was significantly higher when sampled from the unrestricted cannula (CON: 179 ± 67 nM, BR: 473 ± 164 nM) in comparison to venepuncture (CON 112 ± 51 nM, $P = 0.03$; BR 387 ± 136 nM, $P < 0.001$) and the cannula during tourniquet application (CON 109 ± 43 nM, $P = 0.02$; BR 384 ± 124 nM, $P < 0.001$). Plasma [NO_3^-] was not different between sample sites in either trial (all $P > 0.05$). **CONCLUSIONS:** The application of a tourniquet for venous blood sampling causes ischemia, localized hypoxia, and reduces plasma [NO_2^-], possibly due to an increased conversion to NO or greater uptake of NO_2^- by the tissue. Researchers should ensure consistency in blood collection methodologies and consider how the use of a tourniquet may influence NO metabolism.

2429 Board #93 May 31 11:00 AM - 12:30 PM
Associations Among Indices of Insulin Resistance and Vascular Reactivity in Older, Obese Adults

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Insulin resistance (IR), estimated by calculating the homeostasis model assessment of IR (HOMA-IR), independently predicts incident cardiovascular disease (CVD) events. Further, HOMA-IR is inversely associated with brachial artery flow-mediated dilation (FMD) in non-diabetics, suggesting that IR may contribute to vascular dysfunction that increases CVD risk. **PURPOSE:** We sought to determine associations among indices of IR/glucose control and vascular reactivity in older, obese adults. We hypothesized that brachial artery FMD and hyperemic shear rate area under the curve (AUC) would be inversely associated with indices of IR/glucose control. **METHODS:** Preliminary data are from older, obese adults [$n = 20$ (16 women); age = 64.2 ± 4.8 y; BMI = 35.3 ± 5.3 kg/m²] participating in an ongoing clinical study. Brachial artery FMD and hyperemic shear rate AUC were assessed by a trained technician using high-resolution ultrasonography following an overnight fast. Additionally, fasting blood glucose (FBG) and serum insulin concentrations, HOMA-IR, hemoglobin (Hb)A1c, and postprandial blood glucose responses (i.e., 2 h AUC) to mixed meal ingestion (0.3 g protein/kg lean body mass + 0.5 g glucose/kg lean body mass) were measured to assess IR/glucose control. Partial correlations (controlling for age and sex) were used to examine associations among these variables. **RESULTS:** Participants were insulin resistant (HOMA-IR = 3.7 ± 2.2) but not diabetic (FBG = 99.5 ± 9.5 mg/dL, HbA1c = $5.5 \pm 0.2\%$). Fasting brachial artery FMD ($3.4 \pm 1.6\%$) was not correlated (all $P \geq 0.44$) with FBG ($r = -0.18$) or serum insulin (14.2 ± 7.5 μ IU/mL; $r = -0.07$), HOMA-IR ($r = -0.13$), HbA1c ($r = -0.19$), or 2 h blood glucose AUC ($13,430 \pm 2,298$ mg/min/dL; $r = -0.23$). Hyperemic shear rate AUC was not correlated with indices of IR/glucose control (all $P \geq 0.11$). **CONCLUSIONS:** Preliminary data from our ongoing clinical study show that indices of IR/glucose control are not associated with vascular reactivity in older,

obese adults. Continued recruitment of participants will more definitely determine the potential contribution of IR to vascular dysfunction and CVD risk. Supported by National Institute on Aging (1R15AG055923-01).

2430 Board #94 May 31 11:00 AM - 12:30 PM
Muscle Oxygen Saturation In Patients With Deep Venous Thrombosis In The Lower Limbs

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Deep venous thrombosis (DVT) is a disease characterized by an acute thrombus formation in deep veins. It is unclear whether DVT chronically impairs muscle metabolism during exercise.

Purpose: To analyze the impact of DVT on muscle oxygen saturation (STO_2) during exercise.

METHODS: Ten patients with chronic unilateral DVT were recruited. Patients were submitted to two submaximal walking exercise tests to assess STO_2 in calf. In one test the leg with previous DVT was assessed and in the other test the counter lateral leg was assessed. Onset, at the end, maximal, minimal and average STO_2 during exercise were obtained.

RESULTS: Onset (DVT leg: 64(14)% vs. Control leg: 67(6)%, $p = 0.117$), at the end (DVT leg: 72(4)% vs. Control leg: 74(5)%, $p = 0.099$), maximal (DVT leg: 73(10)% vs. Control leg: 73(5)%, $p = 0.878$), minimal (DVT leg: 59(14)% vs. Control leg: 61(24)%, $p = 0.678$), and average (DVT leg: 66(9)% vs. Control leg: 66(9)%, $p = 0.678$), were similar between legs.

CONCLUSION: DVT does not affect muscle STO_2 during exercise.

Key words: Venous thrombosis, exercise, lower extremity.

2431 Board #95 May 31 11:00 AM - 12:30 PM
Does 24-hour Ambulatory Blood Pressure Monitoring Act as Ischemia Preconditioning and Influence Endothelial Function?

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Ischemic preconditioning can exert a powerful protection against a subsequent period of ischemia in a variety of organs, via repeated inflation and deflation of a blood pressure cuff. Most often, damages of ischemia reperfusion injury and benefits of preconditioning are evaluated via endothelial function. The ambulatory blood pressure device takes repeated blood pressure measurements and constitutes repeated bouts of ischemia for 24 hours. In practice, measurements of endothelial function and ambulatory (24-hour) blood pressure are often combined. **PURPOSE:** We determined whether repeated bouts of ischemia accumulated for 24 hours through 24-hour ambulatory blood pressure monitoring influence endothelial function. **METHODS:** Twenty-two apparently healthy non-medicated middle-aged subjects (41 ± 8 years, 12 males and 10 females) participated in the study. Flow-mediated dilation (FMD; index of endothelium-dependent vasodilation) was measured twice 30 minutes apart at baseline to confirm test-retest reliability. Subsequently, subjects were fitted with an ambulatory (24 hour) blood pressure monitoring device. Blood pressure was measured every 15 minutes during the daytime and 20 minutes at nighttime. Upon returning after 24 hours, FMD was remeasured. Shear rate and reactive hyperemia were also measured simultaneously. **RESULTS:** The ambulatory blood pressure monitoring device went through an average of 110 ± 13 inflation/deflation cycles, which resulted in 46 ± 6 minutes of cumulative ischemic stimuli. Two measurements of FMD at baseline were not different, showing the measurement stability. Following 24-hours of ambulatory blood pressure monitoring, FMD did not change significantly (6.6 ± 2 vs. $6.8 \pm 3\%$). Similarly, shear rate (4.4 ± 2.6 vs. 5.1 ± 5.9 cm/s) and reactive hyperemia (13.7 ± 12.1 vs. 17.6 ± 21.1 cm/s) were unchanged (all $p > 0.05$). **CONCLUSIONS:** Ambulatory blood pressure monitoring and the associated ischemia repeated for 24 hours, did not influence endothelium-dependent vasodilation acting via ischemic preconditioning.

- 2432** Board #96 May 31 11:00 AM - 12:30 PM
Peripheral Vascular Function in Individuals with Posttraumatic Stress Disorder
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THE IMPACT OF POSTTRAUMATIC STRESS DISORDER ON PERIPHERAL VASCULAR FUNCTION

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 The physiological manifestations of posttraumatic stress disorder (PTSD) have been associated with an increase in risk of cardiovascular disease (CVD) independent of negative lifestyle factors. Peripheral vascular dysfunction may be a mechanism by which PTSD increases CVD risk via increases in oxidative stress, inflammation, and/or sympathetic nervous system activity. **PURPOSE:** This study sought to examine peripheral vascular function in those with PTSD compared to age-matched controls. **METHODS:** Eight individuals with PTSD (5 women, 3 men; age 22 ± 2 years), and sixteen healthy controls (CON; 10 women, 6 men, 23 ± 2 years), participated in the study. Leg vascular function was assessed via passive leg movement (PLM) technique and evaluated with Doppler ultrasonography. PLM-induced increases in leg blood flow were quantified as peak change in blood flow from baseline (Δ Peak LBF) and blood flow area under the curve (LBF AUC). **RESULTS:** Significant differences in leg vascular function were revealed between groups. The PTSD group reported significantly lower Δ Peak LBF (PTSD: 294.16 ± 54.16 ; CON: 594.78 ± 73.70 ml·min⁻¹; $p = 0.01$) and LBF AUC (PTSD: 57.23 ± 24.37 ; CON: 169.92 ± 29.84 ml; $p = 0.02$) when compared to the CON group. **CONCLUSION:** This study revealed that lower limb vascular function is impaired in individuals with PTSD when compared to healthy counterparts.

- 2433** Board #97 May 31 11:00 AM - 12:30 PM
Measurement of Peripheral Pulse Wave Velocity Responses to Prolonged Sitting: Influence of Posture
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Measurement of Peripheral Pulse Wave Velocity Responses to Prolonged Sitting: Influence of Posture

PURPOSE: Prolonged sitting acutely increases (worsens) pulse wave velocity (PWV), a measure of arterial stiffness. Though the effect of prolonged sitting on PWV would be best captured while maintaining a seated posture, measurement of PWV is recommended to be performed in a supine posture. We examined whether peripheral PWV responses to a simulated workday of prolonged sitting differed when measured in a seated vs. supine posture. **METHODS:** Adults with overweight or obesity (BMI ≥ 25.0 kg/m²) and elevated blood pressure participated in an 8-hr simulated workday of prolonged sitting (only necessary restroom and meal breaks allowed). Carotid-radial (crPWV) and carotid-ankle (caPWV) PWV were both measured using tonometry at baseline, mid-day, and afternoon. At each timepoint, participants rested for 10 minutes in a seated posture followed by seated PWV, then rested for 10 minutes in a supine posture followed by supine PWV. Generalized linear mixed models evaluated main effects of posture and time, and their interaction on PWV. **RESULTS:** Participants ($n=25$) were 42 ± 12 years old, 64% self-reported as male, had a systolic blood pressure of 132 ± 9 mmHg and diastolic blood pressure of 83 ± 8 mmHg, and mean BMI 32 ± 5 kg/m². Participants took an average of 3.7 ± 1.3 restroom breaks. For crPWV ($n=23$ with valid data), there was no posture x time interaction ($\beta = -0.03$ m/s; $P = 0.840$); the main effect of posture was significant ($\beta = 0.47$ m/s; $P = 0.001$) but the main effect of time was not ($\beta = 0.095$ m/s; $P = 0.241$). For caPWV ($n=21$ with valid data), the interaction was not significant ($\beta = -0.64$ m/s; $P = 0.074$); there were significant main effects of time ($\beta = 0.24$ m/s; $P = 0.017$) and posture ($\beta = 1.94$ m/s; $P = 0.001$). **CONCLUSION:** Peripheral PWV was higher when measured while seated vs. supine. However, the effect of prolonged sitting over time on PWV was not statistically different across postures. Especially for crPWV, seated and supine measurement of PWV appear to capture similar responses to prolonged sitting.

- 2434** Board #98 May 31 11:00 AM - 12:30 PM
The Acute Effects of Aerobic, Resistance, and Integrated Concurrent Exercise on Blood Pressure and Arterial Stiffness
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 (No relevant relationships reported)

While the acute peripheral and central blood pressure responses to aerobic and resistance exercise have been well documented, a comparison between these types of exercise and integrated concurrent exercise has not yet been investigated. **PURPOSE:** To investigate the acute peripheral and central blood pressure, and arterial stiffness (augmentation index) responses following an aerobic, resistance, and integrated concurrent exercise sessions. **METHODS:** Ten resistance trained males ($M = 20.8 \pm 1.69$) performed aerobic exercise (AER), resistance exercise (RES), and integrated concurrent exercise (ICE) sessions in random order following a familiarization session. The AER session consisted of 45 min of stationary cycling at 70% HR reserve (HRR) ($M = 156.13 \pm 2.93$ cpm), while the RES and ICE sessions consisted of the performance of 5 resistance exercises preceded by 2 min of seated rest or stationary cycling at 70% HRR respectively. Cardiovascular parameters including central and peripheral systolic and diastolic blood pressures (cSBP, cDBP, sSBP, and pDBP respectively) and augmentation index (AIx) were collected prior to and 0, 15, 30, 45, and 60 minutes post exercise with pulse wave analysis using the Sphygmocor Xcel System. Five 3x6 Repeated Measures Factorial ANOVAs were used to examine the presence of an interaction effect or main effects with respect to exercise condition (AER, RES, ICE) and time for cSBP, cDBP, sSBP, sDBP, and AIx. No significant interaction or main effect for condition was found for any of the dependent variables. Significant differences were found for time across the dependent variables cSBP, pSBP, and AIx ($p \leq .05$). These differences represented typical physiological responses to exercise. AIx was significantly elevated following RES 0 and 15 min post exercise ($p \leq .05$) but was not found to significantly increase following AER or ICE. Regardless of exercise condition, acute cardiovascular responses in terms of peripheral and central blood pressures were similar. **CONCLUSION:** Integrated concurrent exercise resulted in similar acute cardiovascular responses compared to aerobic and resistance exercise; however, the aerobic component of ICE may possibly blunt the acute increase in arterial stiffness elicited by RES performed in isolation.

- 2435** Board #99 May 31 11:00 AM - 12:30 PM
Aerobic Training And Vascular Protection: Insight From Altering Blood Flow Patterns
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 (No relevant relationships reported)

Adequate blood flow patterns are essential in maintaining vascular homeostasis. Exercise-induced increases in antegrade, or forward, blood flow is a major modulator of vascular health; however, as vascular function in the conduit arteries is normalized as aerobic training progresses it is unknown if aerobically-trained vessels can adequately counteract vascular insults. **PURPOSE:** The study sought to determine the ability of aerobically-trained individuals to counteract an acute vascular insult (increased retrograde shear). **METHODS:** Ten young male trained rowers (20 ± 1 yrs) and ten male recreationally active controls (24 ± 1 yrs) were recruited for this study. Subjects completed two brachial artery (BA) flow mediated dilation (FMD) tests separated by a 30 minutes of sub-diastolic cuff inflation (60 mmHg) of the forearm. BA diameter, blood flow, and shear rate were evaluated prior to and throughout both FMD tests. **RESULTS:** The sub-diastolic cuff inflation intervention resulted in significant increases in retrograde shear rate ($p < 0.001$) and oscillatory shear index ($p < 0.001$) over time (pre- to post-FMD measures). Significant reductions across time were revealed in brachial artery (BA) dilation (absolute: $p = 0.008$; relative change: $p = 0.011$) and the post-cuff release hyperemic response (BA blood flow AUC: $p < 0.001$; BA shear rate AUC: $p = 0.001$), but no group differences were observed in these variables. **CONCLUSIONS:** This study revealed that individuals with prior upper limb training were unable to attenuate the vascular dysfunction associated with acute increases in retrograde shear.

2436 Board #100 May 31 11:00 AM - 12:30 PM

Influence Of Acute Inflammation On Central Hemodynamics During A Mild Sympathoexcitatory Stimulus.Neil J. McMillan, Elizabeth C. Schroeder, Wesley K. Lefferts, Thessa I.M. Hilgenkamp, Bo Fernhall, FACSM. *University of Illinois at Chicago, Chicago, IL*. (Sponsor: Bo Fernhall, FACSM)

(No relevant relationships reported)

Acute inflammation is associated with an increased risk of cardiovascular events. Acute inflammation causes vasodilation and impairs vascular sensitivity to sympathetically stimuli, which could impact wave reflections and central blood pressure. **PURPOSE:** Determine the effect of acute inflammation on central hemodynamics during a mild sympathoexcitatory stimulus. **METHODS:** Central hemodynamics were assessed in 22 apparently healthy young adults (12 males, 25.3 ± 4.4 years, 22.8 ± 3.2 kg/m²) before and during a mild sympathoexcitatory stimulus (-20 mmHg lower body negative pressure [LBNP]) at baseline and 24h following a typhoid vaccination. Central pressure and augmentation index (AIx) were obtained via radial tonometry and a validated generalized transfer function. Aortic pulse wave velocity (PWV) and reflection index were also measured. Measures were calibrated to brachial mean and diastolic pressure measured via oscillometric cuff. C-reactive protein (CRP) and interleukin-6 (IL-6) were assessed via standard ELISA techniques. **RESULTS:** Acute inflammation was induced with significant increases in IL-6 (1.12 ± 0.53 to 2.38 ± 1.33 pg/mL; $p < 0.001$) and CRP (1.11 ± 2.03 to 2.81 ± 3.79 mg/L; $p = 0.001$). No changes were observed for heart rate or pulse wave velocity in response to inflammation. Acute inflammation resulted in reductions in diastolic and mean arterial pressure, and central augmentation index (AIx) ($p < 0.05$), while reflection index was not altered ($p > 0.05$). There were no effects of LBNP, and no effect of inflammation on LBNP responses (interactions > 0.05). **CONCLUSION:** Acute inflammation lowered mean pressure as well as global wave reflections, suggesting peripheral vasodilation. Central hemodynamic control during a sympathoexcitatory stimulus is preserved during acute inflammation in young, apparently healthy adults.

Variable	Baseline Rest	Baseline LBNP	24hr - Rest	24hr - LBNP
Brachial systolic blood pressure (mmHg)	117 ± 12	117 ± 11	116 ± 9	114 ± 11
Brachial diastolic blood pressure (mmHg)*	71 ± 8	73 ± 7	70 ± 7	70 ± 7
Central systolic blood pressure (mmHg)	103 ± 10	104 ± 9	103 ± 8	102 ± 9
Mean arterial pressure (mmHg)*	86 ± 8	87 ± 8	84 ± 7	84 ± 7
Heart rate (bpm)	56 ± 11	57 ± 10	57 ± 10	56 ± 10
Augmentation index (%)*	3 ± 10	0 ± 11	0 ± 10	-2 ± 12
Augmentation index@HR75 (%)*	-6 ± 12	-9 ± 12	-9 ± 11	-12 ± 14
[§] Pulse wave velocity (m/s)	6.7 ± 0.6	6.6 ± 0.6	6.8 ± 0.6	6.7 ± 0.8
[§] Reflection index (%)	47 ± 8	47 ± 9	44 ± 9	45 ± 10
[§] Forward pulse pressure height (mmHg)	30 ± 7	29 ± 7	31 ± 7	30 ± 7
[§] Reflective pulse pressure height (mmHg)	14 ± 3	13 ± 4	13 ± 4	13 ± 4

All values are mean ± standard deviation. [§]n=21 participants*Effect of inflammation, $p < 0.05$

2437 Board #101 May 31 11:00 AM - 12:30 PM

Greater Reliance On Carbohydrates During Single Leg Versus Double Leg CyclingSarah G. Kearney, Shane Draper, John McDaniel. *Kent State University, Kent, OH*. Email: skearne5@kent.edu

(No relevant relationships reported)

Small muscle mass exercise allows for greater muscle specific blood flow and tissue perfusion. This increase in oxygen delivery should allow individuals to tolerate a greater muscle specific workload which potentially would result in greater reliance on carbohydrate oxidation. However, the metabolic consequences of manipulating active muscle mass is not fully understood. **PURPOSE:** To determine if there is a difference in carbohydrate and fat oxidation between single-leg and double-leg

cycling at the same rate of whole body oxygen consumption. **METHODS:** Eight healthy college aged men (n=5) and women (n=3) completed the study. Participants arrived fasted and completed two conditions across two days (matching for oxygen consumption): 30-minute single leg cycling and 30-minutes double leg cycling. Oxygen consumption (VO₂), respiratory exchange ratio (RER), kilocalories (kcal), carbohydrate oxidation (CHO), fat oxidation (FTO), and power (PWR) were recorded throughout the entire bout of exercise. Paired samples t-tests were performed to find differences in all dependent variables across both conditions. **RESULTS:** Matching for oxygen consumption (1.6 ± 0.39 versus 1.58 ± 0.38 L/min) required slightly lower PWR ($t=3.08$, $p=0.015$) in SL (86.58 ± 25.26 W) than DL (94.23 ± 30.67 W) while still maintaining the same energy expenditure (239.38 ± 75.64 versus 232.19 ± 74.65 kcal). However, participants had a greater rate of carbohydrate oxidation ($t=7.61$, $p<0.001$) during SL (1.46 ± 0.45 g/min) compared to DL (1.01 ± 0.49 g/min). This is further demonstrated with significantly greater RER values ($t=5.28$, $p=0.001$) in SL (0.92 ± 0.03) than DL (0.86 ± 0.05) and reduced FTO in SL ($t=5.47$, $p<0.001$; 0.22 ± 0.06 g/min) than DL (0.36 ± 0.09 g/min). **CONCLUSION:** Despite the same global intensity based on oxygen consumption and energy expenditure within both conditions, there was an increase in CHO and decrease in FTO during SL cycling. This suggests that there is a potential for smaller muscle mass activities (i.e. single leg exercise training) to have greater impact on post-prandial blood glucose control compared to larger muscle mass activities. Future research should consider participants with metabolic disease.

2438 Board #102 May 31 11:00 AM - 12:30 PM

The Effect Of An Antioxidant Cocktail On Flow-Mediated Dilation In Endurance AthletesTrevor J. King, Heather L. Petrick, Philip J. Millar, Jamie F. Burr, FACSM. *University of Guelph, Guelph, ON, Canada*. (Sponsor: Jamie Burr, FACSM)

(No relevant relationships reported)

Flow-mediated dilation (FMD) is a measure of endothelial function, and an FMD response can be initiated by different blood flow induced shear stimuli (e.g. sustained vs. transient exposure), each testing a different aspect of endothelial function. Excessive reactive oxygen species (ROS) are known to impair FMD, but low levels of ROS may be involved in endothelial cell signaling. Endurance exercise bombards the endothelium with ROS and may induce an adaptive response in the endothelium of trained individuals. However, it is unknown whether ROS are involved in the FMD response among endurance trained athletes. **PURPOSE:** To identify the involvement of ROS in the FMD response of trained endurance athletes to a variety of shear stimuli. **METHODS:** 10 trained runners and cyclists (n=3 women) performed an incremental exercise test and two experimental FMD visits. An antioxidant cocktail (AOC) or inactive placebo was given prior to each experimental visit (1 g vitamin C, 600 IU vitamin E, 600 mg alpha lipoic acid). Each identical experimental visit involved 3 FMD tests. FMD was measured as reactive hyperemia (RH)-FMD (transient stimulus), sustained stimulus (SS)-FMD (6-min of 9 kg rhythmic handgrip squeezing), and progressive (p)-FMD (rhythmic handgrip squeezing at 3, 6, and 9 kg). **RESULTS:** Mean VO_{2max} was 58 ± 5 ml·kg⁻¹·min⁻¹. Within each FMD method (RH-, SS-, and p-FMD) shear rate was not different between AOC and Placebo (all $p > 0.4$). SS-FMD was not altered by AOC (PLA = 2.3 ± 1.0 mm, AOC = 2.6 ± 1.6 mm, $p = 0.44$), and the FMD/shear rate slope created using p-FMD was not altered by AOC (PLA = 0.018 ± 0.002 mm·s, AOC = 0.017 ± 0.001 mm·s, $p = 0.78$). There was a trend for a reduction in RH-FMD following AOC consumption (PLA = 3.1 ± 0.8 mm, AOC = 2.5 ± 1.4 mm, $p = 0.08$), and the RH-FMD response to AOC was significantly different from the SS-FMD response to AOC ($p = 0.04$). Following covariation for baseline diameter, SS-FMD ($p = 0.003$) and RH-FMD ($p = 0.04$) were significantly reduced following AOC consumption, and there was a trend for a difference in response to AOC between methods ($p = 0.06$). **CONCLUSIONS:** These preliminary data suggest that ROS may be involved in the FMD response of trained endurance athletes, and the degree of involvement may vary based on shear stress stimulus. *NSERC, CFI, ERA-OMRIS*.

2439 Board #103 May 31 11:00 AM - 12:30 PM

High Intensity Endurance and Resistance Training Does Not Improve Orthostatic Tolerance Compared to Recreationally ActiveCourtney E. Wheelock¹, Hayden W. Hess¹, Zachary J. Schlader, FACSM¹, David Hostler, FACSM². ¹University at Buffalo, Buffalo, NY. ²University at Buffalo, Buffalo, NY. (Sponsor: Dave Hostler, FACSM) Email: cwheeloc@buffalo.edu

(No relevant relationships reported)

Endurance-trained adults often display a relative inability to maintain blood pressure during orthostatic challenges. In contrast, resistance-trained adults often have augmented orthostatic tolerance. However, little is known about the effects of concurrent high intensity endurance and resistance training (CT) on orthostatic

tolerance. **PURPOSE:** To test the hypothesis that CT will have a greater orthostatic tolerance compared to recreationally active (RA) adults. **METHODS:** Twelve subjects (26 ± 4 y), six (3 males) CT (76.5 ± 14.0 kg; fat free mass (FFM) = 66.5 ± 15.1 kg) and 6 (3 males) RA adults (78.5 ± 26.5 kg; FFM = 64.1 ± 22.5 kg) underwent body composition testing (air displacement) followed by a progressive lower body negative pressure (LBNP). The LBNP test began at 20 mmHg and decreased 20 mmHg every 3 min until pre-syncope. Heart rate (ECG; HR), mean arterial pressure (Penaz method; MAP), stroke volume (Modelflow; SV), and changes in leg blood volume measured by calf circumference (plethysmography) were recorded continuously. Orthostatic tolerance was quantified via cumulative stress index (CSI), calculated as the sum of the product of LBNP stage and duration of that stage (e.g., 20 mmHg*3 min + 40 mmHg*3 min, etc.). **RESULTS:** Baseline HR (RA: 66 ± 91 bpm, CT: 62 ± 10 bpm $p=0.72$), SV (RA: 99 ± 29 mL, CT: 100 ± 30 mL $p=0.96$), and MAP (RA: 82 ± 28 mmHg, CT: 83 ± 8 mmHg $p=0.95$) did not differ between groups. During LBNP, SV and MAP decreased, while HR and calf circumference increased (all $p<0.01$). There were no differences in HR, SV, MAP, and calf circumference between groups over time or at pre-syncope (HR- RA: 108 ± 24 bpm; CT: 116 ± 20 bpm $p=0.54$; SV- RA: 32 ± 20 mL, CT: 30 ± 22 mL, $p=0.90$; MAP- RA: 41 ± 18 mmHg, CT: 57 ± 21 mmHg, $p=0.20$; calf circumference- RA: 1.8 ± 1.8%, CT: 3.7 ± 1.6%, $p=0.08$). CSI did not differ between groups (RA: 575 ± 383 mmHg*min, CT: 800 ± 530 mmHg*min, $p=0.42$). **CONCLUSIONS:** Orthostatic tolerance did not differ between combined high intensity endurance and resistance trained adults when compared to recreationally active adults. Combined endurance and resistance training does not improve nor hinder orthostatic tolerance compared to that of recreational exercise.

2440 Board #104 May 31 11:00 AM - 12:30 PM

Attenuated Pulsatile Load During Metaboreflex Activation is Associated with Excess Adiposity in Dynapenic Postmenopausal Women

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The age-related loss in muscle strength (dynapenia) is associated with elevated blood pressure (BP) and fat mass (FM). Aortic pulse pressure (PP), rather than brachial PP, more closely relates to cardiovascular events because it represents left ventricular pulsatile load, which is particularly important in older women. **PURPOSE:** To examine the impact of dynapenia and adiposity on aortic BP responses to metaboreflex activation (post-exercise muscle ischemia, PEMI) in postmenopausal women. **METHODS:** 71 postmenopausal women [(dynapenic, $n=41$, 57±1 years), (non-dynapenic, $n=30$, 59±1 years)] were included in this study. FM, percent body fat (BF%) and percent lean mass (LM%) were measured using Dual Energy X-Ray Absorptiometry. Normalized handgrip strength (nMVC) was calculated as maximal voluntary contraction/body weight. Dynapenia was classified as an nMVC ≤ 0.30 kg/kg. Heart rate and aortic BP (radial applanation tonometry) were measured at rest and during 3-min PEMI following 2-min isometric handgrip exercise at 30% MVC. **RESULTS:** Resting BP was similar in both groups. The dynapenic group had significantly lower nMVC (0.24 ± 0.01 vs 0.38 ± 0.01 kg/kg, $p < 0.001$) and LM% (51.5 ± 0.6 vs 60.9 ± 0.9 , $p < 0.001$), and higher FM (44.5 ± 1.7 vs 26.5 ± 1.3 kg, $p < 0.001$) and BF% (48.5 ± 0.6 vs 39.1 ± 0.9 , $p < 0.001$) compared to the non-dynapenic group. The dynapenic group exhibited a blunted brachial PP (9 ± 2 vs 16 ± 2 mmHg, $p < 0.05$) and aortic PP (9 ± 2 vs 15 ± 2 mmHg, $p < 0.05$) response to PEMI without differences in heart rate response to PEMI (3 ± 1 vs 3 ± 1 beats/min) compared to the non-dynapenic group. In the dynapenic group, attenuated brachial and aortic PP responses to PEMI were related (all $p < 0.05$) to FM ($r = -0.48$; $r = -0.47$) and BF% ($r = -0.51$; $r = -0.49$). **CONCLUSIONS:** Pulsatile load responses to PEMI were blunted in dynapenic postmenopausal women. Excess adiposity contributes to the attenuated pulsatile response to metaboreflex activation in dynapenic postmenopausal women.

2441 Board #105 May 31 11:00 AM - 12:30 PM

Lower Leg Lean Mass Is Associated With Reduced Pulse Pressure Amplification In Postmenopausal Women

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(No relevant relationships reported)

Sarcopenia, the age-related loss of skeletal muscle mass, has been associated with increased arterial stiffness (pulse wave velocity, PWV). Lower leg muscle mass has been associated with increased brachial-ankle PWV (baPWV), a measure of systemic arterial stiffness. Pulse pressure (PP) is lower in the aorta compared to the brachial artery (PP amplification, PPA), in healthy individuals. PPA decreases with aging due

to increased aortic stiffening. Lower PPA is an independent predictor of cardiovascular death. It is unknown whether leg muscle mass is associated with lower PPA in postmenopausal women. **PURPOSE:** To examine relationships between leg lean mass (LegLM), PPA, and baPWV in postmenopausal women.

METHODS: 93 postmenopausal women (aged 48 - 71 years; BMI: 30 ± 7) underwent vascular function and body composition testing. Aortic PP was determined using applanation tonometry. baPWV and brachial PP were measured using an oscillometric device with cuffs placed on the arms and ankles. LegLM was measured by dual-energy x-ray absorptiometry. Handgrip strength was measured as the maximal voluntary contraction (MVC). The relationships between these variables were analyzed using Pearson's correlations. Significant correlations were subsequently analyzed using multiple linear regression.

RESULTS: LegLM was correlated with baPWV ($r = -.218$, $p = .034$) and PPA ($r = .298$, $p = .004$). PPA was also negatively correlated with baPWV ($r = -.261$, $p = .01$). LegLM was positively associated with PPA ($\beta = 0.216$, $t = 2.320$, $p = .023$) after adjusting for age, MVC, systolic pressure, and heart rate.

CONCLUSIONS: Low leg lean mass was related to vascular dysfunction measured as increased systemic arterial stiffness and reduced PPA. Greater muscle mass in the legs may be protective against increased systemic arterial stiffness and reduced PPA associated with aging.

2442 Board #106 May 31 11:00 AM - 12:30 PM
Aerobic Training-induced Increase In Follistatin-like 1 Secretion Is Associated With eNOS Phosphorylation In Diabetic Rats.

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INTRODUCTIN: Aerobic exercise training reduces arterial stiffness via elevation of nitric oxide (NO) production in type 2 diabetes. Follistatin-like 1 (FSTL1) is a muscle-derived myokine and stimulates protein kinase B (Akt)/endothelial nitric oxide synthase (eNOS) signaling via binding to receptor (DIP2A) in endothelial cells. However, it is unclear whether FSTL1 secretion induced by aerobic exercise training is related to a reduction of arterial stiffness in type 2 diabetic rats. **PURPOSE:** This study aimed to investigate whether FSTL1 secretion induced by aerobic exercise training is related to a reduction of arterial stiffness with activation of aortic eNOS phosphorylation in type 2 diabetic rats. **METHODS:** Twenty-week-old male type 2 diabetic (OLETF) rats were randomly divided into sedentary control (OLETF-Con: $n=7$) and aerobic exercise training (OLETF-Ex: treadmill running for 60min at 25m/min, 5days/week: $n=7$) groups. In addition, 7 male LETO rats were used as healthy sedentary control. After 8-week experiment, we measured carotid-femoral pulse wave velocity (cfPWV: as an index of arterial stiffness), and thoracic aorta was isolated after collection of blood. **RESULTS:** Fasting blood glucose and cfPWV significantly increased ($p<0.05$) and aortic Akt and eNOS phosphorylation levels, plasma nitrate/nitrite (NOx) level, and serum FSTL1 protein level significantly decreased ($p<0.05$) in OLETF-Con as compared to LETO. OLETF-Ex showed significant decrease in fasting blood glucose and cfPWV ($p<0.05$), and significant increase in aortic Akt and eNOS phosphorylation, plasma NOx, and serum FSTL1 protein levels ($p<0.05$) as compared to OLETF-Con. However, no significant difference in aortic DIP2A protein level among three groups was seen. Serum FSTL1 protein level was positively correlated with aortic eNOS phosphorylation level ($p<0.05$, $r=0.630$), and plasma NOx level was negatively correlated with cfPWV ($p<0.05$, $r=-0.546$). **CONCLUSION:** The results suggest that the increase in FSTL1 secretion induced by aerobic exercise training is associated with the reduction of arterial stiffness via activation of arterial NO production-related signaling pathway in type 2 diabetic rats. Supported by Grants-in-Aid for Scientific Research (#17H02182, #16K13059, M. Iemitsu)

2443 Board #107 May 31 11:00 AM - 12:30 PM
Effects of Somatosensory Afferent on Cerebral Hemodynamics during Orthostatic Stimulation

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(No relevant relationships reported)

PURPOSE: The effect of somatosensory afferent on the cerebral circulatory control is not clear. This study aimed to reveal whether the somatosensory input from lower extremities can affect cerebral hemodynamic regulation during orthostatic stimulation. **METHODS:** Eleven young adults (4 women) underwent two consecutive 6-min

lower body negative pressure (LBNP) stimulations (-30 mmHg and -50 mmHg) under following two conditions: hanging up the body by a harness (leg-free) and bracing feet on the wood board in the LBNP chamber with slight knee flexion (leg-resisted) against suction. These conditions were conducted in random order. Heart rate (HR), mean arterial pressure (MAP), cardiac output (CO), end-tidal CO₂ (EtCO₂), and cerebral blood flow velocity (CBFv) from the middle cerebral artery were continuously recorded. Dynamic cerebral autoregulation (dCA) was evaluated by transfer function analysis. **RESULTS:** HR was significantly higher, and CO and EtCO₂ were significantly lower during -50 mmHg of LBNP stimulation than each baseline value irrespective of leg conditions, whereas MAP and mean CBFv remained at similar levels throughout the LBNP stimulation under both leg conditions. Power spectral density of mean CBFv in the low-frequency range (0.07-0.2 Hz) significantly increased at -30 and -50 mmHg of LBNP stimulations in the leg-resisted condition (from 1.41 ± 0.62 to 5.42 ± 3.27 and 5.19 ± 3.46) but not in the leg-free condition. Likewise, transfer function gain in the low-frequency range were significantly augmented at -30 and -50 mmHg of LBNP stimulations in the leg-resisted condition (from 1.22 ± 0.34 to 1.58 ± 0.39 and 1.56 ± 0.43) but not in the leg-free condition. **CONCLUSIONS:** These results suggest that somatosensory afferent from lower extremities may modify cerebral hemodynamic regulation during orthostatic stimulation.

2444 Board #108 May 31 11:00 AM - 12:30 PM
Relationship Between Arterial Stiffness And Cardiac Function In Athletes

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Arterial function and left ventricular (LV) function are inter-related. In fact, increased arterial stiffness increases afterload and causes decrease in LV diastolic function in elderly hypertensive patients. The high arterial stiffness causes increased myocardial workload for compensation. However, the relationship between arterial stiffness and cardiac function in athletes remain unknown.

PURPOSE: The present study aimed to determine the relationship between aortic stiffness and LV function in athletes.

METHODS: The participants in this study were 16 male college athletes (age 21.5 ± 0.9 yrs). Carotid-femoral pulse wave velocity (cfPWV), which reflects aortic stiffness, was measured using an automatic oscillometric device. In addition, cardiac function was measured using an ultrasound echography. Color Doppler, Pulsed Doppler, and Tissue Doppler images were recorded and used to assess LV diastolic function, evaluated as the early and late mitral inflow velocity ratio (E/A ratio) and early septal mitral annulus movement velocity (e'). The "E/A ratio" is a classical method of assessing LV diastolic function and is influenced by afterload. On the other hand, "e'" is an index of myocardial stiffness, but is not influenced by afterload. We examined the correlation between cfPWV and each indicator of LV diastolic function. Data analysis was performed using Spearman's rank correlation coefficient.

RESULTS: A negative correlation between cfPWV and E/A ratio (r = -0.557, p = 0.02) was observed. However, there was no correlation between cfPWV and e' (r = -0.076, p = 0.772).

CONCLUSION: These results suggested that higher aortic stiffness causes decreased LV diastolic function in athletes, regardless of LV myocardial stiffness.

2445 Board #109 May 31 11:00 AM - 12:30 PM
Effects Of Habitual Isometric Handgrip Exercise On Arterial Function & Cognitive Function In Older Adults

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Physical exercise is important for prevention of cardiovascular diseases and cognitive impairment and for decreasing its rate of progression. Isometric handgrip exercise can effectively decrease peripheral blood pressure (BP). However, the effects of isometric handgrip exercise on arterial function and cognitive function remain unknown.

PURPOSE: The present study aimed to determine whether habitual isometric handgrip exercise decreases arterial stiffness and improves cognitive function in older adults.

METHODS: Eleven males and females (mean age 75 ± 3 y; ± SEM) who were not actively involved in regular resistance or endurance training. The isometric handgrip exercise comprised four unilateral 2-min isometric contractions at 30% of maximal voluntary contraction using a programmed handgrip dynamometer with 1-min rest periods for five days per week for 8 weeks. Heart-carotid pulse wave velocity (hcPWV), carotid systolic BP (cSBP), brachial systolic BP (bSBP), and brachial diastolic BP (bDBP) were non-invasively measured after resting in the supine position for at least five minutes in both groups before (baseline) and after four weeks of

training using an arterial applanation tonometry system. Trail making test (TMT) Part A, which measures processing speed, and Part B, which assesses task shifting, were used to determine processing speed and flexibility in task switching and cognition.

RESULTS: cSBP and bSBP after training were significantly lower than baseline values, decreasing from 148 ± 6 to 138 ± 5 mmHg and from 140 ± 5 to 132 ± 4 mmHg, respectively (p < .01, for both), although bDBP did not change significantly before and after training (from 81 ± 3 to 78 ± 3 mmHg). TMT-A and TMT-B after training were significantly lower than baseline values, decreasing from 34.73 ± 3.04 to 26.41 ± 2.33 and from 60.52 ± 5.25 to 49.39 ± 4.51 sec, respectively (p < .05 for both). A significant positive correlation was observed between the amount of change in hcPWV and the amount of change in TMT-A (r = 0.595, p < .05). In addition, a significant positive correlation was observed between the amount of change in hcPWV and the amount of change in TMT-B (r = 0.589, p < .05).

CONCLUSIONS: These results demonstrate that isometric handgrip exercises exert a beneficial effect on arterial and cognitive function.

2446 Board #110 May 31 11:00 AM - 12:30 PM
Effect of Musclin on Aerobic Training-induced Reduction of Arterial Stiffness in Obese Rats

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 (No relevant relationships reported)

Aerobic exercise training (AT) reduces arterial stiffness with elevation of arterial nitric oxide (NO) production via activation of endothelial NO synthase (eNOS) phosphorylation even in obesity. Secretion of musclin, a myokine which binds to natriuretic peptide receptor-C (NPR-C) and leads to vasoconstriction, accelerates in obese patients. However, it remains unclear whether AT attenuates musclin secretion and NPR-C levels, thereby decreasing arterial stiffness with the activation of arterial NO production pathway in obese rats. **PURPOSE:** This study aimed to clarify whether AT-induced attenuation of arterial musclin and NPR-C protein levels are related to reduction of arterial stiffness with NO production pathway in obese rats.

METHODS: Twenty-week-old male obese rats were randomly divided into two groups; sedentary control and aerobic exercise training (treadmill running for 60min at 25m/min, 5days/week) (n = 7 each group), and seven male LETO rats were used as healthy sedentary control. After 8 weeks experiment, we measured carotid-femoral pulse wave velocity (cfPWV, an index of arterial stiffness), arterial nitrate/nitrite (NOx), musclin, NPR-C, eNOS phosphorylation (p-eNOS), and Akt phosphorylation (p-Akt) levels.

RESULTS: In sedentary obese rats, cfPWV and arterial NPR-C protein levels increased, and arterial NOx, p-eNOS and p-Akt levels decreased compared to LETO (each p < 0.05). In contrast, AT in the obese rats induced reduction of arterial stiffness and arterial NPR-C protein level, and elevation of arterial NOx, p-eNOS and p-Akt levels (each p < 0.05). AT reduced an augmented arterial musclin level by obesity. Arterial NPR-C protein level was negatively correlated with arterial p-eNOS (r = -0.501, p < 0.05) and NOx (r = -0.645, p < 0.05).

CONCLUSIONS: The results suggest that AT-induced attenuation of arterial musclin and NPR-C protein levels may participate in reduction of arterial stiffness with increased NO production pathway (i.e., Akt/eNOS signaling). Supported by Grants-in-Aid for Scientific Research (17H02182, #16K13059, M. Iemitsu)

2447 Board #111 May 31 11:00 AM - 12:30 PM
Impact of a High Fat Meal Combined with Prolonged Sitting on Central and Peripheral Arterial Stiffness; A Pilot Study

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Acute sedentary behavior, such as prolonged sitting, has a detrimental impact upon markers of central and peripheral arterial health, including arterial stiffness. Similarly, a high-fat meal can also negatively impact post-prandial measures of central and systemic arterial stiffness. However, the interaction between prolonged sitting and high-fat meal consumption and its effects on central and peripheral arterial health has not been investigated.

PURPOSE: To determine the effects of 3 hours of prolonged sitting, with and without a high fat meal on central and peripheral arterial stiffness.

METHODS: Five young healthy males (Age: 22.8±2.5 yrs, BMI: 25±4.4 kg/m²), from a target of 18, have been recruited. Following familiarization, participants visited the laboratory on two occasions and completed a 3 hour period of prolonged sitting following the consumption either a high-fat (HF) or low-fat (CON) meal, in a randomized order. Visits were separated by a minimum of 2, and maximum of 7 days. Before and after prolonged sitting, supine central (carotid-femoral pulse-wave velocity [cfPWV]) and peripheral (femoral-ankle pulse-wave velocity [faPWV]) arterial stiffness were measured. High (60g of fat) and CON (10 g of fat) meals were matched for macronutrient content and volume. Data was analyzed using two-way repeated measures analysis of variance. Alpha was set at $P < 0.1$ *a priori* for preliminary analyses.

RESULTS: A significant interaction effect was observed for cfPWV (Group x Time, $P = 0.079$); *post hoc* analysis revealed that cfPWV increased following HF (Pre = 5.7±0.6 m/s vs. Post = 6.1±0.6; $p < 0.05$, $\eta^2_p = 0.71$) but was unchanged following CON (Pre = 6.2±0.8 m/s vs. Post = 6.2±0.6; $p > 0.05$, $\eta^2_p = 0.016$). No interaction ($P = 0.643$) or group ($P = 0.175$) effect was observed for faPWV, but faPWV did significantly decrease following sitting (Pre = 9.7±0.4 m/s vs. Post = 8.9±0.5; $p < 0.05$, $\eta^2_p = 0.641$).

CONCLUSIONS: The preliminary findings of this study suggest that, in young healthy adults, a high-fat meal, in combination with prolonged sitting may lead to a greater increase in central arterial stiffness than sitting combined with a low fat meal. Further, prolonged sitting may differentially impact central and peripheral arterial stiffness.

2448 Board #112 May 31 11:00 AM - 12:30 PM
Effect Of Isometric Handgrip Exercise On Hypercapnia-induced Shear-mediated Dilation In The Internal Carotid Artery

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(No relevant relationships reported)

The previous study reported that flow-mediated dilation in peripheral conduit arteries decreased following an acute bout of isometric exercise. On the other hand, it remains unknown whether an acute isometric exercise affects cerebrovascular endothelial function. **PURPOSE:** The purpose of the present study was to examine the effect of acute isometric handgrip (IHG) exercise on hypercapnia-induced shear-mediated dilation in the internal carotid artery (ICA). **METHODS:** Four subjects participated in the present study and performed four 2-min IHG exercises at 25% of maximum voluntary contraction. Shear-mediated dilation in the ICA as an index of cerebrovascular endothelial function was measured by using Doppler ultrasound before and immediately after the IHG exercise protocol. Shear-mediated dilation in the ICA was induced by hypercapnia (target end-tidal carbon dioxide; +10mmHg from individual baseline value) and was calculated as the percent rise in peak diameter from baseline value. **RESULTS:** ICA blood velocity and diameter did not change after acute IHG exercise protocol compared with resting value. Also, shear-mediated dilation in the ICA was unchanged by IHG exercise protocol (4.4±2.0 vs. resting value, 4.5±1.9, $P=0.84$). **CONCLUSIONS:** In the present study, the IHG exercise trials did not change cerebrovascular endothelium function. These findings suggest that the response of cerebral endothelial function to IHG exercise is different from that of the peripheral endothelial function.

2449 Board #113 May 31 11:00 AM - 12:30 PM
The Impact Of Pulsed Electromagnetic Field Therapy On Blood Pressure And Circulating Nitric Oxide Levels: A Double-blind, Randomized Study In Subjects With Metabolic Syndrome.

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 (No relevant relationships reported)

Regulation of blood pressure (BP) is important in reducing the risk for cardiovascular disease. There is growing interest in non-pharmacological methods to treat BP including a novel approach using pulsed electromagnetic field therapy (PEMF). PEMF therapy has been proposed to impact physiological function at the cellular and tissue level and one possible mechanism is through an impact on endothelial function and nitric oxide (NO) related pathways

PURPOSE: The purpose of this study was to evaluate the therapeutic effect of PEMF on BP and NO in subjects with metabolic syndrome

METHODS: 23 subjects (PEMF group, Age: 58±12yrs, Ht: 169.7±11.9cm, Wt: 93.2±17.7kg) underwent PEMF therapy (Biomobility Inc., Shanghai, China) and 21 subjects (SHAM group, Age: 59±10yrs, Ht: 167.3±10.7cm, Wt: 87.5±18.1kg)

underwent sham therapy. The protocol for therapy included 16-min sessions, 3 sessions/day for 12 wk using both hands and feet. BP was measured at rest and near the end of submaximal exercise pre and 12 wk post therapy. Moreover, NO was measured at similar time points

RESULTS: There were no changes in wt in either group over the 12 wk of therapy. The PEMF demonstrated a trend toward increases in NO after therapy but SHAM did not ($p=0.09$). For resting BP, there were no differences in systolic BP (SBP), diastolic BP (DBP) or mean arterial pressure (MAP) between groups ($p>0.05$). During exercise, the PEMF had a reduction in pk SBP ($p=0.04$), but not SHAM ($p=0.57$). However the PEMF demonstrated a significant relationship between baseline SBP and change in SBP following therapy ($r = -0.71$, $p < 0.01$) and between MAP and change in MAP following therapy ($r = -0.60$, $p < 0.01$), but there were no such relationships found in SHAM ($r = -0.040$, $p > 0.05$ and $r = -0.043$, $p > 0.05$ respectively). Subjects with resting hypertension (defined as BP>140 SBP) in the PEMF ($n=11$) had significant reductions in SBP, DBP and MAP when compared to SHAM with HTN ($n=9$) ($p < 0.05$). In this sub-group analysis, PEMF demonstrated lowered pk SBP ($p=0.04$) at a given exercise load ($p=0.40$) but SHAM did not ($p > 0.05$)

CONCLUSIONS: PEMF may increase plasma NO availability and improve BP at rest and during exercise. This indicates that PEMF may be a therapeutic technique to regulate BP in metabolic syndrome. However, this beneficial effect appears to be limited to subjects with existing high blood pressure

2450 Board #114 May 31 11:00 AM - 12:30 PM
Sleep Metrics are Associated with Markers of Cardiovascular Disease Risk in Youth

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(No relevant relationships reported)

There is accumulating evidence identifying relationships between insufficient sleep in children and adolescents and negative cognitive, psychosocial, and metabolic health consequences. However, the relationship between childhood sleep metrics and cardiovascular (CV) risk profile is less clearly defined.

PURPOSE: To characterize the relationship between sleep and CV health in young, healthy children through traditional risk factor assessment and vascular function assessments.

METHODS: Sleep metrics and habitual physical activity assessments were performed on 12 young, healthy boys and girls (12.3 ±1 years) using wrist-worn accelerometry for 7 days and nights. Sleep onset latency (SL) was calculated as the mean time of transition from wakefulness to sleep, while sleep efficiency (SE) was calculated as the mean percentage of time spent asleep between sleep onset and wake onset. Central blood pressures and markers of wave reflection were assessed using pulse wave analysis (PWA) with an oscillometric device. Arterial stiffness was assessed through pulse wave velocity (PWV) measurements obtained using applanation tonometry and volumetric displacement. Vascular function was assessed using Doppler ultrasound measurements of femoral artery hemodynamics and diameter during passive leg movement (PLM).

RESULTS: SL was significantly associated with body mass index ($r=0.66$, $p < 0.05$) and PWV ($r=0.64$, $p < 0.05$) and tended to show moderate relationships with leg blood flow (LBF) responses during PLM (Δ LBF from baseline to peak, $r=-0.45$; LBF area under the curve, $r=-0.50$). SE was significantly associated with systolic blood pressure (SBP) ($r=-0.58$, $p < 0.05$) and aortic SBP ($r=-0.57$, $p=0.05$). Subjects whose SE was >85% had lower aortic SBP (86.9 ±1 vs. 93.7 ±2, $p < 0.05$) and tended to have lower percent body fat, more steps per day, and better blood flow responses during PLM compared to those whose SE was <85%.

CONCLUSIONS: Preliminary findings suggest that metrics indicative of better sleep quality, such as greater SE and reduced SL, are associated with more favorable CV profiles in children. These results support the usefulness of assessing sleep as a potential approach for early prevention of CV disease risk during youth.

2451 Board #115 May 31 11:00 AM - 12:30 PM
Investigating the Effect of a High Fat Meal and Prolonged Sitting on Executive Function: A Pilot Study

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(No relevant relationships reported)

Prolonged periods of sitting have been shown to reduce cerebral blood flow and autoregulation, which may subsequently impair executive function. Similarly, the consumption of a high-fat diet can negatively impact cerebral perfusion. However, whether prolonged sitting combined with a high fat meal additionally impairs both executive function and cerebral perfusion is unknown.

PURPOSE: To investigate the effects of consuming a high-fat meal followed by 3 hours of prolonged sitting on executive function and cerebral perfusion.

METHODS: Five young healthy males (Age: 22.8 ± 2.9 yrs; stature 177.7 ± 6.4 cm; mass 78.9 ± 14.3 kg), from a target of 18, were recruited. Following familiarisation, participants completed two randomised sessions of 3 hours of prolonged sitting following the consumption of a high-fat (HF) and low-fat (LF) meal. Each visit was separated by a minimum of 2 and maximum of 7 days. Participants completed a Stroop test (containing both congruent and incongruent trials) and trail-making test (TMT) both pre- and post- sitting period. The TMT consists of two parts, A and B. Continuous wave near-infrared spectroscopy (cw-NIRS) was used to measure cerebral perfusion at AF4 both before (baseline) and throughout each trial. Data was analyzed using two-way repeated measures analysis of variance. Alpha was set at $P < 0.1$ a priori for preliminary analyses.

RESULTS: There were no significant differences between or within trials for completion time for Stroop and TMT part A. Completion time for TMT part B was significantly ($p = 0.078$, $d = 2.2$) faster in the low-fat condition compared to HF condition (16.4 ± 4 s vs. 21.6 ± 0.7 s). There were no significant differences in cerebral perfusion between or within groups ($p = 0.201$).

CONCLUSIONS: These preliminary findings suggest that the consumption of a high-fat meal may negatively impact core executive functions measured by TMT Part B, namely working memory and task-switching ability. However, cerebral perfusion, as measured by cw-NIRS, failed to identify a mechanism. This may be a consequence of limited statistical power given the sample size, or uncertainties regarding the sensitivity of cw-NIRS when measuring cerebral perfusion.

2452 Board #116 May 31 11:00 AM - 12:30 PM
Serial Lower Limb Occlusion and Reperfusion Augments Muscle Oxygen Saturation despite Attenuated Cardiac Hemodynamics

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(No relevant relationships reported)

INTRODUCTION: Remote ischemic preconditioning (RIPC) involves brief, serial manually-imposed blood flow restriction of the limbs. The alternating periods of occlusion and reperfusion lead to endothelial adaptations, capable of enhancing blood flow and oxygen delivery. An understanding of the cardiovascular, ventilatory, and local metabolic adjustments to RIPC is essential to optimize the technique as a physiological stimulus. **PURPOSE:** To investigate reactive and sustained changes in cardiac hemodynamics, local muscle oxygen saturation, and ventilation in response to serial RIPC application. **METHODS:** Ten (M:4, F:6) recreationally aerobically trained college students (22 ± 2 y, 170.4 ± 9.8 cm, 73.6 ± 8.7 kg, 19.8 ± 6.4 % BF, VO_{2peak} : 45.5 ± 5.0 mL·kg⁻¹·min⁻¹ at 208 ± 31 W) received 5-min of alternating-leg blood flow occlusion using a blood pressure cuff (220 mmHg) placed on the upper thighs for a total of 40 min in a supine position. Muscle oxygen saturation (SmO₂) was measured continuously using a portable NIRS-based sensor placed over the vastus lateralis. Cardiac hemodynamics were measured continuously using impedance cardiography. Continuous ventilatory changes in response to RIPC were measured in a small subset (n=4) using a metabolic cart. **RESULTS:** Serial occlusion resulted in a more rapid decrease in SmO₂ over time (15.13 ± 2.95 vs. 16.67 ± 2.12 %·min⁻¹), and a lower heart rate (61 ± 9 vs. 58 ± 7 bpm) and cardiac output (5.1 ± 0.8 vs. 4.9 ± 0.7 L·min⁻¹) from occlusion 1 to 4. Serial reperfusion resulted in a greater reactive peak SmO₂ (86.7 ± 2.4 vs. 88.3 ± 2.8 %), and a lower peak heart rate (74 ± 9 vs. 70 ± 10 bpm) and cardiac output (6.6 ± 0.8 vs. 6.2 ± 0.8 L·min⁻¹) from reperfusion 1 to 4. Ventilatory data suggest a decrease in oxygen consumption from the first to last occlusion (-0.046 ± 0.013 L·min⁻¹) and from the first to last reperfusion ($-0.030 \pm$

0.009 L·min⁻¹). **CONCLUSIONS:** Both the occlusion and reperfusion stimuli appear less physiologically stressful when applied serially, despite a heightened peak SmO₂ following reperfusion. The serial reperfusion response indicates vascular modulation and/or lower local metabolic demand, rather than cardiac hemodynamics, may be responsible for enhancement of local muscle oxygen saturation.

2453 Board #117 May 31 11:00 AM - 12:30 PM
Arterial Smooth Muscle Cell PAQR7 Activation Attenuates Myogenic Tone In Pressurized Cerebral Arteries

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(No relevant relationships reported)

Sex steroid hormones (estrogen, progesterone) are regulators of arterial contractility. Specifically, progesterone exerts rapid, nongenomic vasodilation via membrane receptors termed membrane progesterone receptors (mPR) belonging to the GPCR-like family of Progesterin & Adiponectin Q Receptors (PAQR). Moreover, PAQR7 (mPR α) is reportedly expressed in smooth muscle cells (SMC) of human conduit vessels and has a putative role in vasodilation. However, the expression and function of PAQR7 in pressurized resistance size arteries, arteries that regulate local blood flow and blood pressure, have not been investigated. **PURPOSE:** To examine the expression and physiological function of PAQR7 in cerebral resistance size arteries. **METHODS:** RT-PCR was performed on whole cerebral arteries and isolated arterial SMCs to detect PAQR7 mRNA expression. Western blotting was performed on whole cerebral arteries to examine PAQR7 protein expression. Pressurized artery myography was performed on endothelium-intact and -denuded cerebral arteries to examine the role of SMC PAQR7 in vasodilation using the PAQR7-specific agonist, Org OD 02-0. **RESULTS:** PAQR7 mRNA (whole artery and isolated arterial SMCs) and protein were detected in resistance size cerebral arteries (n=4). Interestingly, there were no significant differences in vasodilation between endothelium-intact and -denuded arteries at any concentration (10^{-9} M to 10^{-5} M, n=4). **CONCLUSION:** These data suggest that arterial smooth muscle PAQR7 activation elicits vasodilation in pressurized resistance size arteries.

2454 Board #118 May 31 11:00 AM - 12:30 PM
Modification of Vascular Function after Acute Handgrip Exercise Training in College Students

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Structural and functional changes in the arterial system following exercise training are well documented. These adaptations are associated with reduced vascular resistance, improved blood delivery and diffusion in the contracting muscles. Training-induced adaptations (i.e., regional vascular improvements) have been reported following one week of exercise training. **PURPOSE:** To examine the influence of an acute unilateral exercise training protocol on microvascular function. **METHODS:** Eleven apparently healthy young college students (age: 22 ± 1.43 years) participated in this study. Microvascular function was assessed (fingertip Digital Thermal Monitoring of vascular reactivity), before and at the end of 5-day training program. Training consisted of a unilateral handgrip training protocol (nondominant arm) at 60% of maximal voluntary handgrip strength, performed for 5 days, 20 min per session, and a cadence of one contraction per 4 sec. **RESULTS:** After training, handgrip strength increased significantly by 14.40 % (pre-training = 36.1 ± 8.7 kg; post-training = 41.3 ± 1.7 kg, $p < 0.05$) in the trained arm. The participants experienced a significant 36% increase in Vascular Reactivity Index (VRI) from baseline (2.60 ± 0.40 to 3.53 ± 0.42 , $p < 0.05$). **CONCLUSIONS:** These data indicate that a localized acute isometric exercise program results in significant improvements in microvascular function among healthy college students. The unilateral improvements in vasoreactivity, once again, confirm the concept of specificity of training.

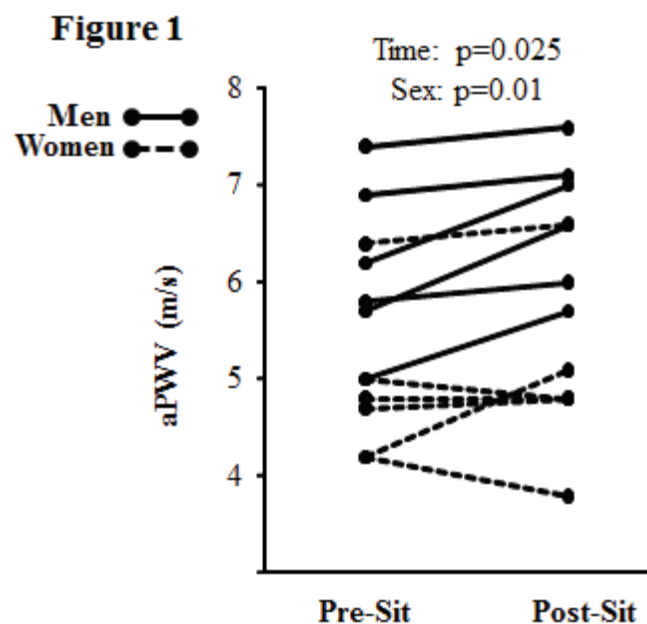
2455 Board #119 May 31 11:00 AM - 12:30 PM

Sex Differences in the Central Arterial Stiffness Response to Prolonged Uninterrupted SittingDaniel Paul Credeur¹, Sabina M. Miller², Raymond Jones¹, Stephanie M. McCoy¹, David R. Dolbow³, Lee Stoner, FACSM⁴.¹University of Southern Mississippi, Hattiesburg, MS. ²George Mason University, Fairfax, VA. ³William Carey University, Hattiesburg, MS. ⁴University of North Carolina, Chapel Hill, NC. (Sponsor: Lee Stoner, FACSM)

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Prolonged periods of uninterrupted sitting (i.e., 3 hours) can negatively affect markers of central vascular health, including aortic arterial stiffness. It is unclear whether individual differences, particularly biological sex, can modify the central vascular health response to prolonged periods of sitting. **PURPOSE:** To test the hypothesis that prolonged sitting will increase (worsen) central arterial stiffness, a response that will be greater in men as compared to women. **METHODS:** Twelve relatively healthy participants (i.e., free of diagnosed disease; women=6) completed a 3-hour bout of uninterrupted sitting. Before and after sitting (supine), assessments of heart rate (HR), mean arterial pressure (MAP), and aortic pulse wave velocity (aPWV) were measured via surface electrocardiography, cuff oscillometry, and applanation tonometry, respectively. **RESULTS:** Participants were similar in age (men=25±2 vs. women=25±3 yrs; $p=0.93$) and BMI (men=29±2 vs. women=25±2 kg/m²; $p=0.17$). Prior to sitting, HR and MAP were similar, but men had a higher aPWV ($p=0.021$). Following sitting, there was a significant reduction in HR (-5±2 bpm; $p=0.027$), with no change occurring in MAP ($p=0.916$). In response to sitting, there was a time ($p=0.025$) and sex ($p=0.010$) effect for aPWV; aPWV increased in men (pre-sit=6.2±0.4 vs. post-sit=6.7±0.3; $p=0.011$) but not in women (pre-sit=4.9±0.3 vs. post-sit=5.0±0.4 m/s; $p=0.55$) (Figure 1). **CONCLUSIONS:** These preliminary findings suggest that prolonged periods of uninterrupted sitting augment central arterial stiffness, a response that appears to be apparent in men, but not in women.



2456 Board #120 May 31 11:00 AM - 12:30 PM

The Reliability of Lower-Limb Pulse-Wave Velocity Assessments Using an Oscillometric TechniqueJake C. Diana¹, Elizabeth Kelsch¹, Katie Burnet¹, Daniel Creuder², Simon Fryer³, Keeron Stone³, Lee Stoner, FACSM¹.¹University of North Carolina at Chapel Hill, Chapel Hill, NC.²University of Gloucestershire, Gloucester, United Kingdom.³University of Southern Mississippi, Hattiesburg, MS. (Sponsor: Lee Stoner, FACSM)

(No relevant relationships reported)

Sedentary behavior appears to target the athero- and arterio-sclerotic susceptible vasculature of the lower extremities. For example, vascular function in the leg is acutely impaired following periods of prolonged sitting. **PURPOSE:** Studies have

relied on techniques which are challenging to perform, therefore impeding further study. Consequently, there is a pressing need to identify precise (reliable), yet simple, techniques for evaluating lower extremity vascular health. Oscillometric assessment of pulse-wave velocity (PWV) in the leg may be one potential solution. The current study aimed to determine the between-day reliability of femoral-ankle PWV (faPWV) in supine and seated positions using the oscillometric-based SphygmoCor XCEL device. **METHODS:** 15 participants (22.1 y, 80% F; BMI 22.7) were tested on three mornings in a fasted state, separated by a maximum of 7 days. In a balanced, randomized order, faPWV was measured in sitting and supine positions using SphygmoCor XCEL. Carotid-femoral PWV (cfPWV) was also assessed for quality control. **RESULTS:** The intra-class correlation coefficient (ICC) for supine faPWV (ICC = 0.89) was above the 0.75 criterion, but not for seated (ICC = 0.54). The standard error of measurement (SEM) was 0.42 m/s and 0.95 m/s in the supine and seated positions, respectively. Similarly, reliability measures for cfPWV met the criterion in the supine (ICC = 0.75, SEM = 0.42 m/s) but not seated positions (ICC = 0.66, SEM = 0.48 m/s). **CONCLUSIONS:** These findings indicate that, in a healthy cohort, faPWV can be determined in supine position with acceptable precision using SphygmoCor XCEL. The next step is to measure precision in populations of varying age and health states. The use of these devices may provide researchers with a simple and precise way of investigating the impact of sedentary behaviors.

2457 Board #121 May 31 11:00 AM - 12:30 PM

Effects of Acute Capsaicin on the Central and Peripheral Hemodynamic Response to Passive Leg MovementStephen J. Ives¹, Gaia Giuriato², Massimo Venturelli², Meaghan Lynch¹. ¹Skidmore College, Saratoga Springs, NY. ²University of Verona, Verona, Italy.

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(No relevant relationships reported)

Previous work in vitro and animal models suggests, capsaicin, the pungent ingredient in peppers, which acts on transient receptor potential vanilloid type 1 channels improves vascular function, in an endothelium and nitric oxide (NO) dependent manner. Recently, topical capsaicin has also been shown to attenuate the metaboreflex in humans. Thus, whether acute oral capsaicin improves an NO-dependent measure of vascular function, or the mechanoreflex response to PLM, remains elusive. **Purpose:** to determine the effects of capsaicin on the vascular and mechanoreflex responses to continuous PLM. **Methods:** In a single blind crossover design, 13 young healthy men (21±3 yr, 177±7cm, and 73±12kg) underwent continuous PLM at 1 hz for 2 min after taking placebo (800 mg fiber) or capsaicin (780 mg pepper extract, ~2mg Capsaicin). At baseline and during PLM, Near-infrared spectroscopy (NIRS) of v. lateralis continuously measured tissue oxygen saturation (StO₂), total hemoglobin concentration (THb), oxyhemoglobin concentration (HbO), and deoxyhemoglobin concentration (Hb), as estimates of microvascular function. Central hemodynamic responses (stroke volume, SV; heart rate, HR; cardiac output, CO; and mean arterial pressure, MAP) were measured using finger photoplethysmography. **Results:** The individual absolute peak change in StO₂ (4.9 ± 1.2 vs 4.0 ± 0.7%), THb (22 ± 15 vs 11 ± 4 ΔμM), HbO (22 ± 16 vs 10 ± 4 ΔμM), and Hb (-2.5 ± 1.3 vs -1.2 ± 1.1 ΔμM), were all unaffected by capsaicin ($p>0.05$, placebo vs. capsaicin, respectively). Exploring the area under the curve (AUC) in StO₂ (301 ± 128 vs 155 ± 85), THb (1491 ± 1032 vs 758 ± 386 μM), HbO (1549 ± 1102 vs 707 ± 318 μM), and Hb (-59 ± 89 vs 51 ± 129 μM) were not different between placebo and capsaicin (all, $p>0.05$). Peak changes in CO (1.3 ± 0.5 vs 1.1 ± 0.2 ΔL/min), and HR (10 ± 4 vs 8 ± 3 Δbeats/min), tended to be lower, while SV and MAP were not different between conditions ($p>0.05$). Post hoc analysis of potential racial differences, people of color and Caucasian's elicited similar individual absolute peak change in StO₂ (3.0 ± 1 vs 3.4 ± 1%), but tended to have lower AUC (108 ± 68 vs. 251 ± 83, $p=0.09$). **Conclusion:** In the current model, using a modest acute dose in young healthy males, capsaicin does not alter the central or peripheral hemodynamic responses to PLM, but warrants further work with aging or disease.

2458 Board #122 May 31 11:00 AM - 12:30 PM

Arterial Stiffness Is Unaffected By Acute Hyperglycemia And Menstrual Cycle Phase In Premenopausal Women.

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BACKGROUND: Acute hyperglycemia results in transient increases in arterial stiffness in healthy males and postmenopausal women. However, research in premenopausal women is lacking and the impact of menstrual phase (early follicular (EF) and late follicular (LF)) on vulnerability to acute hyperglycemia-induced increases in arterial stiffness is unknown. It is hypothesized that increases in arterial stiffness in the EF phase will be attenuated in the LF phase. **PURPOSE:** To examine

the impact of acute hyperglycemia on arterial stiffness in premenopausal women in the early and late follicular phases of the menstrual cycle. **METHODS:** Seventeen healthy, naturally menstruating women (21±1 years) participated in three experimental visits. During two visits ($EF_{Glucose}$, $LF_{Glucose}$), arterial stiffness was assessed via central and peripheral (arm and leg) pulse wave velocity (PWV) before and 15-, 45-, 75-, and 105-minutes after consuming an oral glucose challenge (75g glucose/300mL solution). Blood samples were taken to assess blood glucose (BG), insulin (BI), estrogen, progesterone and blood viscosity levels. During a third visit in the EF phase, participants ingested 300mL of water to act as a time-control for PWV ($EF_{Control}$). **RESULTS:** BG and BI levels increased 30 minutes post-glucose ingestion ($p < 0.001$), with no difference between visits ($p = 1.00$, $p = 0.577$, respectively). Both central and peripheral PWV measurements were unchanged across visits and time. **CONCLUSION:** These results suggest that acute hyperglycemia and menstrual phase do not impact central and peripheral PWV. Premenopausal women may experience protection from acute hyperglycemia-induced increases in arterial stiffness previously observed in men and postmenopausal women. Research supported by: NSERC Discovery Grant & Canadian Graduate Scholarship - Master's

2459 Board #123 May 31 11:00 AM - 12:30 PM

Effects of Resistance Training with Blood Restriction on Flow-Mediated Dilatation of Brachial Artery in Elderly

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(No relevant relationships reported)

Endothelial function is one of the early markers of atherosclerosis and thus consecutively of cardiovascular disease risks. Brachial Artery Flow-Mediated Dilatation (DILA) is an indicator of endothelial function that can be obtained by a non-invasive technique. Physical exercise is a non-pharmacological therapy that has the benefit of homeostasis of endothelial function. **PURPOSE:** To evaluate the effects of resistance training with restriction of blood flow on endothelial function and total occlusion pressure in elderly. **METHODS:** The elderly were invited to participate of the study in the written informed consent term. We selected 37 elderly women who were divided into 3 groups (placebo control (C), 60% restriction of blood flow (R60) and 80% restriction of blood flow (R80)), and were submitted to the DILA protocol, which is a test that verifies the total artery occlusion pressure through an ultrasound and an inflatable cuff, with endothelial control function and the total vascular occlusion pressure, so that the training pressure restriction is determined. All were submitted to a maximum load protocol (1RM), to determine the training load (20% of 1RM) with blood flow with duration of 8 weeks. Comparison of data was done through two-way ANOVA. **RESULTS:** Significant differences were found only in the group that trained with 60% blood flow restriction when compared to all groups in the post-training (C: 0.0213 ± 0.0160 cm vs. R60: 0.0503 ± 0.0180 cm vs. R80: 0.0306 ± 0.0200 cm, $*p \leq 0.05$) and with pre-training of group R60 (0.0190 ± 0.0135 cm vs. 0.0503 ± 0.0180 cm $*p \leq 0.05$). In occlusion pressure, the group which trained with 60% of flow restriction had a difference significant before and after the training R60 (186.67 ± 10.33 mmHg vs. 156.66 ± 16.32 mmHg, $*p \leq 0.05$). **CONCLUSION:** Resistance training with blood flow restriction is able to increase brachial artery dilatation and reduce the pressure of occlusion in elderly women who trained with 60% blood flow restriction.

2460 Board #124 May 31 11:00 AM - 12:30 PM

Effect Of A Two-week Exercise Intervention On Postprandial Extracellular Vesicles In Adults With Prediabetes

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(No relevant relationships reported)

PURPOSE: Postprandial hyperglycemia is a stronger predictor of cardiovascular disease (CVD) compared to fasting glucose, but the mechanism remains unclear. Extracellular vesicles (EVs) are potential bio-effectors that impact CVD, and exercise is known to modify fasting EVs. However, the effect of exercise on EVs in the postprandial state in relation to CVD risk is unknown. **METHODS:** Twelve older (64.7 ± 2.3 yrs), obese (BMI: 31.1 ± 1.7 kg/m²) and sedentary (19.3 ml/kg/min) adults were screened for prediabetes using ADA criteria (75 g OGTT and/or HbA_{1c}). Subjects

underwent 12 bouts of supervised cycle ergometer training at 70%HR_{peak} for 60 min/d. Annexin V- total EVs, platelet EVs (CD31⁺/CD41⁺), endothelial EVs (CD105, CD31⁺/CD41⁺) and leukocyte EVs (CD45⁺/CD41⁺) were collected at fasting and 2-hr during a 75g OGTT from fresh plasma. EVs were analyzed via imaging flow cytometry pre-/post-intervention. CVD risk factors including BMI, VO_{2peak}, glucose, systolic (SBP), diastolic (DBP), arterial pressure (AP), and arterial stiffness (augmentation index; AIx) were assessed at fasting and 2-hr during the 75g OGTT. **RESULTS:** Exercise tended to decrease BMI ($P=0.06$) and postprandial AIx assessed at 2-hr (trend: $P=0.08$) and tAUC₁₂₀ (trend: $P=0.11$), but had no significant effect on VO_{2peak} ($P=0.19$) or 2-hr glucose ($P=0.26$). All AV- EVs except CD31⁺/CD41⁺ increased post-training (all $P < 0.001$). However, when accounting for changes in fasted EVs following training, only AV-CD105 remained significantly elevated at 2-hr post-training ($P=0.01$). Increases in postprandial total AV- EVs correlated with reductions in postprandial AP ($r=-0.73$, $P=0.03$) and AIx ($r=-0.75$, $P=0.02$) while postprandial AV- CD31⁺/CD41⁺ was related to lowered SBP at 2-hr ($r=-0.71$, $P=0.05$). **CONCLUSION:** Although exercise training may modify the postprandial AV- EV response in adults with prediabetes, this response appears to be driven by alterations in fasted EVs. Future work should consider the physiological and clinical relevance of EVs in the fasted versus postprandial state to elucidate the physiologic underpinnings by which postprandial hyperglycemia confers CVD risk.

2461 Board #125 May 31 11:00 AM - 12:30 PM

Cardiorespiratory And Cerebrovascular Function Of Long-neck Karen Women In Thailand

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(No relevant relationships reported)

Karen Kayan women live in the deep forest of northern Thailand. They wear brass coils around their necks all their lives starting from 5-7 years of age. The coils are replaced by a longer one as they grow older. There is only scarce information regarding the physiological and health impact of lifelong wearing of the neck brass coils in these women. **PURPOSE:** To determine the influence of wearing brass neck coils on cardiorespiratory and cerebrovascular function in long-neck Karen tribes. **METHODS:** A total of 28 Karen women (23 – 66 years) living in Mae Hong Son Province (at high altitude) in the northern Thailand were studied. Fourteen Karen women who had been wearing neck brass coils were compared with 14 Karen women who had not been wearing brass neck coils. We also studied 14 age-matched women living at sea level. **RESULTS:** There were no significant group differences in body fat percentage, resting heart rate, and brachial-ankle pulse wave velocity (measure of arterial stiffness). Both systolic and diastolic blood pressure was greater and maximal oxygen consumption was lower in both Karen women than in the sea level controls (all $p < 0.05$). Karen women wearing neck coils demonstrated lower flow-mediated dilation (index of endothelium-dependent vasodilation), lung functions, including forced vital capacity and forced expiratory volume during the first second, and cerebral blood flow velocity than Karen women without neck brass (all $p < 0.05$). **CONCLUSIONS:** Karen women wearing neck brass coils demonstrate reduced endothelial and lung functions as well as cerebral perfusion compared with age-matched Karen women without coils living in the same villages. Karen women wearing brass neck coils may be at elevated risks of developing cardiopulmonary and cerebrovascular diseases. Supported by the 90th Anniversary of Chulalongkorn University, The Ratchadaphisek Somphot Fund and Faculty of Sports Science's Scholarship for Research 2018.

2462 Board #126 May 31 11:00 AM - 12:30 PM

Examination of Underlying Mechanisms Contributing to the Enhanced Post-Exercise Blood Pressure Response.

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Insulin resistance contributes to endothelial dysfunction establishing a causal link between type 2 diabetes and cardiovascular disease. An acute bout of exercise has been shown to enhance insulin sensitivity and endothelium function potentially contributing to a commonly observed reduction in blood pressure post-exercise. However, the underlying molecular mechanism(s) for these improvements in smooth muscle remains unclear. **PURPOSE:** To examine blood pressure response and key signaling proteins involved in insulin sensitivity and endothelial function following an acute session of exercise in aged rodents. **METHODS:** Based on body mass, aged (~12 months) female Sprague-Dawley rats ($n=50$) were assigned to one of four groups: 1) sedentary control group without insulin injection (CON-ins), 2) control group with insulin injection (10mU/g; CON+ins), 3) exercise group without insulin injection (EX-ins), and 4) exercise group with insulin injection (EX+INS). Insulin or saline injections were administered 5-min prior to sacrifice. Under isoflurane anesthesia, blood pressure was assessed and the descending aorta was harvested. Exercise cohorts

were sacrificed 3-hr after a 60-min swimming protocol. Western immunoblotting was used to determine phosphorylated Akt (p-Akt^{Ser473}), phosphorylated AMPK (p-AMPK^{Thr172}), and phosphorylated eNOS (p-eNOS^{Ser1177}). **RESULTS:** Blood pressure was significantly lower following exercise compared to sedentary conditions (EX-ins and EX+ins vs. CON-ins and CON+ins, $p<0.05$). p-Akt^{Ser473} was significantly ($p<0.05$) higher under insulin stimulated compared to non-insulin stimulated conditions, and this effect was also attenuated with exercise (CON+ins > EX+ins; $p<0.05$). Although not statistically significant, there was a trend for a difference between groups in p-eNOS^{Ser1177} (CON+ins: 1.29, CON-ins: 0.80, EX+ins: 1.31, EX-ins: 0.65, $p=0.11$). No significant differences were observed in p-AMPK. **CONCLUSION:** The post-exercise improvement in blood pressure is at least partially mediated by enhanced insulin sensitivity via Akt signaling and potentially p-eNOS signaling in smooth muscle.

2463 Board #127 May 31 11:00 AM - 12:30 PM
Sex Differences In Sitting-induced Vascular Dysfunction: Evidence Of Augmented Antioxidant Defense.

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PURPOSE: This study sought to examine the role of oxidative stress in sitting-induced vascular dysfunction across genders. **METHODS:** On two separate occasions, ten males (25±5 yrs) and eleven females (23±3 yrs) had leg vascular function assessed using passive leg movement (PLM) technique before and after 1.5 hours of sitting. Superficial femoral artery (SFA) blood flow and shear rate patterns, heart rate, mean arterial pressure (MAP), and calf circumference (CC) were measured throughout sitting. One gram of vitamin C (VC) or placebo (PL) was consumed 1.5 hours prior to each sitting trial. **RESULTS:** All subjects ($n=21$), regardless of condition (PL or VC), reported significantly decreased SFA blood flow (-28.6 ± 41.8 ml/min; $p<0.01$) and shear rate (-11.3 ± 15.5 s⁻¹; $p<0.01$) as well as a significant increase in MAP (3.6 ± 5.1 mmHg; $p<0.01$) and CC (1.2 ± 0.3 cm; $p<0.01$) after 1.5 hours of sitting. In the PL trial, a significant decline in leg vascular function, evaluated as ΔPLM_{PEAK} , was evident in males, but not females [$(-210\pm51$ Aml/min) v. $(-43\pm46$ Aml/min); $p=0.02$] after 1.5 hours of sitting. In the VC trial, both groups revealed no significant declines in ΔPLM_{PEAK} [$(-17\pm51$ Aml/min) v. $(-81\pm46$ Aml/min); $p=0.33$]. **CONCLUSION:** This study revealed that females, but not males, display a resistance to sitting-induced lower limb vascular dysfunction. The vascular dysfunction was significantly attenuated with antioxidant supplementation in males, but not females, which implies a greater inherent antioxidant defense and vascular protection in the lower limb vasculature of females.

2464 Board #128 May 31 11:00 AM - 12:30 PM
The Relationship Between Body Mass Index and Aortic Stiffness in Females Across the Lifespan

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 (No relevant relationships reported)

Obesity, classified by a body mass index (BMI) >30 kg/m², continues to be a health concern for women in the United States across all ages. Obesity is a traditional risk factor for the development of cardiovascular disease (CVD). One novel non-traditional predictor of future CVD risk is aortic stiffness. Obese individuals have increased aortic stiffness compared to those of normal body size. **PURPOSE:** Determine the relationship between BMI and aortic stiffness in 476 women between the ages of 9-83 years old. **METHODS:** Girls ($n=123$, age 9-12 years (yrs), BMI 21 ± 5 g/m²), young women ($n=138$, age 18-39 yrs, BMI 24.89 ± 4.46 kg/m²), middle age women ($n=137$, age 40-59 yrs, BMI 26.73 ± 4.22 kg/m²) and older women ($n=78$, age 60-83 yrs, BMI 26.34 ± 4.26 kg/m²) participated in the study. BMI was calculated as weight (kg) / height (m)². Aortic stiffness was measured as carotid-femoral pulse wave velocity (PWV) using applanation tonometry (SphygmoCor; Sydney, Australia). **RESULTS:** According to results from linear regression, BMI was a significant predictor of PWV for the female children ($\beta=0.387$, $p<0.01$, 95% CI 0.03 – 0.076), young women ($\beta=0.635$, $p<0.01$, 95% CI 0.156 – 0.237) and middle age women ($\beta=0.508$, $p<0.01$, 95% CI 0.113 – 0.210). BMI was not a significant predictor of PWV in the older women ($\beta=0.107$, $p=0.20$, 95% CI -0.073 – 0.178). When exploring age-group by BMI interaction terms, significant group differences were detected in the relation between BMI and PWV. Using the young women as a reference group – there was no significant difference between the slopes of the regression lines for BMI and PWV between the young and middle age women ($\beta=-0.03$, $p=0.36$, 95% CI -0.11 – 0.04). There were significant differences between the slopes of the regression lines between the young women and girls ($\beta=-0.14$, $p<0.01$, 95% CI -0.21 – -0.08) and between the young

women and older women ($\beta=-0.14$, $p<0.01$, 95% CI -0.23 – -0.06). **CONCLUSION:** Our data suggest that the relationship between BMI and aortic stiffness changes with advancing age. BMI is a significant predictor of aortic stiffness in females between the ages of 9-59 yrs, but not in elderly females (>60 yrs). In older females changes in body composition (i.e. increases in body fat and decrease in muscle mass) may change the relationship between BMI and aortic stiffness.

FUNDING SOURCES: NIH, DRI, AHA, ACSM

2465 Board #129 May 31 11:00 AM - 12:30 PM
Differing Impact of Weight Cycling on Ambulatory Blood Pressure Versus Conventional Blood Pressure Assessment: A Possible Explanation to Controversy

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BACKGROUND: Weight Cycling (WC) is a widespread behavior associated with deleterious cardiovascular (CV) health, including elevated blood pressure (BP). Yet, a 2010 review analyzing the effects of WC on BP concluded there was not enough quality evidence to draw any sort of decisive conclusions. Ambulatory BP (ABP) monitoring is recognized as a superior method of measurement and predictor of the CV state when compared to traditional laboratory BP assessment. The impact that WC may have on ABP per se is unknown.

METHODS: Impact of self-reported WC history on ABP was assessed via a causal comparative non-experimental design. Sixty-five women completed the Weight and Lifestyle Inventory questionnaire (WALI). The WALI has been shown to be a reliable index of WC ($r=.87$, $P<0.001$). Subjects were classified as weight cyclers (WC) if they reported a weight loss of ≥ 4.5 kg at least 3 times followed by weight regain. Those who reported less than this were classified as non-weight cyclers (NWC). Main outcome was mean differences between groups on laboratory BP and ABP.

RESULTS: WC ($n=31$) were older (39.7 ± 8.9 vs 33.1 ± 11.3 yr), had a higher percent body fat (47.1 ± 6.2 vs 41.4 ± 7.8 (%)), and were less fit (21.2 ± 5.4 vs 26.7 ± 7.6 ml.kg⁻¹.min⁻¹) than NWC ($n=34$). No significant differences were found for laboratory BP values. WC women had higher systolic (130.1 ± 13.6 vs 122.0 ± 8.2 mmHg, $P=0.006$) and diastolic (76.2 ± 8.9 vs 70.0 ± 9.0 mmHg, $P=0.011$) ABP values than NWC women. Systolic (23% versus 17%, $P<0.001$) and diastolic (13% versus 9%, $P<0.001$) BP load was higher for WC compared to NWC women.

CONCLUSION: WC may deleteriously impact BP outcomes that might only be witnessed when ABP monitoring is used.

2466 Board #130 May 31 11:00 AM - 12:30 PM
Vascular Response to Submaximal Intensity Aerobic Exercise in Individuals with Down Syndrome

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Individuals with Down syndrome (DS) exhibit autonomic dysfunction, which causes significant reductions in aerobic capacity (VO_{2peak}). Autonomic dysfunction alters central regulation of the cardiovascular system in DS, demonstrated by reduced peak heart rate and cardiac contractility. Vascular function, especially arterial stiffness, is inversely related to aerobic capacity and is a well-known cardiovascular disease risk factor. However, there is very limited information regarding vascular function in response to moderate intensity exercise in individuals with DS. **Purpose:** To investigate the hemodynamic and vascular response to moderate intensity exercise in individuals with and without DS (control). **Methods:** Thirty-eight volunteers (DS=19, age=24 yr for each group) participated in this study. Central hemodynamic variables (aorSBP, aorDBP, aorPP, AIx@75) and pulse wave velocity (PWV) were measured with an ambulatory blood pressure monitor. Carotid ultrasonography was used to obtain arterial stiffness indices β -stiffness and elastic modulus (Ep). All measures were performed at baseline and immediately- and 30-min post moderate intensity treadmill exercise. **Results:** Individuals with DS had significantly lower VO_{2peak} (DS: 28.3 ml/kg/min; Control: 40.8 ml/kg/min). There were no group differences in the hemodynamic response (aorSBP, aorDBP, aorPP) to exercise between DS and controls ($p>0.05$ for all). Furthermore, no group differences were observed in arterial stiffness variables, AIx@75, β -stiffness, PWV and Ep, in response to exercise ($p>0.05$ for all). **Conclusions:** Our results suggest that individuals with DS do not exhibit different arterial stiffness and altered hemodynamic responses to moderate intensity exercise when compared individuals without DS.

	DS (N = 19)			Control (N = 19)		
	Baseline	Immediate Post EX	30 min Post EX	Baseline	Immediate Post EX	30 min Post EX
aorSBP (mmHg)	109 ± 12	112 ± 12	110 ± 14	111 ± 10	117 ± 10	110 ± 10
aorDBP (mmHg)	71 ± 9	77 ± 8	73 ± 9	73 ± 6	83 ± 8	76 ± 9
aorPP (mmHg)	37 ± 7	51 ± 11	37 ± 11	38 ± 8	50 ± 14	34 ± 10
Alx@75	10.2 ± 13.2	22.2 ± 7.0	19.0 ± 12.1	16.6 ± 15.3	26.4 ± 8.1	15.5 ± 8.2
PWV (m/s)	5.2 ± 0.4	5.3 ± 0.5	5.2 ± 0.5	5.1 ± 0.4	5.4 ± 0.4	5.1 ± 0.4
B-Stiffness	4.0 ± 1.0	4.4 ± 1.3	4.3 ± 1.3	3.7 ± 0.8	4.3 ± 0.7	4.2 ± 0.9
Ep	48.5 ± 14.0	52.34 ± 14.5	50.3 ± 14.0	43.89 ± 11.6	53.5 ± 9.7	50.1 ± 10.9

Mean ± SD, Significance level, $p < 0.05$

2467 Board #131 May 31 11:00 AM - 12:30 PM
The Influence of Habitual Physical Activity on Arterial Baroreflex Sensitivity in Healthy Young Adults

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The arterial baroreflex is an essential component of beat-to-beat blood pressure (BP) regulation, and impaired baroreflex function is associated with cardiovascular disease states. Exercise training in at-risk populations improves (increases) sympathetic baroreflex sensitivity (sBRS) and cardiac vagal baroreflex sensitivity (cBRS). While high habitual physical activity (PA) has cardioprotective benefits, it is unknown if high habitual PA is associated with improved arterial baroreflex function in healthy young adults. **PURPOSE:** We tested the hypothesis that high habitual PA is associated with greater sBRS and cBRS. **METHODS:** Seventeen non-obese adults (sex: 7F/10M, age: 24±3 years, BP: 110±12/60±8 mmHg) underwent muscle sympathetic nerve activity (MSNA; microneurography, n=12), beat-to-beat BP (finger photoplethysmography), and heart rate (single-lead ECG) measurements throughout ten minutes of quiet supine rest. The sequence method was used to estimate spontaneous cBRS using beat-to-beat time series of systolic BP and R-R interval (HemoLab v8.9). Briefly, baroreflex sequences were identified when systolic BP and R-R interval changed in the same direction in four or more consecutive cardiac cycles. Overall cBRS was determined by combining up and down sequences (increase/decrease in both systolic BP and R-R interval, respectively). Spontaneous sBRS was estimated using beat-to-beat time series diastolic BP (3mmHg bins) and MSNA burst area. Step count and moderate-to-vigorous PA (MVPA) were assessed via accelerometry (ActiGraph wGT3X) over seven consecutive days. **RESULTS:** Among participants, mean step count was 8766±3778 steps/day (4884-18520 steps/day) and mean MVPA was 79±31 min/day (45-140 min/day). Overall cBRS was 30±14 ms/mmHg (up: 30±20 ms/mmHg; down: 37±24 ms/mmHg) and spontaneous sBRS was -1.3±0.6 AU MSNA/beat/mmHg diastolic BP (mean±SD for all). Higher step count ($r=-0.62$, $p=0.03$) and MVPA ($r=-0.68$, $p=0.02$) were associated with greater spontaneous sBRS. Higher step count ($r=-0.43$, $p=0.12$) and MVPA ($r=0.41$, $p=0.14$) were not significantly associated with greater overall cBRS. **CONCLUSIONS:** These preliminary findings suggest that high habitual PA is associated with greater sympathetic, but not cardiac vagal, baroreflex sensitivity in healthy young adults.

2468 Board #132 May 31 11:00 AM - 12:30 PM
Association Among Bone-loading Physical Activity, Arterial Stiffness, And Body Composition In Healthy College-aged Students

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(No relevant relationships reported)

PURPOSE: The aim of this cross-sectional study was to determine if bone-loading physical activity was positively related to arterial stiffness and body composition in healthy college-aged students. **METHODS:** Healthy college-aged women (n=56, 20.3±1.3 years) and men (n=47, 21.0±1.2 years) between the ages of 18 and 25 years were recruited from the University of Massachusetts Lowell. The total bone-specific physical activity questionnaire (tBPAQ, average of past and current BPAQ) was used to obtain a comprehensive account of lifetime bone-loading physical activity. We

measured the carotid to femoral pulse wave velocity (cf-PWV) to evaluate arterial stiffness using a novel oscillometric device (SphygmoCor XCEL). Dual energy X-ray absorptiometry was used to measure lean mass (kg) and percent body fat (%BF) for this study. **RESULTS:** Pearson's correlation tests showed a significant inverse relationship between tBPAQ and cf-PWV ($r=-0.338$, $p=0.011$) in college-aged women; however, this relationship was not found in college-aged men ($p>0.05$). There were significant negative correlations between tBPAQ and %BF in both college-aged women ($r=-0.265$, $p=0.048$) and men ($r=-0.306$, $p=0.036$). No significant relationships were found between tBPAQ and lean mass in both groups ($p>0.05$). **CONCLUSION:** We found that bone-loading physical activity was negatively associated with arterial stiffness measured by the cf-PWV in college-aged women, but not in men. The %BF was inversely related to tBPAQ scores in both college-aged women and men. Thus, high impact bone-loading physical activity could be recommended to improve arterial stiffness and reduce %BF in young college-aged students.

2469 Board #133 May 31 11:00 AM - 12:30 PM
Characterization Of Exercise Blood Pressure Responses In Adolescents With A Chronic Inflammatory Condition

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(No relevant relationships reported)

Exaggerated blood pressure (BP) responses to exercise are prognostic of cardiovascular disease (CVD) in adults. There are no criteria to define exaggerated BP responses in children, yet higher exercise BPs have been shown to be associated with CVD risk factors. Therefore, exercise BPs may provide important prognostic information in children, especially those at higher risk for CVD. **PURPOSE:** The study sought to characterize the exercise BP responses in an "at-risk" sample of adolescents with a chronic inflammatory condition. **METHODS:** Twenty-one adolescents (7 males; 14.7 ± 1.8 years) with a confirmed single diagnosis of chronic kidney disease, cystic fibrosis, inflammatory bowel disease, juvenile idiopathic arthritis or type 1 diabetes mellitus participated in this study. Brachial BP was assessed using a motion-tolerant automated auscultatory device every 2 minutes during the McMaster All-Out Progressive Continuous cycling test, using pediatric-specific criteria for test termination at "maximal" effort. Maximal BPs were compared to (1) sex-specific reference values for healthy adolescents, and (2) exaggerated BP criteria for adults. **RESULTS:** Maximal systolic BPs for males and females were 184 ± 35 and 172 ± 19 mmHg, respectively. Maximal diastolic BPs for males and females were 71 ± 11 and 74 ± 9 mmHg, respectively. Two males (29%) had a maximal BP above reference values with one having a higher systolic BP and the other having a higher diastolic BP. Nine females (64%) had a maximal BP above reference values with five exceeding the systolic BP reference, one exceeding the diastolic BP reference, and three exceeding both BP references. An exaggerated BP response occurred in two males and two females. **CONCLUSION:** Approximately half of our sample of adolescents with a chronic inflammatory condition reached higher exercise BPs compared to healthy adolescent reference values. Elevated exercise BPs were also more common in females compared to males, and 19% of our sample met the adult-criteria for exaggerated BP responses. Collectively our observations of elevated exercise BPs in an "at-risk" population highlight the importance of examining BP responses in children, including research on its potential prognostic value.

Funding: Canadian Institutes of Health; Heart and Stroke Foundation

2470 Board #134 May 31 11:00 AM - 12:30 PM
A Comparison of Whole Blood Viscosity and Hematocrit Levels between Yoga Practitioners and Sedentary Adults

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(No relevant relationships reported)

Alterations in rheological measures such as elevations in whole blood viscosity (WBV) and hematocrit (Hct), have been linked with increased risk of cardiovascular disease (CVD). Endurance training has been demonstrated to lower WBV and Hct; however, evidence supporting the efficacy of yoga in modulating WBC and Hct is sparse. **PURPOSE:** The purpose of this trial was to determine the effect of a regular yoga practice on WBV and Hct. **METHODS:** A cross-sectional study was conducted examining WBV at multiple shear rates and Hct levels among yoga practitioners with a minimum of 3 months of consistent practice and sedentary, healthy adults. Fasting blood samples were collected from an antecubital vein from a total of 42 participants: 23 sedentary adults and 19 regular yoga practitioners. Brachial arterial blood pressure (BP) was measured and the averages of 3 measures were reported. **RESULTS:** Yoga practitioners had significantly lower WBV at 45 s⁻¹ ($p < 0.01$), 90 s⁻¹ ($p < 0.01$), 220 s⁻¹ ($p < 0.05$), and 450 s⁻¹ ($p < 0.01$) than sedentary participants. No significant group differences in Hct ($p = 0.38$) were found. A tendency toward lower systolic BP ($p=0.06$)

was observed in the yoga practitioner group; however, no significant group differences in BP were exhibited. **CONCLUSION:** Although a consistent yoga practice was associated with lower WBV, a health indicator related to CVD risk, yoga was not associated with changes in Hct, a major determinant of WBV.

E-35 Free Communication/Poster - Bone and Bone Mineral Density

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2471 Board #135 May 31 11:00 AM - 12:30 PM Bone Health in Elite Norwegian Endurance Cyclists and Runners: A Cross-Sectional Study

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Athletes who compete in non-weight-bearing activities such as swimming and cycling are at risk of developing low bone mineral density (BMD). Athletes in long distance running are at risk of low BMD.

PURPOSE: 1. To evaluate the bone health in Norwegian male and female national-elite road cyclists and middle- and long distance runners, and to identify cases of low BMD, classified as having a Z-score ≤ -1 , according to ACSM criteria. 2. To identify possible risk factors associated with low BMD.

METHODS: Twenty-one runners, 11 females and 10 males, and 19 road cyclists, 7 females and 12 males were enrolled in this cross-sectional study. DXA measurement of BMD in total body, femoral neck and lumbar spine was measured. Participants completed a questionnaire regarding training, injuries, calcium intake and health variables.

RESULTS: The cyclists had lower BMD for all measured sites compared to the runners ($p \leq 0.05$). Ten of 19 cyclists were classified as having low BMD, despite reporting to train heavy resistance training on the lower extremities. One male cyclist had a Z-score ≤ -2 . Low BMD was site-specific, having occurred in the lumbar spine and the femoral neck, and was not confined to females. Type of sport was the only factor significantly associated with low BMD.

CONCLUSIONS: National elite Norwegian road cyclists had lower BMD compared to runners, and a large proportion were classified as having low BMD, despite having performed heavy resistance training. Interventions to increase BMD in this population should be considered.

2472 Board #136 May 31 11:00 AM - 12:30 PM Relationship of Bone Mineral Density and Body Composition in Student Athletes and College Aged Students

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Introduction: Bone health and body composition (BC) provide insights into the risk factors for fracture and other bone related disease. Peak bone development is thought to be achieved in the young adult years of an individual's life and can be indicative of the risk of osteoporosis later in life. Regular physical activity can be a major factor in healthy bone development. **Purpose:** To elucidate the relationship between bone mineral density (BMD) and BC measurements between a college aged non-student athlete (NA) population and a student-athlete (ATH) population. **Methods:** Bone mineral density (BMD) and BC measurements from NA population ($n = 61$) and from ATH population ($n = 39$) were collected using the Dual Energy X-ray Absorptiometry (DEXA). Furthermore, sex specific differences between and within the subgroups were evaluated. The variables compared between groups for the two-sample t-tests included BMD, weight (WT), fat mass (FM), lean mass (LM), and bone mineral content (BMC). Statistical analysis was performed using Minitab 18 software. **Results:** No statistical difference was found for BMD, WT, LM, and BMC between subgroups. However, sex-specific differences were present for all variables of interest (BMD Females: 1.170 ± 0.07 g/cm² vs Males: 1.277 ± 0.105 g/cm²; WT Females: 132.0 ± 20.3 lbs vs Males: 169.1 ± 25.7 lbs; FM Females: 36.1 ± 13.5 lbs vs Males: 27.0 ± 16.0 lbs;

LM Females: 90.3 ± 13.1 lbs vs Males: 135.0 ± 18.0 lbs; BMC Females: 5.61 ± 0.87 lbs vs Males: 7.3 ± 1.07 lbs). Pearson's correlation coefficient results indicate that there was a moderate to strong relationship between BMD and lean mass for all groups.

Conclusions: Activity may play a role in the relationship between BMD and BC. The results of this study can help direct future studies on bone health and BC. Data from this study could be utilized in the formation of a predictive model for the development and interactions of osteoporosis and obesity. Such a model would help in the identification of risk factors early in life so appropriate intervention can be put in place. Quantitative bone health and BC data can help coaches and medical professionals prescribe appropriate training and medical interventions if necessary for subjects who are at risk for developing bone or metabolic diseases. Small sample size and lack of activity data were limitations of this current study.

2473 Board #137 May 31 11:00 AM - 12:30 PM Regional Lumbar Bone Mineral Density Differs In Cricket Fast Bowlers With Lumbar Bone Stress Injury

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Lumbar bone stress injuries (LBS) are among the most serious sustained by fast bowlers in cricket, with symptoms often indistinguishable from low back pain.

They most often occur in the non-dominant lumbar spine in response to the unique lumbar loading characteristics of fast bowling. It is not known whether lumbar spine bone mass differs according to current or previous LBS. **PURPOSE:** To determine differences in lumbar bone mineral density (BMD) between current LBS, previous LBS and never LBS fast bowling groups. **METHODS:** 58 fast bowlers (mean \pm SD: age: 21.23 ± 4.21 years; height: 1.88 ± 0.06 m; body mass: 84.13 ± 9.14 kg) declared as fit to bowl received a lumbar MRI scan (3.0T Discovery MR750w, GE Healthcare, Milwaukee, WI), an AP lumbar DXA scan (Lunar iDXA, GE Healthcare, USA), and had their medical history and MRI scans reviewed for historical incidence of LBS. MRI scans were analysed to determine current LBS. DXA scans were analysed to measure specific bone accrual of dominant (ipsilateral to bowling arm) and non-dominant sides of the lumbar spine. Rectangular custom regions of interest (Lunar enCORE v 17.0) were added to the lateral 33% of each lumbar vertebral body, to exclude the spinous process, and BMD of these regions were calculated. One-way ANOVA determined if groups differed in age, height, body mass, and whole vertebra BMD. Two-way mixed repeated measures ANOVA determined within and between group differences between sides. **RESULTS:** MRI and medical history demonstrated 19 current, 23 never and 16 previous LBS fast bowlers. Age was significantly greater ($p < 0.05$) in previous LBS (23.71 ± 4.80) compared with current (19.52 ± 2.22) and never LBS (20.90 ± 4.36). No significant differences were found between groups for height, body mass or whole vertebra BMD ($p > 0.05$). BMD was higher at the non-dominant than dominant side of the vertebrae (1.63 vs. 1.50 g/cm², $p < 0.001$) and this differed between vertebra (3.0 - 30.8%, $p < 0.001$) and groups ($p = 0.03$). BMD on the dominant side was higher in current (+4.4%) and previous (+3.7%) than never LBS. BMD on the non-dominant side was lower in current (-2.3%) and previous (-0.8%) than never LBS. **CONCLUSION:** Bone mineral accrual differs between current, never and previous LBS groups possibly due to differences in bowling technique, workload and maturation, and may identify those at risk of LBS.

2474 Board #138 May 31 11:00 AM - 12:30 PM Biometric, Dietary And Training Influences On Bone Mineral Content In Competitive Triathletes

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PURPOSE: Physical activity is important for optimal bone development, however, biometric, training, and dietary practices may compromise bone health. The purpose of this study was to explore potential influences on bone mineral content (BMC) in competitive triathletes.

METHODS: Participants were 12 male and 13 female triathletes. Standard protocols were used to determine BMC (DXA), weight (digital scale), training volume (self-reported exercise duration X intensity) caloric intake (7 day dietary recall) and calcium intake (7-day dietary recall).

RESULTS: Participants were 25 adult triathletes. Males ($n=12$) had an average weight of 169 lbs (± 18.9), BMC of 2,737 g (± 507.4), training volume of 44,948 ($\pm 18,433$), total lean mass of 62,686 g (± 6083.6), kcals of 2,776 (± 774.1), and calcium intake of 991.5 (± 577.2). Females ($n=13$) had an average weight of 127.8 lbs (± 17.3),

BMC of 2,092 (± 239.8), training volume of 30,934 ($\pm 11,377.8$), total lean mass of 42,727 (± 3958.8), average kcals of 1,987.4 (± 386.0), and calcium intake of 755.0 (± 365.9). Results of bivariate correlations for males indicated significant positive associations among BMC and weight ($r = 0.85$, $p < .001$), and total lean mass ($r = 0.72$, $p < .001$). There were no significant correlations among BMC and calories, calcium or training volume. Preliminary analyses using multiple linear regression indicated that weight, caloric intake, calcium, total lean mass, and training volume did not significantly explain potential influences on BMC for males. For females results of the bivariate correlations found significant positive associations among BMC and weight ($r = 0.74$, $p < .01$), and total lean mass ($r = 0.49$, $p < .05$). There were no significant correlations among BMC and calories, calcium or training volume. Preliminary analyses using multiple linear regression indicated that weight, caloric intake, calcium, total lean mass, and training volume explained 74.4% of the variance in BMC for females ($p < .05$). Weight ($\beta = 0.97$) was the only significant predictor at the univariate level.

CONCLUSION: Given the critical role that optimal bone development plays in overall health, it is important to consider potential influences on BMC, particularly in long endurance athletes. Further studies with more participants are needed to better understand the current findings.

2475 Board #139 May 31 11:00 AM - 12:30 PM

Development of Skeletal System on Young Elite Basketball Players Between 10-19 Years

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Several studies have been reported, the positive effects of basketball playing on the bone system. (Rodrigues 2017; Agostinete 2016; Tarmo 2016).

PURPOSE: We described - in a cross-sectional study - the physical development and bone status of 172 basketball players. Our hypothesis is the growth of the bone mass - in the examined age period - does not necessarily parallel with the developmental pattern of the bone structure.

METHODS: The sample divided into age groups: U12 (10.9 \pm 0.3 years), U14 (12.1 \pm 0.6 years), U16 (14.1 \pm 0.7 years), U18 (16.1 \pm 0.7 years), U19 (17.4 \pm 0.4 years). The biological maturity defined by estimating the bone age and morphological age. The bone age estimated with Sunlight Bone Age ultrasound scanner and the morphological age estimated on specific anthropometric measure, Mészáros-Mohácsi method (Mészáros 1983). Bone structure measured by GE Lunar Prodigy DEXA scanner with Medimaps TBS inSight software. Statistical analysis completed with IBM SPSS Statistics 21 software. The measurements carried out between March 2017 and September 2018.

RESULTS: The bone mass (BMC) increase significantly ($p < 0.05$) correlated ($r = 0.92$) with the changes of the longitudinal parameters of the players. The change pattern is similar to the change of the body weight. Most of the bone density (BMD) value found in the normal range. The mean values of the age groups showed the BMD developmental pattern is different from the change of the BMC. We observed the mean values of the bone structure between the U12 and U14 age groups were located at the lower edge of the normal range. Surprisingly, increase of the BMC followed by the change of the bone structure at U14 and later age groups (during the late phase of puberty). The BMD values stagnate at age U16 and U18. Mean values of the BMD were the upper part of the normal range after the age of U18, it also means the structure of the bone reached the status of the adults.

CONCLUSIONS: Our results confirm our hypothesis about the structural change in the growing bone mass is non-linear. After the intensive growing period there is a delay in bone density development. We observed increased number of the bone fracture during the examination period, it could be explained by the above finding.

2476 Board #140 May 31 11:00 AM - 12:30 PM

Sedentary Time Predicts 2-Year Longitudinal Bone Strength in Hispanic Girls

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(No relevant relationships reported)

Physical activity during adolescence is important for optimizing bone strength during this rapid period of bone mineral accrual. However, most adolescent females do not meet the physical activity guidelines of 60 min moderate to vigorous physical activity (MVPA) per day and sedentary time has been associated with decreased bone mineral density (BMD) and bone strength. The effect of sedentary time on longitudinal bone strength has not been established in adolescent Hispanic females.

PURPOSE: To determine if baseline sedentary time predicts 2-year longitudinal tibia and femur bone strength in Hispanic girls. **METHODS:** A cohort of primarily Hispanic adolescent females ($n = 112$), age 9-12 years, wore tri-axial accelerometers

for seven consecutive days at baseline. Evenson cut points were used to classify sedentary activity. Femoral and tibial bone strength strain index (SSI) was assessed using peripheral quantitative computed tomography (pQCT) at 2-year follow up. We used linear regression analysis to test associations between sedentary time and SSI after controlling for relevant variables (baseline SSI, lean soft tissue mass, height, maturity offset, and ethnicity). **RESULTS:** Average daily sedentary time was 865 ± 84 minutes. Sedentary time was negatively associated with femur and tibia SSI, although the association was only significant for tibia SSI ($p = 0.029$). **CONCLUSION:** Higher levels of baseline sedentary time are associated with lower longitudinal (2-year follow-up) SSI in the tibia and femur. Interventions to decrease sedentary time in adolescent females may improve bone outcomes.

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Predictors	β (SE)	95% CI	P
66% Tibia Adjusted R-squared = 0.858			
Baseline Sedentary Time (min/day)	-0.40 (0.18)	(-0.77, -0.04)	0.029
Maturity Offset (years)	-93.42 (25.89)	(-144.76, -42.09)	< 0.001
Hispanic Ethnicity*	23.91 (33.58)	(-42.68, 90.50)	0.478
Height (cm)	12.02 (3.33)	(5.42, 18.62)	< 0.001
Lean soft tissue mass (kg)	12.45 (4.10)	(4.33, 20.58)	0.003
Baseline Strength Strain Index	0.82 (0.069)	(0.68, 0.95)	< 0.001
Constant	-1302.86 (472.46)	(-2239.67, -366.04)	0.007
20% Femur Adjusted R-squared = 0.808			
Baseline Sedentary Time (min/day)	-0.33 (0.27)	(-0.87, 0.20)	0.216
Maturity Offset (years)	-92.63 (38.63)	(-169.28, -15.98)	0.018
Hispanic Ethnicity*	81.42 (49.04)	(-15.88, 178.72)	0.100
Height (cm)	16.06 (4.83)	(6.48, 25.64)	0.001
Lean soft tissue mass (kg)	22.38 (5.98)	(10.51, 34.25)	0.003
Baseline Strength Strain Index	0.72 (0.09)	(0.55, 0.89)	< 0.001
Constant	-1965.63 (686.17)	(-3327.14, -604.11)	0.005

2477 Board #141 May 31 11:00 AM - 12:30 PM

Lower Limb Peak Power and Cortical and Trabecular Bone Strength in the General Population

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(No relevant relationships reported)

Physical activity is beneficial to both the skeletal and muscular systems. The connection between muscular forces and bone strength is explained by the Mechanostat Theory (bone responds to forces applied to them). Therefore, muscle function tests may provide a non-invasive measure of bone strength. Recent studies report significant correlations between lower limb muscle power and bone strength (Janz, 2015, Yingling, 2017).

PURPOSE: To assess the relationship between lower limb power and bone strength in the cortical and trabecular bone of the radius and tibia in a healthy (non-athletic) population.

METHODS: 40 females (age (yrs) 31.6 ± 12.5 , height (cm) 160.7 ± 6) and 37 males (age (yrs) 26.8 ± 7.7 , height (cm) 172.8 ± 7.7) performed a vertical jump test. Peak Power (PP) was calculated from vertical jump height (Sayers, 1999). Peripheral Quantitative Computed Tomography (pQCT) was used to quantify bone strength at the radius and tibia for both cortical and trabecular sites. Cortical site measures included Moment of Inertia (J), Cortical Area (Ct.Ar), cortical Bone Mineral Density (cBMD), Strength-Strain Index (SSI). Bone Strength Index (BSIc), Total Area (T.Ar.tb), trabecular volumetric Bone Mineral Density (vBMD.tb), and trabecular volumetric Bone Mineral Content (vBMC.tb) were measured. Pearson's correlation analyses were run $p < 0.05$.

RESULTS: PP measures were associated with cortical and trabecular bone strength parameters in the tibia and radius. Strong associations were found in cortical bone sites except for cBMD as indicated by the correlation coefficients (r) [tibia - J (0.7374), Ct.Ar (0.7650), SSI (0.7344), radius - J (0.7028), Ct.Ar (0.7830), SSI (0.6788)]. Similar results were found in the trabecular region for both the tibia and radius respectively [BSIc (0.6199), T.Ar.tb (0.5204), vBMc.tb (0.6016), vBMD.tb (0.4415) and BSIc (0.7950), T.Ar.tb (0.5943), vBMc.tb (0.7371), vBMD.tb (0.7188)]. **CONCLUSIONS:** PP is associated with cortical and trabecular bone strength parameters in the radius and tibia for a diverse population of healthy adults. PP seems to have the greatest effect on bone strength and structure for both the cortical and trabecular sites, but is not associated with cortical BMD. Lower limb muscle power could provide a means to monitor bone health in a general population.

2478 Board #142 May 31 11:00 AM - 12:30 PM
Body Composition, Bone Mass and Bone Geometry in Adolescent Athletes

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Sports practice is a strong osteogenic stimulus promoting bone mineral accrual, and growing bones have more responsive improvements to high-impact sports. **PURPOSE:** To analyze the influence of exposure to soccer and basketball practice on body composition, bone mass, and bone geometry in adolescent male athletes, accounting for maturity-associated variation on body composition. **METHODS:** Three hundred and eighty young athletes (soccer: $n = 235$, age = 14.2 ± 0.94 years, body mass = 57.1 ± 9.7 kg, stature = 169.1 ± 10.3 cm; basketball: $n = 145$, age = 14.7 ± 0.13 years; body mass = 68.6 ± 16.4 kg; stature = 177.1 ± 13.8 cm). Body composition, bone mineral content (BMC) and bone mineral density (BMD) of whole body, posteroanterior lumbar spine (L1-L4), femoral neck and geometric variables, such as strength index, buckling ratio, section modulus, cross-sectional moment of inertia (CSMI) and cross-sectional area (CSA) were evaluated by Dual-energy X-ray absorptiometry (model iDXA, GE Healthcare Lunar, enCoreTM software version 13.60, 2011, Madison, WI, USA). Estimated peak height velocity was based on the protocol by Moore (2015). Analysis of covariance (Quade), for non-parametric ANCOVA, was used to examine the variation on body composition, bone mass, and bone geometry of players grouped by sport. **RESULTS:** There was a significant difference between the modalities only for femoral neck parameters [BMO ($F_{\text{Anova}}: 11.237$; $p=0.001$), BMC ($F_{\text{Anova}}: 6.676$; $p=0.010$)] and Bone Geometry [Strength Index ($F_{\text{Anova}}: 51.407$; $p<0.001$), Buckling ratio ($F_{\text{Anova}}: 50.189$; $p<0.001$), Section Modulus ($F_{\text{Anova}}: 175.874$; $p<0.001$), CSMI ($F_{\text{Anova}}: 164.921$; $p<0.001$) and CSA ($F_{\text{Anova}}: 165.230$; $p<0.001$)]. All parameters were higher for basketball, except for Strength Index. **CONCLUSION:** Our results suggest that youth basketball practice may promote a higher effect on bone parameters (BMD, BMC and geometry) related to the femur in contrast to soccer, probably due to the specificity of the modality.

Table 1. Results for the variables of body composition, bone mass and bone geometry according to modality.

Parameters	Variables	Basketball (n=145)				Soccer (n=235)			
		Mean	SD	Min	Max	Mean	SD	Min	Max
Body composition	Fat Mass (Kg)	13.40	5.12	5.61	36.92	8.61	2.49	5.03	22.57
	Fat Free Mass (Kg)	52.36	13.15	25.34	84.69	46.00	8.35	24.19	65.42
Bone Mass	Whole body BMD (cm ²)	1.17	0.17	0.79	1.60	1.12	0.12	0.80	1.44
	Whole body BMC (g)	2905.40	761.87	1334.90	4547.34	2527.73	496.50	1214.73	3881.13
	L1-L4 BMD (cm ²)	1.16	0.22	0.67	1.65	1.07	0.16	0.71	1.52
	L1-L4 BMC (g)	68.84	23.47	25.28	116.57	57.74	15.22	22.42	108.92
	Femoral Neck BMD (cm ²)	1.25	0.22	0.66	1.91	1.23	0.16	0.89	1.73
	Femoral Neck BMC (g)	6.45	1.54	3.24	9.89	6.08	1.07	3.26	9.59
	Strength Index	1.88	0.47	0.90	3.80	2.35	0.54	1.20	4.20
Bone Geometry	Buckling Ratio	3.88	1.92	1.10	9.70	3.88	1.64	1.40	9.70
	Section Modulus (mm ³)	926.53	315.57	363.90	1700.70	825.52	219.06	365.30	1958.30
	CSMI (mm ⁴)	15945.85	6445.47	5138.00	33646.00	13574.54	4396.37	4489.00	38402.00
	CSA (mm ²)	204.48	50.14	97.00	327.00	190.61	34.31	110.00	325.00

SD: standard deviation, Min: minimum, Max: maximum

This work was conducted during a master's scholarship financed by CAPES - Brazilian Federal Agency for Support and Evaluation of Graduate Education within the Ministry of Education of Brazil.

2479 Board #143 May 31 11:00 AM - 12:30 PM
Non-dominant Hand-grip Strength Is Positively Associated With Areal Bone Mineral Density In College-aged Women

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 (No relevant relationships reported)

Previous studies have focused on the relationship between areal bone mineral density (aBMD, g/cm²) and non-dominant hand-grip strength in older populations; however,

there is a lack of research analyzing this relationship in the younger college-aged population. **PURPOSE:** The purpose of this study was to demonstrate the relationship, if any, between aBMD and non-dominant hand-grip strength in healthy college-aged students. **METHODS:** One hundred and four participants aged 18-25 (57 women, 20.3 ± 1.3 years; 47 men 21.0 ± 1.2 years) were recruited from the University of Massachusetts Lowell. aBMD of the non-dominant side of femur (FN: femoral neck, TH: total hip) and lumbar spine (L1-L4) was measured by dual energy X-ray absorptiometry (DXA). JAMAR Dynamometer was used to measure non-dominant hand-grip strength (kg) and body composition (lean mass, kg) was measured by DXA. The total bone-specific physical activity (tBPAQ, average of past and current BPAQ) score was used to obtain a comprehensive account of lifetime physical activity related to bone health. **RESULTS:** Pearson's correlation tests showed positive correlations between non-dominant hand-grip strength and aBMD of the non-dominant FN ($r=0.559$, $p=0.001$), TH ($r=0.523$, $p=0.001$), and lumbar spine ($r=0.430$, $p=0.001$) in college-aged women. These relationships were not observed in college-aged men ($p>0.05$). There were positive relationships between non-dominant hand-grip strength and lean mass in both college-aged men ($r=0.540$, $p=0.001$) and women ($r=0.647$, $p=0.001$). No significant relationships were found between BPAQ scores and aBMD in both groups. **CONCLUSION:** This study presents evidence that aBMD is positively correlated with non-dominant hand-grip strength in college-aged women, but not in college-aged men. Further analysis is needed to better understand the factors associated with this relationship.

2480 Board #144 May 31 11:00 AM - 12:30 PM
Muscular Fitness And Bone Health In Athletes And Non-athletes

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 (No relevant relationships reported)

Abstract

Muscular fitness has been associated with several health-related outcomes including bone health. However, evidence on this relationship considering sport participation is scarce. **Purpose:** To examine associations between several expressions of muscular fitness and bone speed of sound (SoS) in young people of both sexes according to current sport participation (ATHL-athletes engaged in formal competition vs. Non-ATHL - non-athletes). **Methods:** Participants were 184 boys (11.1-18.9 yrs old; 90 athletes) and 198 girls (12.2-18.8 yrs old; 45 athletes) at and above the age of peak height velocity (PHV). Bone SoS evaluation was conducted by quantitative ultrasound (QUS) at the distal radius (R-SoS) and midshaft tibia (T-SoS) of the non-dominant limbs. Muscular fitness included the handgrip strength (HG), the vertical jump (VJ), agility (shuttle-run 4x10m), and speed (20-m sprint test). All statistical analyzes were performed separately for boys and girls and adjusted for maturity (yrs from the age of PHV), body mass index (WHO z-BMI), and daily calcium intake. **Results:** The ANCOVA revealed superior muscular fitness in athletes compared to non-athletes ($p<0.05$) in both sexes, with the exception of HG strength in which no differences were observed. There were no dissimilarities in bone SoS between the athletes and non-athletes, except for the tibia in which the male athletes showed lower SoS than the non-athletes (ATHL: 3743.78 ± 8.90 m/s vs. Non-ATHL: 3775.33 ± 8.71 m/s, $p=0.013$). In both sexes, multiple linear regression showed a greater number of muscular fitness predictors of bone SoS in non-athletes than in athletes: in non-athletes, the HG strength associated with the T-SoS ($\beta=5.36$, $p=0.002$) and the speed with the R-SoS ($\beta=-58.97$, $p=0.001$) in girls and the VJ height ($\beta=3.01$, $p=0.017$) and speed ($\beta=-71.69$, $p=0.022$) associated both with the T-SoS in boys. In athletes, HG strength associated with R-SoS ($\beta=1.99$, $p=0.049$) in girls and the sprint associated with the T-SoS ($\beta=-65.78$, $p=0.020$) in boys. **Conclusion:** Despite higher values of muscular fitness, athletes did not reveal higher bone SoS than non-athletes and showed less associations between these variables. In young people, muscular fitness appeared to be a better marker of bone health in non-athletes compared to athletes.

2481 Board #145 May 31 11:00 AM - 12:30 PM
Relationship Of Physical Activity With Bone Parameters In Young Hispanic Girls

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 (No relevant relationships reported)

Increased levels of moderate-to-vigorous physical activity (MVPA) are associated with enhanced bone mass/density development in non-Hispanic children, which may prevent osteoporosis later in life. This relationship has not been established in Hispanic females; as osteoporosis rates increase, an understanding of this relationship across populations is vital. **PURPOSE:** To determine the impact of MVPA on bone density, content, structure and strength in young Hispanic girls. **METHODS:** Young, primarily Hispanic female subjects ($N=320$), age 9-12 yr., wore accelerometers for

seven consecutive days. Wear time was classified into sedentary, light, moderate, and vigorous activity based on Evenson cut points. Femoral and tibial bone density, content, strength, and architecture were assessed using peripheral quantitative computed tomography (pQCT). Whole body soft tissue composition was measured by DXA. Associations between each bone variable and average daily MVPA were determined using multivariate regression, adjusting for maturity offset, BMI, and ethnicity. **RESULTS:** Average height, weight, and percent fat were 145.8 ± 9.6 cm, 44.1 ± 14.7 kg, and $32.5 \pm 9.8\%$, respectively. Multiple linear regression resulted in consistently significant ($p < 0.05$) or trends toward significant associations between bone parameters and daily MVPA. Average daily MVPA was 22.3 ± 63.1 minutes. Femur 20% periosteal circumference, strength-strain index (SSI), 4% tibia average bone strength index, average periosteal circumference, average cortical thickness, and 66% tibia cortical content, periosteal circumference, and SSI all had significant associations with average daily minutes of MVPA, while other pQCT measures approached significance. The variance explained by MVPA ranged from approximately 0% to 4.8%. Together, BMI, maturity offset, and ethnicity explained 2.6% to 70.2% of the variance in the models. **CONCLUSION:** There is a significant positive relationship between average daily MVPA levels and bone content and strength in Hispanic girls. Physical activity interventions could lead to enhanced bone development and strength, as shown in non-Hispanic populations. Sponsored by: NIH Grant 5R01HD074565-05

2482 Board #146 May 31 11:00 AM - 12:30 PM
Middle School Recreational Sport Participation as a Determinant of Adult Muscle and Bone Strength

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(No relevant relationships reported)

Physical activity during adolescence promotes the development of skeletal strength and muscle function. Musculoskeletal adaptations result from mechanical forces common in sporting activities. Recent studies have reported strong positive correlations between muscle power and bone strength (Janz, 2015, Yingling, 2017).

PURPOSE: To determine if participation in middle school sports (self-report questionnaire) resulted in greater muscle and bone strength later in life.

METHODS: 79 participants, 41 female and 38 male (age (yrs) 29.2 ± 10.8 , height (cm) 166.5 ± 9.2 , body fat (%) 24.6 ± 9.3) performed a Relative Grip Strength (RGS) test using a hand grip dynamometer, 1 Repetition Maximum leg extension test (1RM), and a vertical jump test. Peak Power (PP) was calculated from jump height (Sayers, 1999). Peripheral Quantitative Computed Tomography (pQCT) was used to measure bone strength (polar Strength-Strain Index (SSI_p)) in the cortical region of the tibia and radius. A questionnaire completed by participants stated "Did you participate in recreational sports during middle school (Grades 6-8)?" Welch's t-test determined differences in the muscle function tests and bone strength measures based on middle-school sports participation.

RESULTS: 55 individuals participated in recreational sports during middle school, 16 individuals did not. Those who participated in sports during middle school had an average relative PP of 55.41 W/kg, RGS of 6.46 N/kg, 1RM of 2.86 RW/BM, radial SSI_p of 279.31 mm³, and tibial SSI_p of 2036.13 mm³. Individuals that did not participate in recreational sports during middle school had an average PP of 49.12 W/kg, RGS of 5.58 N/kg, 1RM of 2.45RW/BM, radial SSI of 268.49 mm³, tibial SSI of 1957.50 mm³. Middle school sports participation resulted in significantly greater PP ($p = 0.008$), RGS ($p = 0.010$) and 1RM ($p = 0.018$) but no differences were found for bone strength in either the radius or tibia.

CONCLUSIONS: Adolescence is a key time for bone and muscle strength adaptation. However, the results suggest that self report of middle school recreational sport involvement may not be an optimal way to predict muscle and bone strength in adulthood. Evaluating past activity by survey has limitations with self-reported activity including the inability to determine the intensity of activity.

2483 Board #147 May 31 11:00 AM - 12:30 PM
Morning Downhill Exercise Reduces Bone-resorption Marker After Midday, But Not After Morning Meal.

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(No relevant relationships reported)

PURPOSE: In view of the importance of nutrient intake in suppressing markers of bone resorption, our aim was to find out the time course of changes in plasma concentrations of markers of bone formation (osteocalcin (OS) and C1CP, C-terminal

propeptide of type 1 collagen) and resorption (CTX, C-terminal telopeptide of type 1 collagen), relative to 40 minutes of downhill or uphill exercise performed at 8-8:40 h, and to three isocaloric meals eaten at 7, 13, and 19 h.

METHODS: Twenty postmenopausal women, 58 y old, were assigned to walk on either an uphill (slope 8 to 12 °) or -6° downhill treadmill for 40-minutes (40 UP, 40 Down) or to remain sedentary. Ground reaction forces (GRF) were measured with mechanosensitive Novel Pedar shoe inserts, and physical effort as % VO₂max with a metabolic cart. Hourly measurements of anabolic growth (GH) and parathyroid (PTH) hormones, catabolic cortisol and bone markers served to assess the metabolic responses relative to timing of meals and exercise. An osteogenic index was calculated as percent change in the C1CP/CTX ratio.

RESULTS: Peak GRFs were significantly higher in downhill (1097 N) than uphill (814 N) exercise while relative effort was significantly higher during uphill than downhill exercise (74.6% vs 46.6% VO₂ max, respectively) exercise. In the 40 Down trials, the osteogenic C1CP/CTX ratio rose between 13 and 20 h with a peak between 15 and 17 h and produced a 55% greater area under the curve relative to 40 Up and SED trials. There was a significant correlation between the C1CP/CTX and the GRFs ($r^2 = 0.708$, $F = 15.55$, $p < 0.0009$), as was the case for the OS/CTX ratio. The GH/cortisol ratio was elevated between 15 and 20 h, and the PTH/cortisol ratio between 16 and 22 h in 40 Up compared to 40Down and SED groups. Cortisol concentration was elevated in 40 Up trial. There was no correlation between the osteogenic and anabolic endocrine indices.

CONCLUSIONS: Greater mechanical loading in downhill morning exercise increases the osteogenic bone-marker and anabolic hormone indices after the start of midday meal, but not after the morning meal. No such anabolic effect is seen after uphill exercise which produces lower mechanical loading, higher VO₂ max and high cortisol response. This suggests that optimal anabolic responses to morning loading exercise require energy intake during the midday meal.

2484 Board #148 May 31 11:00 AM - 12:30 PM
Racial/Ethnic Differences in Bone Health, Bone Free Lean Mass, and Fat Mass in Young Women

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(No relevant relationships reported)

The burden of osteoporosis and fracture incidence varies significantly with race/ethnicity. Caucasians are reported to have a lower bone mineral density (BMD) than African-Americans, and a higher, lower, or similar BMD than Asians. However, majority of these studies are focused on East-Asians, with few well-defined studies focusing on South-Asians, who are culturally and geographically different from East-Asians. **PURPOSE:** The purpose of the current study is to evaluate bone mineral density/content, bone free lean mass (BFLM) and strength, and fat mass in young women belonging to Caucasian, East-Asian and South-Asian descent. **METHODS:** Twenty-nine young women aged 18-30 years self-identified themselves as Caucasian (Cau; n=13), South-Asian (SA; n=11), and East-Asian (EA; n=5). Quadriceps (Q) angle was measured using a hand-held goniometer. Body composition (fat, BFLM, and bone mineral content) and total and regional BMD were measured using Dual Energy X-Ray Absorptiometry, while handgrip, jump test, and 1Repetition-Maximum (1-RM) leg press were used to quantify lower limb muscle strength and power. Ethnic differences in each outcome variable were determined using one-way ANOVA, and Pearson correlation coefficients quantified relationships between variables. Statistical significance was set at $p < 0.05$. **RESULTS:** Q-angle was significantly higher in SA in comparison to Cau ($p < 0.05$). Muscle strength tests revealed that Cau had considerably higher values for 1-RM leg press than SA ($p = 0.027$). Jump height ($p = .002$) and time in air ($p = .003$) were considerably higher for Cau and EA compared to SA. Additionally, SA had a significantly higher percent body fat and fat mass at the total body and in the lower limbs ($p \leq 0.001$). Though non-significant, BFLM was highest in Cau, followed by EA, and least in SA ($p = 0.068$). **CONCLUSION:** Our preliminary data indicates an increased adiposity in SA, without a concurrent increase in muscle mass. Such a phenotype is deteriorative for bone, and suggestive of an early, sub-clinical form of osteosarcopenic obesity. We also see differences in percent body fat and muscle strength between EA and SA, emphasizing the need to consider these two groups separately while assessing the bone-muscle-fat unit.

2485 Board #149 May 31 11:00 AM - 12:30 PM
Tibia Bone and Soft Tissue Characteristics in Oral Contraceptive Users and Non-Users
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Oral contraceptives (OC) contain different formulations of the synthetic estrogen, ethinyl estradiol (EE), and progestin; these sex steroids can exert metabolic effects on bone, muscle, and fat tissues. OC use affects body composition and bone density; however, its effects on muscle quality are not clear. Increased fat infiltration within the muscle associated with OC use could negatively impact muscle quality and performance. **PURPOSE:** To compare tibia bone and soft tissue variables assessed by pQCT in OC users and Non-users. **METHODS:** Women ages 20-30 were divided into low dose OC users (<20 ug EE, n=18), high dose OC users (>20 ug EE, n=15) and Non-users (n=22). Bone variables (vBMD, geometry, strength) were measured at 4%, 38%, and 66% of the non-dominant tibia by pQCT. Muscle and fat densities and areas were analyzed by BoneJ software at the 66% site. **RESULTS:** There were no significant differences between low dose and high dose OC users for any variables. Low dose and high dose OC groups did not differ from Non-users in age, height, BPAQ scores, or calcium intake. Weight-adjusted comparisons determined low dose OC users had lower total BMC (p=0.046), total area (p=0.003), Peri C (p=0.003), cortical area (p=0.048), and SSI (p=0.022) than Non-users at the 38% site. High dose OC users had lower muscle area (p=0.041), total fat density (p=0.039), and subcutaneous fat density (p=0.030) than Non-users at the 66% site. **CONCLUSION:** Our findings suggest that OC formulated with EE concentrations > 20 µg affect tibia soft tissue characteristics while OC pills containing < 20 µg affect bone variables. Further investigations are needed examining multiphasic combined OC to provide a more comprehensive picture of OC effects on soft tissue and bone characteristics.

Table 1. Bone and Soft Tissue Characteristics in OC Users and Non-Users (Mean ± SD)

Variables	Non-Users (n=22)	Low Dose OC Users (n=18)	High Dose OC Users (n=15)
Muscle Density (mg/cm ³)	79.79 ± 1.74	79.92 ± 1.24	79.85 ± 0.78
Muscle Area (cm ²)	69.38 ± 11.73	60.10 ± 10.86	59.91 ± 6.7*
Total Fat Density (mg/cm ³)	1.70 ± 2.99	1.46 ± 3.51	-0.40 ± 2.59*
Total Fat Area (cm ²)	29.80 ± 10.97	27.84 ± 12.27	30.20 ± 6.97
Subcut Fat Density (mg/cm ³)	1.11 ± 3.01	0.09 ± 3.55	-1.11 ± 2.57*
Subcut Fat Area (cm ²)	27.13 ± 10.79	25.37 ± 12.08	27.70 ± 6.90
38% Total BMC (mg/mm)	356.02 ± 55.79	305.02 ± 38.86*	320.16 ± 52.50
38% Total Area (mm ²)	384.47 ± 50.54	320.24 ± 44.11**	353.09 ± 54.75
38% Peri C (mm)	69.37 ± 4.56	63.29 ± 4.46**	65.89 ± 4.80
38% Cortical Area (mm ²)	286.58 ± 46.61	243.99 ± 32.06*	257.86 ± 40.52
38% SSI (mm ³)	1653.75 ± 346.47	1300.15 ± 249.10*	1481.84 ± 323.40

*p<0.05, **p<0.01 significantly different than Non-Users, Subcut = Subcutaneous, Peri C = Periosteal Circumference, SSI = Strength-strain Index

2486 Board #150 May 31 11:00 AM - 12:30 PM
Hip Structural Analyses Characteristics Based on Physical Activity Status in Young and Middle-aged Premenopausal Women
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Mechanical loading associated with physical activity (PA) is important for optimizing hip bone health. Bone cells are inherently mechanosensitive and adapt to the mechanical environment. Bone adaptation to loading is regulated by the Wnt signaling pathway, which is inhibited by several glycoproteins including sclerostin (Scl) and Dickkopf-1 (DKK-1). Elevated Scl levels are associated with low bone mineral density and increased risk for hip fracture. **PURPOSE:** This study compared age and PA level differences in hip structural analyses (HSA) variables [SI (strength index);

SM (sectional modulus); BR (buckling ratio); and CSMI (cross-sectional moment of inertia)] in young (20-30 yrs, n=25) and middle-aged premenopausal women (35-45 yrs, n=25). The relationships between Scl and DKK-1 with HSA variables were also studied. **METHODS:** Fasting morning blood samples were analyzed for serum Scl and DKK-1 by ELISA. HSA variables were measured at dual femur site by DXA. PA levels were classified as low moderate-active (LM) and health enhancing physical activity-active (HA) based on the International Physical Activity Questionnaire. **RESULTS:** Two-way ANOVA showed a significant age group effect for Lt SM, which was lower in middle-aged women (p<0.05). Significant main effects of age and PA (p<0.05) were found for Rt BR, which was higher in middle-aged and lower in HA women. HSA variables were not correlated with serum Scl and DKK-1 levels (p>0.05). **CONCLUSIONS:** Lower SM and higher BR in middle-aged women support an age-related decrease in hip bone strength. Based on our findings, HSA variables are not related to Wnt signaling inhibitors.

Table 1. HSA variables based on Age and PA Levels (Mean ± SD)

Variables	Young (n=25)		Middle-aged (n=25)	
	LM (n=13)	HA (n=12)	LM (n=12)	HA (n=13)
Rt SI	1.5 ± 0.0	1.7 ± 0.3	1.4 ± 0.2	1.6 ± 0.3
Lt SI	1.6 ± 0.3	1.7 ± 0.4	1.5 ± 0.3	1.5 ± 0.3
Rt SM (mm ³)	659.1 ± 110.8	702.5 ± 138.8	614.9 ± 110.2	614.5 ± 116.3
Lt SM (mm ³)*	651.6 ± 84.3	714.91 ± 139.3	627.1 ± 129.9	593.7 ± 93.8
Rt BR***	3.0 ± 0.6	2.0 ± 0.5	3.4 ± 1.2	2.9 ± 0.9
Lt BR	2.9 ± 0.9	2.8 ± 1.0	3.1 ± 1.1	3.4 ± 1.0
Rt CSMI (mm ⁴)	103100 ± 2798.0	10671 ± 2924.3	9397.1 ± 2188.1	9393.8 ± 32151.1
Lt CSMI (mm ⁴)	9914.5 ± 1898.8	11041.8 ± 2857.4	9690.8 ± 2457.3	8986.5 ± 1565.1

* Significant age effect p<0.05; ** Significant PA levels p<0.01; Rt, Right; Lt, Left

2487 Board #151 May 31 11:00 AM - 12:30 PM
Six-month Assessment Of Biomarkers, Skeletal Attributes, Body Composition, And Performance In Collegiate ROTC Members
 Breanne S. Baker, Samuel R. Buchanan, Alison Balderas, Hoang Van M. Nguyen, Cameron S. Combs, Christopher D. Black, FACSM, Michael G. Bembien, FACSM, Debra A. Bembien, FACSM. *University of Oklahoma, Norman, OK.* (Sponsor: Dr. Debra Bembien, FACSM)
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Physical activity has been associated with greater areal bone mineral density (aBMD) and reduced fracture rates, however, active military personnel report high rates of bone injuries. Current assessment tools, DXA, pQCT, and serum biomarkers, have not been consistently correlated with injury status in this cohort. **PURPOSE:** To follow ROTC and matched controls over six months and study changes in parathyroid hormone (PTH) and sclerostin concentrations, bone density and quality, and body composition. **METHODS:** Collegiate ROTC members (n=16) were matched to active sex, age (±2yrs), and body mass (±5lbs) controls (n=15). Participants completed testing in November (fall), January (pre), March (mid), and April (post). ROTC participants engaged in an exercise training intervention from pre to post testing periods. Total body, lumbar spine, dual hip aBMD and BMC, and body composition were measured by DXA, while tibial volumetric BMD (vBMD) was measured by pQCT. ELISA kits were used to measure PTH and sclerostin. **RESULTS:** At baseline no significant group differences existed (all p≥0.052). Significant (group × time) interactions were found in the dominant hip (Table 1). Significant interactions were also found at the 4% and 66% tibia. From fall to post, controls decreased mean total vBMD 4.221 mg/cm³ and increased mean total area and mean periosteal circumference 18.30 mm² and 1.0 mm respectively (all p≤0.018). Mean 66% muscle cross-sectional area significantly increased from pre to post 645.1 mm² in ROTC only (p<0.001). PTH did not change but sclerostin significantly increased from fall to pre (p=0.001) and then leveled off from pre to post in both groups (p>0.278). **CONCLUSIONS:** Over time ROTC measures of bone density and quality either improved or did not change, while controls lost aBMD at the dominant hip. Additionally, sclerostin, but not PTH, significantly changed throughout the study.

Table 1. Significant (group × time) interactions in dominant hip aBMD (g/cm³) variables (means±SD).

Variable	ROTC (n=16)			Controls (n=15)		
	January	April	Result	January	April	Result
Femoral Neck	1.235 ± 0.135	1.246 ± 0.141	↑ *	1.276 ± 0.136	1.263 ± 0.138	↓ *
Trochanter	0.989 ± 0.126	0.993 ± 0.125		0.988 ± 0.144	0.976 ± 0.144	↓ †
Total Hip	1.216 ± 0.136	1.224 ± 0.134	↑ *	1.231 ± 0.144	1.227 ± 0.144	↓ *

Significant after post-hoc analysis: * p≤0.05, †p≤0.01

2488 Board #152 May 31 11:00 AM - 12:30 PM

Sex Differences in Muscle-Bone Interactions in Chinese Men and WomenAlison Balderas¹, Zhaojing Chen², Meihua Su¹, Samuel Buchanan¹, Breanne Baker³, Michael Bemben, FACSM¹, Debra Bemben, FACSM¹. ¹University of Oklahoma, Norman, OK.²California State University San Bernardino, San Bernardino, CA. ³University of Missouri, Columbia, MO. (Sponsor: Debra A. Bemben FACSM, FACSM)

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(No relevant relationships reported)

Muscle-bone interactions are important for bone health as mechanical forces from muscular contraction place large stresses on bone. Little is known about sex differences in bone and muscle characteristics in Asians. **PURPOSE:** To examine sex differences in bone characteristics, grip strength, and lower body strength and power in Chinese adults (n=53). **METHODS:** Chinese males (n=28) and females (n=25) had body composition and aBMD (total body, lumbar spine, dual femur) assessed by DXA, and bone geometry (4%, 38%, 66%) of the non-dominant tibia measured by pQCT. Leg strength (two-leg press) and power (jump mat) and maximal grip strength (handgrip dynamometer) were measured. **RESULTS:** There were no sex differences in physical activity or calcium intake. After adjusting for height and weight, males had significantly greater leg press 1RM, grip strength, jump height, jump time, lumbar spine aBMD, 4% total BMC, 4% total area, and 4% bone strength index (BSI) ($p \leq 0.05$) than females. In males, leg 1RM was positively correlated with total body aBMD ($r = 0.427$), and left femoral neck aBMD ($r = 0.445$), and jump power was positively correlated with total body aBMD ($r = 0.580$) and all hip aBMD variables ($r = 0.487$ to 0.646) (all $p < 0.05$). Females generally had stronger correlations between muscle and bone variables: leg 1RM (all $p < 0.05$) and jump power (all $p < 0.003$) were positively related to all aBMD variables ($r = 0.432$ to 0.819). Jump power and BSI were positively correlated ($r = 0.378$, $p = 0.048$) in males, whereas jump power and leg 1RM showed moderate to strong correlations with 4% total BMC, total area, and total BSI ($r = 0.460$ to 0.836 , $p < 0.05$) in females. **CONCLUSION:** Based on our findings, Chinese males had greater bone size, bone strength, and muscle strength than females; however, females exhibited more and stronger relationships between muscle and bone variables than males.

Table 1. Sex Differences in Muscle and Bone variables (unadjusted Means \pm SD)

Variable	Females (n=25)	Males (n=28)
Leg Press 1RM (kg)	110.2 \pm 17.3	187.2 \pm 15.9**
Maximal Grip Strength (kg)	27.8 \pm 1.2	42.1 \pm 1.1**
Jump Height (in)	13.2 \pm 0.6	18.6 \pm 0.6**
Jump Time (s)	0.51 \pm 0.01	0.62 \pm 0.01**
4% Tibia		
Total BMC (g)	330.2 \pm 10.2	384.4 \pm 9.4*
Total Area (mm ²)	1047.0 \pm 29.8	1165.6 \pm 27.4*
BSI (mg/mm ⁴)	104.9 \pm 6.4	128.6 \pm 5.9*

* $p < 0.05$ vs. females, ** $p < 0.01$ vs. females**E-36 Free Communication/Poster - Activities of Daily Living**Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2489 Board #153 May 31 9:30 AM - 11:00 AM

Added Load Alters Ankle And Knee Joint Moments During Stair AscentWilliam G. Robinson¹, Alexis K. Nelson¹, Jake A. Melaro¹, Alexander M. Carnall¹, Rachael Ard¹, Victoria White¹, Derek Beeler², Spring Glover², Cris Stickley², Douglas W. Powell, FACSM¹. ¹University of Memphis, Memphis, TN. ²University of Hawaii at Manoa, Honolulu, HI. (Sponsor: Douglas W. Powell, FACSM)

(No relevant relationships reported)

INTRODUCTION: Approximately 66% of the United States is overweight or obese. Obesity is associated with many negative health conditions including osteoarthritis. Research has investigated the effects of increased mass on gait biomechanics, however weight-related changes stair locomotion biomechanics are less understood.

PURPOSE: to assess changes in lower extremity joint moments associated with acutely added body mass during stair ascent. **METHODS:** Ten college aged participants performed 5 stair ascent trials in each of 5 loading conditions: body weight (BW), BW+5%, BW+10%, BW+15%, and BW+20%. Mass was added using a weighted vest. An 18-camera motion capture system (240 Hz) and embedded force platform (1200 Hz) were used to collect kinematics and ground reaction forces simultaneously. **Commercial software** was used to calculate ankle, knee and hip joint moments during the stance phase of second step of a five-step stairway. Univariate ANOVAs with Tukey's post-hoc tests were used to compare peak ankle, knee and hip joint moments from each weighting condition. **RESULTS:** Ankle plantarflexion and knee extension moments increased with added load (Table 1). Hip extension moments were not altered with added load. **DISCUSSIONS/CONCLUSION:** The ankle joint is the primary contributor to increased lower extremity joint moments in response to added load during stair ascent. Though an omnibus effect of added load was observed at the knee, only one post-hoc comparison was statistically different (BW vs. BW+15%) suggesting that the knee is not responsible for increased propulsion in response to added load during stair ascent. Interestingly, no changes in peak joint moments were observed at the hip joint. A limitation of this study was that the acutely added load was not similar in location or physical properties to the increased load associated with obesity which may limit the generalizability of these findings to obese individuals.

Table 1. Mean ankle, knee and hip joint moments during stair ascent in the control and added load conditions. P-value represents omnibus findings of the univariate ANOVA.

	BW	BW+5%	BW+10%	BW+15%	BW+20%	P-value
Ankle	-1.4 (0.4)	-1.5 (0.4)*	-1.6 (0.4)*	-1.6 (0.4)*	-1.7 (0.4)*	0.002
Knee	1.1 (0.4)	1.2 (0.3)	1.2 (0.4)	1.3 (0.3)*	1.3 (0.3)	0.024
Hip	-0.6 (0.2)	-0.7 (0.2)	-0.7 (0.3)	-0.7 (0.3)	-0.7 (0.3)	0.620

Note: * – denotes significantly different than BW, ^b – significantly different than BW+5%, ^c – denotes significantly different than BW+10%, ^d – denotes significantly different than BW+15%.

2490 Board #154 May 31 9:30 AM - 11:00 AM

Examination of the Influence of Lead Leg Recovery Mechanics on Slip Induced OutcomesAndrew L. Crawford¹, Tyler Donahue², Chris Hill³, Caleb Williams³, Jeff Simpson⁴, Harish Chander⁵, Chip Wade⁶, Sydni Wilhoite¹, Kristen Neitz¹, Josh Pascal¹, Ariana Haynes¹, Kelsey Lewis¹, Abigail Johnson¹, Barry Munkasy¹, Li Li, FACSM¹, John Garner⁷, Dwight Waddell², Sam Wilson¹. ¹Georgia Southern University, Statesboro, GA. ²University of Mississippi, Oxford, MS. ³LaGrange College, LaGrange, GA. ⁴University of West Florida, Pensacola, FL. ⁵Mississippi State University, Starkville, MS. ⁶Auburn University, Auburn, AL. ⁷Troy University, Troy, AL. (Sponsor: LI, LI, FACSM)

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INTRODUCTION: Slips and falls have serious implications on one's health. Nearly every 10 seconds, an adult is treated in the hospital for fall related issues. Further, injury and mortality rates are on the rise across all populations when slips or falls are involved. Other studies have analyzed different corrective responses. However, how the recovery response may fail during a slip that results in a fall is still unclear.

PURPOSE: To examine lead leg slip recovery corrective responses between falls and recoveries following an induced slip perturbation. **METHODS:** One hundred participants were recruited for this study. Participant's lower extremity gait kinematics and kinetics were collected during normal gait and an unexpected slip. The variables of interest were mean sagittal moments about the ankle, knee, and hip, during stance phase. Peak moments, and time to peak moments. The slip was classified as either a fall or a recovery. Once classified, corrective responses were examined between groups using independent t-tests. Additionally, prediction equations for slip outcome were created using a binary logistic regression model. **RESULTS:** After exclusions, the final analysis included 64 participants, this included 39 trials classified as recoveries, and 25 trials classified as falls. The results from the logistic regression model suggest that increased time to peak hip extension (OR = 1.006, CI: 1.00-1.01) and ankle dorsiflexion (OR = 1.005, CI: 1.00-1.01) moments increased the odds of falling. While the average ankle moment was negatively associated with falling (OR = 0.001, CI: 0.001-0.005). **CONCLUSIONS:** After analyzing lower extremity gait during unexpected slip perturbations the results suggest that the slipping hip's recovery

response is a key factor in preventing falls. Future work focused on slip training may benefit from targeting this primary hip response of the slipping leg in order to mitigate fall risk.

2491 Board #155 May 31 9:30 AM - 11:00 AM
Lead Leg Corrective Responses to Varying Slip Severity

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Slips and falls account for large rates of injury and mortality in multiple populations. While previous research has examined the corrective responses elicited, it is still unclear which responses may break down during more severe slips. **PURPOSE:** To examine lead leg slip recovery corrective responses across slip severity following an induced slip. **METHODS:** One hundred participants were recruited for this study. Participant's lower extremity gait kinematics and kinetics were collected during normal gait and an unexpected slip. The variables of interest were mean sagittal moments about the ankle, knee, and hip, during stance phase. Peak moments, and time to peak moments. The slip was classified based on slip severity, using heel slip distance, and velocity. Once classified, corrective responses were examined between groups using independent t-tests. Additionally, prediction equations for slip severity were created using a binary logistic regression model. **RESULTS:** After exclusions, the final sample included 64 participants for analyses, consisting of 37 non-hazardous slips, and 27 hazardous slips. The results from the logistic regression model suggest that as the average ankle moment increases in the slip period, the odds of experiencing a hazardous slip decrease (OR = 0.01, CI: 0.01-0.03). Further, as the time to peak hip extension (OR = 1.007, CI: 1.000-1.013) and knee extension moments (OR = 1.001, CI: 0.997-1.004) increase, the odds of experiencing a hazardous slip increase. **CONCLUSIONS:** Rapid lower extremity corrective responses appear critical in arresting the slip. While there are various strategies for slip recovery, our findings suggest that the primary recovery mechanism at the slipping hip may play a vital role in preventing the severe slip.

2492 Board #156 May 31 9:30 AM - 11:00 AM
Added Load Alters Ankle And Knee Joint Moments During Stair Descent

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 (No relevant relationships reported)

INTRODUCTION: Combat forces perform a number of tasks with a rigid load added to the trunk including walking, running and stair ascent and descent. Though a number of studies have investigated the effect of added loads on joint biomechanics during over ground and treadmill walking, less focus has been applied to negotiating stairs. Changes in lower extremity biomechanics during stair descent may be associated with excessive joint loading. **PURPOSE:** to quantify changes in joint kinetics when descending stairs with increasing loads. **METHODS:** Ten healthy adults (age: 18 - 30) performed 5 stair descent trials in each of 5 loading conditions: body weight (BW), BW+5%, BW+10%, BW+15%, and BW+20%. Mass was added using a modular vest and metal plates. An 18-camera motion capture system (240 Hz) and embedded force platform (1200 Hz) was used to collect kinematics and ground reaction forces simultaneously. Commercial biomechanical software was used to calculate ankle, knee and hip joint moments during the stance phase of second step of a five-step stairway. Univariate ANOVAs with Tukey's post-hoc tests were used to compare peak ankle, knee and hip joint moments from each loaded condition. **RESULTS:** Hip and knee extension moments were not altered with added load. **DISCUSSIONS/CONCLUSION:** The ankle joint is the primary contributor to increased lower extremity joint moments only in response to added load at or exceeding +15% BW during stair descent. Interestingly, no changes in peak joint moments were observed at the knee and hip joint, suggesting that neither joint is responsible for increased energy absorption in response to added load during stair descent. Further research may seek to investigate the effects of fatigue on joint kinetics during stair descent.

Table 1. Mean ankle, knee and hip joint moments during stair descent in the control and added load conditions. P-value represents omnibus findings of the univariate ANOVA.

	BW	BW+5%	BW+10%	BW+15%	BW+20%	P-value
Ankle	-0.9(0.2)	-1.0(0.2)	-1.0(0.3)	-1.0(0.2) ^{a,b}	-1.1(0.3) ^a	0.025
Knee	1.4(0.3)	1.5(0.4)	1.5(0.5)	1.6(0.4)	1.6(0.4)	0.142
Hip	-0.2(0.2)	-0.1(0.1)	-0.2(0.3)	-0.1(0.2)	-0.1(0.2)	0.485

Note: ^a - denotes significantly different than BW, ^b - denotes significantly different than BW+5%, c - denotes significantly different than BW+10%, d - denotes significantly different than BW+15%.

2493 Board #157 May 31 9:30 AM - 11:00 AM
Dual Tasking Using a Treadmill Desk Affects Middle-Aged but Not Young Adults

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 (No relevant relationships reported)

PURPOSE: Young adults have the capacity to manage dual task conditions with minimal impairment to either the cognitive or the motor task; however, this ability decreases with age. Previous research on dual tasking has primarily examined over ground walking and minimal information is available on dual tasking on a treadmill. The purpose of this study was to examine the effect of dual tasking using a treadmill desk on changes in cognitive performance and gait parameters in young adults (YA) and middle-aged adults (MA). **METHODS:** YA (n=24; mean age 21.1±1.6 yrs) and MA (n=25; mean age 53.0±5.3 yrs) were recruited to participate in this study. Participants completed five cognitive tests (Stroop Word Color Test, phoneme monitoring, typing test, Sternberg working memory test, and serial 7 subtractions) in a single task (ST) and dual task (DT) condition in a randomized and counterbalanced order. Participants were seated at a desk for ST and walked on a treadmill desk at self-selected speed (mean speed YA=1.5±0.4 mph; MA=1.4±0.5 mph) during DT. An OptoGait system recorded gait parameters of step length, stride length, and coefficient of variation. **RESULTS:** There were no significant differences in gait parameters or test scores in YA when comparing DT and ST conditions (p>0.05). MA performed worse on word recall score (89.7±11.3 vs 96.6±7.5%, p=0.03), typing speed (44.9±11.2 vs 49.9±13.3 wpm, p=0.00), and Sternberg reaction time (1.5±2.0 vs 1.0±1.9 s, p=0.00) during the DT compared to the ST condition. MA stride length decreased during DT in the Sternberg test (37.7±5.9 vs 36.5±5.3 in, p=0.01) and serial 7 subtractions (37.2±5.7 vs 36.5±5.3 in, p=0.00). MA showed detriments in reaction times on the Stroop test (0.8±1.2 vs 0.6±0.9 s, p=0.00) and Sternberg test (1.5±2.0 vs 0.9±1.5 s, p=0.02) and decreased word recall score (89.7±11.3 vs 97.5±7.0%, p=0.04) compared to YA during the DT condition. **CONCLUSION:** The impairments in gait and cognitive test scores in MA but not YA suggest that the ability to simultaneously process cognitive demands and treadmill walking requirements decreases with age. Using a treadmill desk might affect work-related performance or gait parameters in middle-aged adults.

2494 Board #158 May 31 9:30 AM - 11:00 AM
The Effects of Postural Control Measures on Induced Slip Outcomes

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Slips and falls are a major health concern in the United States. Injury incidence rates have increased in recent years and now the leading cause of non-fatal injuries and the third leading cause of fatal injuries in the U.S. are due to falls. During an unexpected slip, sensory information is used to elicit an appropriate recovery. Therefore, increased

fall risk has been associated with declines in sensory system integrity. Previous research has suggested that decreased balance scores were associated with more hazardous slips yet measures of postural control between individuals who fall or recover after an induced slip have not been investigated. **PURPOSE:** To examine differences in slip detection using postural control measures between individuals who fall or recover after an induced slip. **METHODS:** One hundred participants were recruited for this study. Standing postural control measures were recorded under six different sensory conditions: eyes open, eyes closed, eyes open with sway referenced vision, eyes open with sway referenced support, eyes closed with sway referenced support, and eyes open with sway referenced vision and support. Variables of interest were sway velocity components and the root mean square of the center of pressure (CoP) in the medial-lateral and anterior-posterior directions. After postural control testing, participants completed testing involving a normal gait and an unexpected slip trial. The slip was classified as either a fall or a recovery. Once classified, standing postural control measures were examined between groups using independent t-tests. Additionally, prediction equations for slip outcome were created using a binary logistic regression model. **RESULTS:** The final analysis sample included 73 participants, with 48 trials classified as recoveries and 25 trials as falls. Postural sway when the proprioceptive (OR = 0.02, 95% CI: 0.01-1.34) and vestibular (OR = 0.60, 95% CI: 0.26-1.39) systems were relied on were negatively associated with odds of falling while visual system reliance resulted in a positive association (OR = 3.18, 95% CI: 0.887-11.445). **CONCLUSIONS:** The data suggests that visual sensory information may have a greater influence on dynamic stability and slip outcomes. Additionally, postural control measures may provide insight into task selection during recovery.

2495 Board #159 May 31 9:30 AM - 11:00 AM
Novel Evidence Of Cortical Control In Severe Slip Responses

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Slips and falls are a major cause of injury and death in the United States. During a human slip response, an ensemble of muscular activations appear in an attempt to maintain balance and prevent a fall. The slip response has several key events that appear reflexive in nature. Though, the temporal nature of these responses may suggest cortical involvement as well. Indeed, some other forms of postural perturbations have provided evidence of cortical control in the recovery response. However, there is little information regarding cortical contribution to the slip response. **PURPOSE:** To examine corticospinal activity in lower extremity slip recovery corrective responses across slip severity. **METHODS:** One hundred participants were recruited for this study, and after exclusions the final analysis included 73 participants. Participant's lower extremity gait kinematics, kinetics, and electromyography (EMG) on the quadriceps (Q), hamstrings (H), dorsiflexors (TA), and plantarflexors (MG) were collected during normal gait (NG) and an unexpected slip (US). The slip was classified based on slip severity, using heel slip distance, and velocity. Once classified, EMG spectral power was examined in the Piper frequency band between gait trials, and groups using a mixed model analysis of variance. **RESULTS:** Spectral power showed no differences in NG trials. However, spectral power in the Piper frequency band was increased in the Q and H, during the US trial for severe slips, but not minor slips. For the quadriceps, a significant gait by slip severity interaction was observed ($F(1,70) = 9.934, p = 0.002, \eta^2 = 0.124$). Simple effects revealed a significant increase in activation between normal gait and unexpected slips for those who experienced hazardous slips ($p < 0.001$), but no differences for non-hazardous slips ($p = 0.364$). For the hamstrings, a significant interaction was also observed ($F(1,70) = 5.076, p = 0.027, \eta^2 = 0.069$). The simple effects revealed a significant increase in activity between gait trials, in the hazardous slips ($p = 0.002$), but not in the non-hazardous slips ($p = 0.651$). **CONCLUSIONS:** We show here novel contributions of the corticospinal pathway to the slip recovery response, particularly in musculature used in the recovery response.

2496 Board #160 May 31 9:30 AM - 11:00 AM
Influence Of Prediction Equations On The Produced Power In The Sit To Stand Movement

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 (No relevant relationships reported)

The sit-to-stand movement (STS) has been used as a tool to evaluate both lower extremity power and function in elderly individuals. Field tests of lower extremity power specific to the STS provide practitioners with clinically meaningful insight into functional capacity across the lifespan. For these field tests to be a useful tool, normative values must be established across the age continuum.

PURPOSE: To compare the mechanical power produced during a field-based STS test in young adults utilizing two different methods of analysis. **METHODS:** Eighteen participants (20.7 ± 3.0 yrs, 72.3 ± 14.7 kg, 1.70 ± 0.1 m) between 18 and 30 years performed three sets of five self-paced STS repetitions on two side-by-side force platforms, one for each lower extremity. Hip and knee angles were set at 90° with the feet positioned on the two force platforms; foot width was standardized based on the distance between the individual's right and left anterior superior iliac spines. Power was analyzed during the rising phase of the force-time curve using an established power equation ($E1, P = FxS/T$) and a modified power equation ($E2, P = FxS/T$; P = mechanical power, F = bodyweight, S = standing minus seated height, = femur length, T = time). Differences in mechanical power calculated by E1 and E2 were determined using a dependent t-test. A Pearson product moment coefficient of correlation (r) was used to examine the relationship between power calculated by E1 and E2. The level of significance was set at $p < 0.05$. **RESULTS:** The calculated power during the rising phase of the STS was significantly greater using E1 compared to E2 (350.96 ± 138.93 W vs. 344.28 ± 138.79 W, $p < 0.0001$). The two methods for calculating power demonstrated a strong correlation ($r = 0.99$). **CONCLUSION:** The two methods used to calculate power were shown to be highly related, demonstrating both are clinically appropriate for use in a field-based setting. This relationship showed that although the two methods provided different values of power, the power differences across all participants changed in the same manner independent of the method used. The difference in calculated power can be explained by the variation in S determination. The results of this study demonstrate that both equations allow for the accurate determination of mechanical power during the rising phase of a field-based STS test.

2497 Board #161 May 31 9:30 AM - 11:00 AM
The Relationship between Cervical Tilt Angle and Upper Body Position in Upright and Slump Sitting

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Malposition of the cervical vertebra caused by poor sitting postures could lead to the development of cervical musculoskeletal disorders. It has been well documented that there is a positive correlation between over-tilted angles and abnormal load-carrying on cervical vertebrae. However, intrinsic cervical angles are difficult to measure without computed tomography or magnetic resonance imaging.

PURPOSE. This study aimed to assess the cervical tilt angle at the C5C4 level based on upper body position in both upright and slump sitting postures.

METHODS. Eight participants (Male: $n = 4$, 50%; Age: 26.0 ± 2.9 yr; Height: 171.9 ± 10.3 cm; Weight: 60.1 ± 11.8 kg) with no history of documented cervical injuries were recruited for this study. An eight-camera, infrared motion analysis system and two force platforms were used to capture the three-dimensional posture and ground reaction forces of a seated human. A musculoskeletal model with detailed neck constructed in the AnyBody Modelling System was used to calculate cervical tilt angles. The correlations between cervical tilt angle at the C5C4 level and sternoclavicular elevation and glenohumeral abduction were examined by sitting postures separately and combined.

RESULTS. Correlations between C5C4 tilt angle and sternoclavicular elevation and glenohumeral abduction in upright and slump sitting are summarized below:

	Sternoclavicular Elevation	Glenohumeral Abduction
C5C4 Tilt Angle in Upright Sitting	0.587	-0.340
C5C4 Tilt Angle in Slump Sitting	0.660	-0.432
Combined	0.516	-0.215

CONCLUSION. Overall, C5C4 tilt angle has a moderate and positive correlation with sternoclavicular elevation, but a low and negative correlation with glenohumeral abduction. Therefore, sternoclavicular elevation may be useful to predict the C5C4 tilt angle in upright and slump sitting.

2498 Board #162 May 31 9:30 AM - 11:00 AM

The Effects of Shoe Type on Muscle Activity During Step Up and Step Down Motions

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(No relevant relationships reported)

Hiking is a popular activity with many health benefits. Evidence suggests that 75% of hiking related injuries are of the lower extremities and that footwear choice may play a role in these injuries. **PURPOSE:** To evaluate the connection between footwear choice and lower extremity muscle activity during step-up and step-down movements, specifically the vastus medialis (VM), tibialis anterior (TA), biceps femoris (BF), and gastrocnemius (G). **METHODS:** Eleven male and female hikers (26 \pm 5 years, 80.3 \pm 12.6 kg, 1.8 \pm 0.08 m) performed three step-up and step-down trials on three AMTI force platforms in both hiking boots and hiking shoes. Footwear weights were standardized. Surface electrodes recorded EMG data of the four muscles of interest on the dominant leg during each trial. Maximal voluntary isometric contractions (MVIC) were conducted for each muscle and used to normalize EMG. Paired t-tests were used to compare differences in muscle activity between footwear. **RESULTS:** Mean EMG amplitude (% MVIC) of BF were 11.37 \pm 5.65% in boots and 11.61 \pm 5.93% in shoes. Mean EMG of G in boots were 27.08 \pm 25.61% and 43.28 \pm 44.30% in shoes. Mean EMG of VM in boots were 41.26 \pm 18.53% and 41.34 \pm 18.55% in shoes. Mean EMG of TA in boots were 16.83 \pm 6.46% and 15.71 \pm 5.59% in shoes. No significant differences were found in muscle activity between footwear. **CONCLUSION:** Muscle activation is not affected by footwear, therefore the user can choose either hiking boots or hiking shoes in a stepping task and not overwork any specific musculature. These results may be valuable for hikers, military personnel, or firefighters when choosing footwear.

2499 Board #163 May 31 9:30 AM - 11:00 AM

Influence of Lower Extremity Strength on Chair Rise Functional Demand in Older Female Cancer Survivors

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(No relevant relationships reported)

Functional demand (FD) is the ratio of the muscular force required by a physical task to the maximal force capacity of the muscle, which is greater in older individuals. Measuring FD in older adult cancer survivors can determine whether functional activities, such as a chair rise, are more exhaustive than for healthy older adults without history of cancer diagnoses. **PURPOSE:** To quantify the differences in hip (HE) and knee extension (KE) strength, the primary muscles used to complete a chair rise, and FD during chair rise, between older female cancer survivors (CS) and older females with no history of cancer (NC). **METHODS:** Eleven NC (65.9 \pm 6.6 yr, 75.4 \pm 26.9 kg, 1.60 \pm 0.04m, 29.5 \pm 10.8 kg \cdot m⁻²) and nine CS who completed chemotherapy and/or radiation treatments within 10 years (57.1 \pm 6.6 yr, 75.5 \pm 23.1 kg, 1.68 \pm 0.07 m, 27.0 \pm 9.2 kg \cdot m⁻²) performed 3 maximal isokinetic contractions on a dynamometer at 30 deg \cdot s⁻¹ to measure HE and KE strength. Retroreflective markers were placed on the lower extremity using the Helen Hayes model and a 3D video motion capture system and an in-ground force plate were used to record kinematic and kinetic data during chair rise. The HE and KE moments during chair rise were calculated by inverse dynamics using Visual3D software; FD was calculated as the ratio of joint moment during chair rise to available strength and expressed as a percentage. Analysis of Covariance was used to compare NC and CS with age and BMI as covariates. Data are reported as estimated population means (95% CI) adjusted for age and BMI. **RESULTS:** KE strength was similar in CS, 1.20 Nm \cdot kg⁻¹ (0.84-1.56 Nm \cdot kg⁻¹), and NC, 1.67 Nm \cdot kg⁻¹ (1.36-1.99 Nm \cdot kg⁻¹, p=0.082). HE strength was lower in CS, 2.12 Nm \cdot kg⁻¹ (1.59-2.64 Nm \cdot kg⁻¹) than in NC, 3.01 Nm \cdot kg⁻¹ (2.55-3.46 Nm \cdot kg⁻¹, p=0.029). Peak knee FD was greater in CS, 131% (92-171%), than in NC, 51% (17-86%, p=0.012). Peak hip FD was similar in CS, 78% (28-128%), and NC, 41% (-2, 85%, p=0.31). **CONCLUSIONS:** Compared to NC, older female CS had significantly lower HE strength and greater knee FD during chair rise, and had a trend for lower KE strength and greater hip FD, which may help explain the greater fall risk and mobility limitation observed in this at-risk clinical population. Resistance training should be incorporated in cancer rehabilitation programs to increase strength and functional reserve capacity.

E-37 Free Communication/Poster - Biomechanics of Running

Friday, May 31, 2019, 7:30 AM - 12:30 PM

Room: CC-Hall WA2

2500 Board #164 May 31 9:30 AM - 11:00 AM

Reliability and Minimum Detectable Difference of Tibial Acceleration during Running

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(No relevant relationships reported)

Tibial acceleration is often measured in runners and may be related to injury risk. To evaluate differences between conditions, reliability and minimum detectable difference of common variables are needed. **PURPOSE:** To determine the test-retest reliability and minimum detectable difference of peak axial and peak resultant tibial acceleration during running in the laboratory and on a treadmill. **METHODS:** We recruited 19 runners (31 \pm 6 years; 1.70 \pm 0.08 m; 68.6 \pm 11.6 kg; 10 women) who provided written informed consent. Tibial acceleration was collected at 1000Hz in the laboratory and 1023Hz on the treadmill via a research grade tri-axial accelerometer firmly attached to the anteromedial distal tibia during running at 3.0m/s. In the laboratory, foot contact was made on a synchronized force platform in 2 sessions for 5 trials each. Participants also ran on a treadmill for one minute following a self-directed warm up. Peak axial and peak resultant acceleration during stance were determined for 2 sets of: 5 steps in the laboratory, and both 5 and 10 steps on the treadmill. Interclass correlations (ICC(3,5) and ICC (3,10)) indicated reliability and minimum detectable differences were calculated. **RESULTS:** Test-retest reliability was excellent for both peak axial and peak resultant acceleration during laboratory and treadmill running. Minimum detectable differences were less than 2g. Averaging over 10 trials instead of 5 did not improve reliability.

Table 1: Reliability and minimum detectable difference for peak axial and peak resultant tibial accelerations during laboratory and treadmill running

Variable	Mean (SD) (g)	ICC (95% CI)	Standard error of measurement (g)	Minimum detectable difference (g)
Peak axial acceleration				
Lab 5 trials	6.1 (2.0)	0.988 (0.968-0.995)	0.7	2.0
Treadmill 5 trials	6.1 (2.4)	0.949 (0.833-0.982)	0.7	2.0
Treadmill 10 trials	6.1 (2.4)	0.963 (0.841-0.988)	0.6	1.7
Peak resultant acceleration				
Lab 5 trials	8.3 (3.2)	0.945 (0.859-0.958)	0.2	0.6
Treadmill 5 trials	8.5 (3.3)	0.949 (0.833-0.982)	0.5	1.5
Treadmill 10 trials	8.6 (3.3)	0.963 (0.841-0.988)	0.5	1.4

CONCLUSION: A difference of at least 1.5g for peak resultant acceleration and 2g for peak axial acceleration is needed to be sure that the difference exceeds measurement error. Smaller differences may simply be due to measurement error and may not reflect meaningful change.

Study funded by College of Nursing and Health Professions Research Award.

2501 Board #165 May 31 9:30 AM - 11:00 AM

Running For Two: A Case Study On Running Throughout Pregnancy

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(No relevant relationships reported)

The American College of Obstetricians and Gynecologists supports physical activity during pregnancy. Healthy women with normal pregnancies can continue running, but only 31% run into their third trimester. Many physiological and anatomical changes during pregnancy, such as increased body mass, hyperlordosis, and ligamentous laxity, can alter movement. While pregnancy related gait changes in walking have been reported, how running is altered remains unknown. **PURPOSE:** This case study biomechanically examined a 32 year old woman running throughout her pregnancy. **METHODS:** Data collection occurred once every four weeks, from the 13th week of pregnancy, until the 39th week. The participant was medically cleared to continue running monthly. Lower body kinematics and kinetics were recorded using a motion

capture system while the participant performed five self-selected velocity trials over a force platform embedded walkway. **RESULTS:** Mean values were calculated for each variable of interest (Table 1). Pelvic motion changes from the second to third trimester were visually pronounced (Figure 1a-c). **CONCLUSION:** Changes in biomechanical variables were seen throughout pregnancy, but were pronounced from the second to third trimester. Altered movement patterns may be acquired to improve gait safety, dynamic stability, and counter pregnancy related anatomical changes.

Variable	3 months*	4 months*	5 months*	6 months*	7 months*	8 months*	9 months*
Self-Selected Velocity (m/s)	3.64	2.64	2.89	2.70	2.14	1.79	1.40
Stride Length (m)	2.37	2.43	2.66	2.46	2.03	1.63	1.54
Stride Width (m)	0.05	0.07	0.07	0.10	0.09	0.13	0.11
Ankle ROM during stance (°)	49.07	42.38	39.73	42.18	36.11	43.44	29.36
Knee ROM during stance (°)	23.63	24.40	23.80	20.28	17.29	15.19	18.57
Hip ROM during stance (°)	35.32	38.13	43.45	40.66	37.07	32.29	22.19

Table 1: Mean values for variables of interest throughout the second and third trimesters of pregnancy; ROM = range of motion;

*Denotes second trimester; †Denotes third trimester

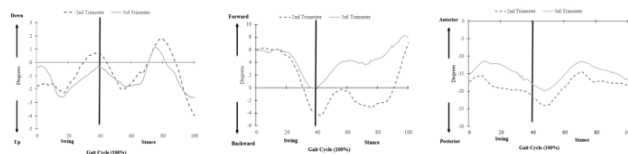


Figure 1a: Pelvic motion during the second and third trimesters throughout the gait cycle

Figure 1b: Pelvic motion during the second and third trimesters throughout the gait cycle

Figure 1c: Pelvic motion during the second and third trimesters throughout the gait cycle

2502 Board #166 May 31 9:30 AM - 11:00 AM Altered Lower Extremity Joint Work Profiles During Inclined Running At Iso-efficiency Speeds

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(No relevant relationships reported)

Inclined running is a common component of many runners' training programs in the form of hill repeats. Runners are often forced to slow their running pace, iso-efficiency speed (ISO), during inclined running to maintain their metabolic effort. Though commonly used in training, little is known regarding the changes in joint kinetics associated with running on an inclined treadmill at an ISO speed. **PURPOSE:** To evaluate changes in lower extremity joint work when running on increasing inclines at ISO speeds. **METHODS:** Eleven NCAA Division I runners performed five 5-second treadmill running trials during each of three ISO speed inclined conditions: 0% incline, 4% incline, and 8% incline. ISO speed was confirmed using oxygen consumption (VO_2) using indirect calorimetry. Kinematics and ground reaction forces were recorded simultaneously using an 8-camera motion capture system (100 Hz, Qualisys Inc.) and instrumented treadmill (1000 Hz, Bertec), respectively. Visual 3D was used to calculate ankle, knee and hip joint powers while custom software (MATLAB, MathWorks) calculated positive and negative joint work as joint power integrated with time. A repeated measures ANOVA with Tukey's post-hoc was used to determine the effect of treadmill incline on joint work. **RESULTS:** Negative ankle joint work increased while negative knee and hip joint work decreased with increasing treadmill incline (Table 1). Positive ankle and hip joint work increased while positive knee work decreased with increasing treadmill incline (Table 1). **CONCLUSIONS:** Our findings suggest that even at ISO speeds (i.e., reduced speeds to maintain effort), inclined treadmill running increases eccentric demands on plantarflexors, and concentric demands on knee and hip extensors. These data may support altered training prescriptions for athletes recovering from joint-specific muscular injuries to minimize training-related stresses placed on those tissues.

Table 1: Mean positive and negative ankle, knee and hip joint work values in the 0% Incline, 4% Incline and 8% Incline conditions.

Joint	Negative			p-value	Positive		
	0% Incline	4% Incline	8% Incline		0% Incline	4% Incline	8% Incline
Ankle (J/kg)	-4.0 (1.0)	-4.8 (1.3)	-5.2 (1.3)	<0.001	9.8 (3.2)	10.9 (2.6)	12.1 (2.2)
Knee (J/kg)	-6.2 (2.3)	-4.8 (2.0)	-3.8 (1.9)	<0.001	6.5 (2.4)	5.6 (2.4)	4.2 (2.3)
Hip (J/kg)	-8.6 (4.1)	-4.5 (3.9)	-2.9 (3.3)	<0.001	1.4 (0.3)	2.8 (1.7)	6.9 (2.7)

Note: P-values represent omnibus testing while superscripts represent post-hoc testing. * – denotes significantly different than 0% Incline condition, † – denotes significantly different than 4% Incline condition.

2503 Board #167 May 31 9:30 AM - 11:00 AM

The Association Between Trunk Lean and Running Kinetics in Competitive Distance Runners

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The annual injury rate among competitive distance runners is over 50%. The vertical loading rate (vLR) and posterior ground reaction force (GRF) are associated with running-related injuries. Knee and lower limb injuries are the most commonly reported sites of injury. Greater forward trunk lean during running contributes to lower knee joint loading. However, it is unclear if trunk lean is associated with GRF characteristics. **PURPOSE:** The purpose of this study was to determine the association between forward trunk lean, GRF, and knee joint loading characteristics in competitive distance runners. **METHODS:** Thirty-six competitive distance runners were recruited for this study (72% male, age=20±1.5 years, height=1.74±0.02 m, mass=61.6±1.4 kg, forefoot strike=58%, 1500m personal best=83.3±3.5% world record). 3-Dimensional biomechanics were recorded during 5 running trials at self-selected speed (±5%) over a force plate. Forward trunk lean was calculated as the angle of the trunk segment relative to the vertical axis of the global coordinate system. GRF characteristics included instantaneous vLR, and peak vertical and posterior GRF. Knee joint kinetics included the peak internal knee extensor moment and sagittal plane knee joint stiffness. Partial correlation, controlling for speed and foot strike angle, was used to assess the association between trunk lean and gait kinetics. **RESULTS:** Trunk lean at foot contact ($r=-0.45$, $p<0.01$), Peak trunk lean ($r=-0.38$, $p=0.03$), and average trunk lean ($r=-0.50$, $p<0.01$) were negatively associated with vLR. Peak trunk lean was positively associated with vertical GRF ($r=0.34$, $p=0.05$). Trunk lean angles were not associated with posterior GRF, knee extensor moment, or knee joint stiffness. **CONCLUSIONS:** Runners with a lesser forward trunk lean angle had a greater vLR. Forward trunk lean may allow runners to position their foot under their center of mass to assist in attenuating vLR. Greater forward trunk lean was also associated with larger vertical GRF, which may allow runners to increase the total force imparted into the ground to propel themselves. Forward trunk lean is a modifiable gait characteristic that may be useful for injury prevention and performance enhancement of competitive distance runners.

2504 Board #168 May 31 9:30 AM - 11:00 AM Comparison of Running Power to Metabolic Cost at Various Submaximal Running Speeds and Inclinations

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(No relevant relationships reported)

Running pace is one of the primary measures of running intensity, however, variations in grade limit quantifying intensity solely based on pace. With the advent of wearable running power meters, runners can address the external work stimulus inclusive of pace and grade. **PURPOSE:** The purpose was to compare running power measured by a Running Power Meter to the metabolic cost of running at different speeds and inclinations. **METHODS:** 5 collegiate cross country runners (male n=2, age=21±1.414 yrs, weight=69.8±3.960 kg, height=180±4.243 cm; female n=3, age=19.67±0.577 yrs, weight=54.07±2.290 kg, height=164.33±10.263 cm) participated in 10 trials of submaximal running at different speeds and inclinations. Subjects first completed an LT test to determine submaximal running speed with lactate collected and analyzed (Lactate Pro) via blood samples taken by finger prick. During subsequent submaximal running trials, metabolic and ventilatory measures were collected with a portable breath-by-breath analyzer (COSMED K5). Speed was controlled by a rider on a bicycle that was equipped with a speedometer. Spearman's Correlation was run between relative VO_2 values and running power for males, females, and all subjects. **RESULTS:** There is a statistically significant, strong positive correlation between relative VO_2 and running power for male ($R=0.778$; $P<0.001$), female ($R=0.846$; $P<0.001$), and combined male and female collegiate cross country runners ($R=0.602$; $P<0.001$). **CONCLUSIONS:** The results support that running power is positively related to VO_2 , which may indicate a strong relationship with running intensity.

Correlation between Running Power and VO2		
Subject	Correlation Coefficient	Significance
Male 1	0.963	P<0.001
Female 1	0.964	P<0.001
Male 2	0.988	P<0.001
Female 2	0.960	P<0.001
Female 3	0.782	P<0.01
Males	0.778	P<0.001
Females	0.846	P<0.001
Combined	0.602	P<0.001

2505 Board #169 May 31 9:30 AM - 11:00 AM
Is Peak Resultant Acceleration A Substitute For Peak Axial Acceleration During Running?

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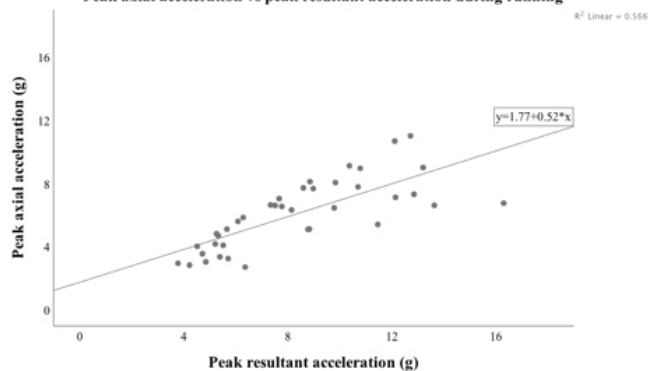
(No relevant relationships reported)

Peak resultant and peak axial acceleration have been used interchangeably in the literature in relation to tibial load. However, they have not been directly compared to establish if this is appropriate.

PURPOSE: To determine the relationship between peak resultant acceleration and peak axial acceleration during running in healthy adults. **METHODS:** Nineteen (10 women) healthy rearfoot striking runners (mean (SD): age: 31 (6) years; height: 1.7 (0.1) m; weight: 68.6 (11.6) kg) who ran at least 10 miles per week were recruited. A tri-axial accelerometer was tightly secured to the distal anteromedial aspect of the right tibia of each runner. Participants completed 10 running trials over ground in the laboratory at 3.0 m/s ($\pm 5\%$). Accelerometer and force plate data were synchronized and recorded at 1000 Hz. Stance was determined from force plate data and peak resultant and peak axial acceleration were extracted for each step. A Wilcoxon-signed rank test determined any group difference between the variables. A simple linear regression was performed to assess the relationship between peak resultant acceleration and peak axial acceleration. **RESULTS:** Peak resultant acceleration (median (IQR)): 8.1 (5.4) g was significantly higher than peak axial acceleration (median (IQR)): 6.3 (3.6) g ($p<0.001$; ES=0.88). Peak resultant acceleration is higher because it is the combined acceleration from all three axes. From the regression, $R^2=0.566$ ($p<0.001$, 95%CI= 0.4 to 0.7), which indicates that peak resultant acceleration accounts for about half of the variance in peak axial acceleration. **CONCLUSION:** Since the peak resultant acceleration was consistently higher and only accounts for about half of the variance in peak axial acceleration, they should not be used interchangeably. Care should be taken when making comparisons between studies reporting tibial acceleration using different dependent variables.

Study funded by College of Nursing and Health Professions Research Award

Peak axial acceleration vs peak resultant acceleration during running



2506 Board #170 May 31 9:30 AM - 11:00 AM
Postpartum Runners: Is There A Difference In Running Kinematics And Kinetics Compared To Controls?

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A recent study found that 70% of elite female runners ran during their pregnancy. Most resumed running within 2 months after childbirth. Despite the increased prevalence of running in women before and after childbirth, there is very little research on the physical changes and impairments experienced by these runners. Pregnancy and childbirth lead to well-established unique anatomical and physiological changes that more than likely influence running kinematics (joint excursion) and kinetics (landing forces). No studies have investigated running gait in this population; however, a few studies have reported the presence of pain in this population. **PURPOSE:** To identify differences in running kinematics and kinetics between postpartum (PP) women and controls. **METHODS:** Four PP and 4 age-matched women without children (CON) ran on a treadmill at their self-selected speed. All participants were pain-free. Five 5s trials were collected after warm-up. A 3D motion capture system was used to determine hip and knee joint angles. Participants also performed 6 overground running trials. Impact peak and vertical loading rates were calculated from the ground reaction forces during overground running. An independent samples t-test was used to compare the 2 groups. **RESULTS:** Hip range of motion (CON: $48.63 \pm 7.68^\circ$; PP: $52.67 \pm 4.65^\circ$), Knee range of motion (CON: $70.26 \pm 10.57^\circ$; PP: $78.74 \pm 16.70^\circ$), peak knee flexion during stance (CON: $43.48 \pm 6.40^\circ$; PP: $38.47 \pm 8.91^\circ$), peak impact force normalized to bodyweight (CON: 1.90 ± 0.47 ; PP: 2.04 ± 0.50), average vertical loading rate (CON: $55.85 \pm 15.69 \text{ s}^{-1}$; PP: $55.47 \pm 25.60 \text{ s}^{-1}$) were not significantly different between the groups. **CONCLUSION:** Though there were no significant differences, postpartum runners had greater hip and knee range of motion but lesser peak knee flexion during stance compared to age-matched controls. Further, the PP group had similar vertical loading rates but greater variability in their rate of loading when compared to their age-matched controls. These preliminary findings could indicate that runners two months into postpartum show similar running biomechanics compared to age-matched women who did not have a child. These results could have implications on guidelines for postpartum women returning to running. A larger sample size is required to confirm these findings.

2507 Board #171 May 31 9:30 AM - 11:00 AM
Loud Music Via Earphones Alters Men'S Running Mechanics, Not Women's: The Impact Factor Trial

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PURPOSE: Listening to music during exercise yields a number of positive and measurable physiological effects. However, to date the possible influence of music listening on the amount of impact forces during running has not been investigated yet. The present pilot trial examined the effects of different volumes of background music on jogging and running mechanics. **METHODS:** A total of 50 recreationally active healthy volunteers (22 women, 28 men; age 23 ± 7 yrs; weight 69.7 ± 11.6 kg) performed 2-minute running stints on a sensorized treadmill integrated with a 3D-gait analysis system over 3 different randomly assigned experimental conditions (running while listening via earphones to 80- or 85-dB music, or no music) at 3 different velocities (8, 10 and 12 km/h). Measures of average and peak ground pressure force along with kinematic and kinetic parameters describing the running mechanics were recorded by the sensorized treadmill during the experimental conditions. **RESULTS:** Running while listening to 85-dB music resulted in significantly greater impact loading at 8 ($p=0.0005$) and 10 km/h ($p=0.04$) but not at 12 km/h ($p=0.35$) and not with a volume of 80-dB. Gender-based analysis revealed significant Condition*Gender interactions only for the comparison "85-dB music" versus "no music". After correcting by body weight, Bonferroni-adjusted comparisons revealed significant music-induced increases in impact loading only for the male group at 8 km/h (men: $+4.1 \text{ kg/cm}^2$, $p<0.0005$; women: $+0.8 \text{ kg/cm}^2$, $p=0.47$) and 10 km/h (men: $+3.3 \text{ kg/cm}^2$, $p=0.004$; women: $+0.8 \text{ kg/cm}^2$, $p=0.51$) but not at 12 km/h. Gender-based comparisons also revealed in the female group significantly reduced knee ROM at 8 km/h (-5° , $p=0.008$) and stride length both at 8 (-5 cm ; $p<0.0005$) and 10 km/h (-4 cm ; $p<0.0005$). **CONCLUSIONS:** Data indicate that, in physically active male subjects, running while listening to loud music results in increased impact forces. This is not the case for women, who showed no changes in impact in response to music. We offer that the lack of effect of music in women may be related to their different morphology of pelvis and lower limb,

which may be accounted for the significant changes in kinematic and kinetic running parameters observed. The present findings introduce music listening during exercise as a new potential risk factor for injury.

2508 Board #172 May 31 9:30 AM - 11:00 AM
Effects of Spinal Coupling and Marker Set on Tracking of Spine Models During Running

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Running is a complex motion producing many muscle and joint forces that cannot be directly measured. Musculoskeletal simulation enables estimation of these muscle and joint forces, but to have confidence these simulations and processes must be biofidelic. Most models include a rigid spine, but prescribing motion with a coupled spine model may allow more accurate inverse kinematics tracking of experimental data and allow truer resulting intervertebral force and muscle activation estimations. **PURPOSE:** To determine the effects of spinal coupling and the quantity of experimental data available on the tracking of experimental running data through use of a rigid and a coupled lumbar spine model. **METHODS:** Two subjects ran on a treadmill and 3 motion capture trials at different speeds were collected with 13 markers placed on the spine and 46 other markers placed over the rest of the body. The Full Body Lumbar Spine model has 30 degrees of freedom (DoF), including a lumbar spine with coupling constraints resulting in a net of 3 DoF among those 5 vertebral bodies. Two iterations of this model were used, one with the coupling of the lumbar spine enabled (CS), and one where the coupling was locked resulting in a rigid lumbar spine (RS). Inverse Kinematics (IK) was executed using six different combinations of spinal markers as tracking inputs for both models. The marker error after IK was computed at each frame, and the root-mean-square (RMS) error computed for the full trial. Effects of the model, subset of tracking markers used as input, and subject were analyzed with multiple regression and differences between tracking subsets were analyzed with Tukey pairwise comparisons. **RESULTS:** Choice of model (CS or RS) had a significant effect on the RMS error of the markers ($p < 0.001$). The average RMS error across all spinal markers was 1.35 ± 0.30 cm for the CS vs. 1.64 ± 0.29 cm for the RS. The multiple regression showed a significant effect of tracking subsets, and subject ($p < 0.001$). Tukey pairwise comparisons showed that the two best tracking subsets were one weighting all 13 spinal markers and one weighting two lumbar markers (L2, L4), two thoracic markers (T10, T4), and the C7. **CONCLUSION:** The CS model exhibits lower RMS errors than the RS model, and this error can be further minimized by the inclusion of additional thoracic and lumbar spine markers.

2509 Board #173 May 31 9:30 AM - 11:00 AM
Does Step Rate Affect Running Injury Incidence? An Observational Study with 12-Month Follow-Up

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 (No relevant relationships reported)

PURPOSE: The primary aim of our study was to observe preferred step rate in military runners and observe injury incidence over one calendar year. **METHODS:** Subjects were recruited prior to the Army Physical Fitness Test (APFT) at West Point, NY and asked to run at their self-selected pace for a timed 2-mile event. Two-dimensional frontal plane video was collected during over ground running from two stationary high-speed cameras sampling at 30 Hz to assess preferred step rate. One-year clinical injury surveillance was conducted among all runners with a full medical record review using the Armed Forces Health Longitudinal Technology Application (AHLTA), an electronic medical record system. Sub-clinical injuries for which medical treatment was not sought were collected via semi-monthly email surveys over one year. Combined clinical and sub-clinical injury incidence was assessed among runners who completed all email surveys over the course of one year. **RESULTS:** Overall, 372 runners (mean age 22.6 ± 6 years, height 163.8 ± 36.8 centimeters, weight 78.5 ± 30.4 kilograms) participated in this study. Out of 372 runners, 16 sustained a clinical injury. Mean step rate for healthy runners was 173.6 and mean step rate for clinically injured runners was 172.7 steps/min. An independent t-test comparing step rate of clinically injured and non-injured runners yielded a non-significant p value: $p = 0.773$. 95 out of 372 runners completed all 4 sub-clinical injury surveys (95/372 = 26%). Out of 95 runners, 19 sustained a clinical or sub-clinical injury. An independent t-test comparing step rate of injured and non-injured runners yielded a non-significant p-value = 0.08, with a mean of 174.5 ± 12.3 for the uninjured group and a mean step rate of 172.4 ± 8.2 for those in the combined injury group. These results demonstrate no clinically meaningful or statistically significant difference in step rate with clinical or sub-clinical injury risk in our population. **CONCLUSIONS:** In this study, self-selected step rate during a timed 2-mile APFT in Department of Defense runners did not influence lower extremity injury rates. Future

studies are needed to further investigate the relationship between step rate and lower extremity injuries, and whether step rate can be a useful screening tool to prevent running related injury.

2510 Board #174 May 31 9:30 AM - 11:00 AM
Comparisons of Running Mechanics Between Injured and Non-injured Cross-country Runners

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 (No relevant relationships reported)

PURPOSE: The purpose of this study was to compare ankle power, peak plantarflexion moment, and ankle range of motion (ROM) between injured and uninjured Division-I cross-country athletes. **METHODS:** Six Division-I female cross-country athletes (height 164.7 ± 4.1 cm; weight 52.0 ± 3.1 kg) reported prior to the start of the cross-country season. Upon providing informed consent, athletes completed 5 running trials at a preferred pace over a 15-m runway in a laboratory equipped with ten 3D motion capture infrared cameras. Kinetic data were collected using three embedded force platforms within a 15-m runway. Ankle ROM, peak plantarflexion moment, and average ankle plantarflexion power were calculated. Injury reports were obtained from the team's certified athletic trainer at the end of the season. These reports allowed for the stratification of athletes into injured and uninjured groups. Data from six athletes were used for the current analysis, thus Hedges' g measures were used to identify effect size. **RESULTS:** Three athletes sustained left foot injuries during the season. Injury status had a small effect prospectively on plantarflexor power ($g = 0.25$) and ankle ROM ($g = 0.25$), and a medium effect on peak plantarflexor moment ($g = 0.68$) of the injured ankle. Injured athletes exhibited lower magnitudes of the variables of interest compared to uninjured athletes: average plantarflexor power (274.8 ± 53.5 and 306.1 ± 101.4 Nm/s respectively), less ankle ROM (41.5 ± 4.3 and $44.1 \pm 8.3^\circ$), and lower peak plantarflexor moments (124.1 ± 12.3 and 140.0 ± 17.8 Nm). **CONCLUSIONS:** Based on the results of the current study, the measured variables, particularly peak plantarflexion moment, may be of interest when investigating foot injury risk. The athletes in the current study may already be altering their motion to protect the at-risk limb. Longitudinal studies with additional data points and robust sample sizes are necessary to determine changes in running gait which may indicate increased risk of injury. This information has the potential to inform pre-screening gait analyses and subsequent coaching and clinical interventions.

2511 Board #175 May 31 9:30 AM - 11:00 AM
Achilles Tendon Stress and Backward Running

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 Backwards running (BR) has a greater cardiovascular demand and requires greater balance compared to forward running (FR). Previous literature has reported a lower patellofemoral joint compressive forces during BR. Therefore, BR has been recommended as a good rehabilitation exercise for patellofemoral pain patients as an intermediate progression from walking to FR. However, the effects of BR on Achilles tendon (AT), a common site of running injury, has not been investigated. To our knowledge, there have been no studies conducted comparing AT stress between FR and BR. **Purpose:** Identify differences in AT stress during FR and BR patterns. **Methods:** 22 healthy males (Age: 21 ± 1.6 years, Height: 181.4 ± 6.6 cm, Mass: 77.92 ± 7.12 kg) participated. Ultrasound imaging of AT cross sectional area (CSA) was measured with the ultrasound probe placed transversely between medial and lateral malleoli with the dominant ankle in a neutral position. After a 5 minute warm-up to familiarize themselves with the different running patterns, each performed 5 trials of both FR with a heel strike pattern and BR on a 20 meter runway with a running velocity between 2.8-3.4 m/s. Kinematic data were collected using a 15 camera motion capture system with a capture rate of 180 Hz using 47 reflective markers. Ground reaction force data were collected at 1800 Hz using a force platform. Human Body Model (HBM) was used to estimate muscle forces through static optimization based on inverse dynamics. AT force was determined from summing medial and lateral gastrocnemius and soleus muscle forces. AT stress was estimated by dividing AT force by AT CSA. Multivariate repeated measures analysis of variance was performed with an alpha value set to 0.05. **Results:** AT stress, force, ankle range of motion, and plantar flexor moments were greater during BR ($p < 0.001$). **Conclusion:** Higher AT loading occurred during BR compared to FR. The increased AT force production and AT stress during BR may prove to be problematic as a rehabilitation exercise for individuals experiencing AT related pathologies.

- 2512** Board #176 May 31 9:30 AM - 11:00 AM
Impact Of Footwear On Running Mechanics In Older Individuals: A Pilot Study
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While previous investigations have extensively examined running biomechanics in different types of footwear, there is a paucity of work examining these differences in an older habitual running population. **PURPOSE:** The purpose of this study was to examine the effects of maximalist and conventional footwear on running mechanics in older runners. **METHODS:** Five participants (Age: 58.8 ± 6.72 years; BMI: 25.14 ± 2.18 ; Miles/week: 24.3 ± 16.7) participated in this preliminary investigation. Participants were provided with a neutral laboratory shoe and a maximal cushioning laboratory shoe in their self-reported size. In addition, participants were asked to bring a pair of their own running shoes to represent a third footwear condition. Shoe characteristics are shown in Table 1. Running kinematics were captured using a 10-camera motion capture system while participants ran at a controlled pace of 4.0 m/s ($\pm 5\%$) over a 10-m runway with force platforms collecting kinetic data. Participants ran in each of the three footwear conditions, the order of which was randomized. Five successful trials from each condition were chosen for analysis. A one-way repeated measures ANOVA assessed differences in mean kinematic and kinetic variables of interest between shoe conditions ($\alpha < 0.05$). **RESULTS:** Mean values for shoe characteristics and gait variables are shown in Table 1. **CONCLUSION:** Preliminary data shows no differences between footwear conditions, suggesting that participants maintain their preferred movement patterns in all three shoes. As the study continues we will be able to ascertain whether this lack of difference is a result of our small current sample size or reflective of the participant's adaptations while running.

Variable	Neutral Shoe	Maximal Shoe	Own Shoe
Shoe Characteristics			
Material Thickness (mm)	32.18 ± 0.94	41.51 ± 1.107	29.94 ± 7.73
Peak g	10.13 ± 0.02	8.52 ± 0.21	11.48 ± 3.54
Peak Force (N)	844.37 ± 2.47	710.70 ± 17.93	956.89 ± 295.04
Time to Peak Force (ms)	19.97 ± 0.48	23.51 ± 0.72	17.43 ± 3.86
Kinematics			
Ankle ROM (°)	46.85 ± 8.69	41.63 ± 7.34	44.57 ± 8.62
Knee ROM (°)	29.96 ± 5.69	29.68 ± 4.81	30.13 ± 5.26
Hip ROM (°)	25.99 ± 6.78	27.09 ± 6.87	25.06 ± 8.06
Ankle angle at IC (°)	1.13 ± 8.26	4.17 ± 10.89	3.72 ± 6.73
Knee angle at IC (°)	23.41 ± 4.31	19.31 ± 5.34	23.21 ± 5.97
Hip angle at IC (°)	16.24 ± 7.69	12.57 ± 9.93	13.61 ± 7.41
Kinetics			
Peak vGRF (N)	1738.26 ± 281.38	1744.17 ± 312.38	1742.29 ± 286.55
Peak PF moment (Nm)	-184.43 ± 43.55	-172.1 ± 48.55	-189.22 ± 47.95
Peak KE moment (Nm)	186.21 ± 40.01	181.83 ± 41.66	179.91 ± 39.73

Table 1: Mean (\pm standard deviation) of shoe characteristics, and kinematic and kinetics during the stance phase of gait. mm = millimeter; ms = millisecond; N = newtons; ROM = range of motion; DF = dorsiflexion; IC = initial contact; ° = degrees; vGRF = vertical ground reaction force; PF = plantarflexion; KE = knee extension; Nm = newton meter

- 2513** Board #177 May 31 9:30 AM - 11:00 AM
An Investigation of Factors Affecting Dynamic Postural Stability in Collegiate Cross Country Runners
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Injury rates for NCAA cross country runners between 2009 and 2014 were 4.7-5.9/1000 athlete exposures. Prevalence of running-related injuries in the general population has been shown to be between 18-92%. Injury could lead to impaired balance which is a common aspect of return-to-sport rehabilitation programs, and various methods of its assessment have been proposed. The Dynamic Postural Stability Index (DPSI) was introduced to measure variability in tri-axial ground reaction forces during specific tasks. DPSI has been shown to be increased in injured runners and predict athletic performance in soccer players. DPSI has been correlated to ankle range of motion and strength in military personnel. These variables have not been measured in healthy collegiate runners. **PURPOSE:** To investigate how previous injury affects DPSI and explore relationship between ankle range of motion and strength with DPSI in collegiate runners. **METHODS:** Twenty-seven Division I collegiate cross country athletes (age: 19.8 ± 1.3 years) participated. Those with an injury in the past 3 years were categorized in the injured group (IG). Athletes jumped over a hurdle on to a force

plate and landed on a single leg. Three trials were performed on each leg. DPSI was calculated for the first 3s after landing. Ankle range of motion was assessed via active dorsiflexion and gastrocnemius length measurement. Ankle and hip strength were measured using a handheld dynamometer. An independent samples t-test was used to determine differences in DPSI between IG and uninjured group (UG). Pearson's correlation coefficient was used to determine relationships between DPSI and other variables. **RESULTS:** No significant difference was found for DPSI on left (IG: 0.30 ± 0.03 vs. UG: 0.32 ± 0.04) and right (IG: 0.30 ± 0.03 vs. UG: 0.31 ± 0.03) sides. There was a significant moderate negative correlation between dorsiflexion range of motion and DPSI (right side $r = -0.605$, $p = 0.001$; left side $r = -0.452$, $p = 0.001$). There were no correlations between strength and DPSI except for right inversion strength and right DPSI ($r = 0.446$, $p = 0.020$). **CONCLUSION:** DPSI seems to be influenced to a greater extent by ankle dorsiflexion than strength or previous injury in a collegiate running population; therefore, improving ankle dorsiflexion may be used as a rehabilitation strategy to improve DPSI.

- 2514** Board #178 May 31 9:30 AM - 11:00 AM
Relationship between Stance Frontal Plane Kinematics and Initial Impact forces in Runners: Asymmetry Implications
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Rearfoot eversion (REV) and contralateral pelvis drop (CPD) play a crucial role in force absorption at impact during running. Controlling and adequately absorbing the repetitive vertical ground reaction force (vGRF) at impact is essential in injury prevention. **PURPOSE:** This study aimed to examine the relationships between vGRF and REV, and vGRF and CPD bilaterally in collegiate runners. **METHODS:** Eleven asymptomatic (5 females, 6 males) NCAA Division II cross country runners (age, 19.1 ± 1.1 yrs; height, 174.2 ± 11.2 cm; mass 62.2 ± 6.2 kg; 38.3 ± 15.9 miles/wk, treadmill speed, 3.6 ± 0.5 m/s) underwent 3D motion analysis during a 7 minute steady state run on an instrumented treadmill. vGRF, REV and CPD were evaluated bilaterally for association via Pearson Correlation coefficients, $p < 0.05$. **RESULTS:** Mean (\pm SD) peak angles of REV and CPD, and vGRF during left stance were $3.6 \pm 6.5^\circ$, $-5.4 \pm 3.8^\circ$, and 1.8 ± 0.6 body weights (BW), respectively. Mean peak angles of REV and CPD, and vGRF during right stance were $2.51 \pm 2.5^\circ$, $-4.9 \pm 4.9^\circ$, and 1.6 ± 0.4 BW, respectively. Significant high negative correlation was found for REV and vGRF during left stance [$r(9) = -.967$, $p = 0.03$] while CPD and vGRF during right stance were significantly highly positively correlated [$r(9) = .714$, $p = 0.02$]. **CONCLUSION:** Despite the low number of subjects, we conclude that frontal plane kinematics are associated with impact force magnitude during running, and the associations appear to be asymmetrical necessitating a bilateral examination of running mechanics.

- 2515** Board #179 May 31 9:30 AM - 11:00 AM
Effect Of Arch Characteristics On Pain In Minimally-shod vs Traditionally Shod Runners
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Minimalist running became popular due to the purported rationale of lowering overuse injury rates. The efficacy of wearing minimalist shoes to prevent injury has been greatly debated. We previously reported that arch height (pes cavus, normal, pes planus) influences lower extremity pain in minimalist runners; however, no clear relationship has been established between either arch height index (AHI) or arch rigidity index (ARI), running shoe type, and pain. The **PURPOSE** of this study was to examine self-reported pain in the lower limbs in minimally and traditionally shod runners with various AHIs and ARIs. **METHODS:** Following consent, 60 experienced runners (age 26.88 ± 9.2 yrs, hgt 171.6 ± 9.8 cm, mass 68.7 ± 15.1 kg, gender: 40F/20M) completed a visual analog scale (VAS) about pain in five common sites of injury: knee, ankle, calf, shin, and foot (VAS $\geq 3/10$ was considered pain). AHI was categorized as high ($n=30$), normal ($n=60$), and low ($n=30$). ARI was categorized as rigid ($n=30$), normal ($n=60$), and flexible ($n=30$). A series of 3-factor chi-square analyses determined if shoe type (minimalist, traditional) and AHI (high, normal, and low arch) were related to overall and site specific pain (yes, no). ($\alpha = 0.05$). Additional 3-factor chi-square analyses determined if ARI (rigid, normal, and flexible) and shoe type (minimalist, traditional) were related to pain (yes, no). ($\alpha = 0.05$). **RESULTS:** More minimalist runners with a normal AHI (70.%; $p = 0.028$) reported pain in at least one site when compared to traditional runners with a normal AHI (40.0%; $p = 0.028$). All minimalist runners with a rigid arch reported pain in at least one site (100%; $p = 0.003$) while reported pain in runners in traditional shoes was less common (28%; $p = 0.003$). However, the interaction between site specific pain, arch characteristics, and shoe type

is not as clear as the results varied between the different AHI/ARI, shoe type, and site specific pain combinations. **CONCLUSIONS:** Generalizations about site specific pain in minimally or traditionally shod runners with high/low or flexible/rigid arches are difficult because the results are combination specific. Runners with a rigid arch may not be able to absorb ground reaction forces as well when wearing minimal shoes and may fare better in a traditional shoe that offers more support during ground contact.

2516 Board #180 May 31 9:30 AM - 11:00 AM
Impact of Progression Run on Sagittal Plane Stance Phase Kinematics

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The impact of fatigue on distance running kinematics is commonly studied by having runners complete exhaustive runs that alter joint kinematics quite dramatically. In this study, we attempt to assess minor changes that occur during a non-exhaustive progression run, by comparing sagittal plane joint-angle plots for the entire stance phase. **PURPOSE:** Compare baseline and final stance phase kinematics for a 16-minute treadmill progression run to determine if there are significant differences among the hip, knee and ankle. **METHODS:** Nineteen runners participated (18-45 years). Kinematic data were collected using 6 Vicon motion-analysis cameras. During testing, baseline data were collected during a 4-minute run at self-selected marathon pace. Then, a 16-minute progression run was completed, that ended at marathon pace. The first 10 clean strides were analyzed during the last minute of the 4-minute run and the last minute of the 16 minute progression run. Stance phase data for each stride was normalized to 101 points. Average joint angle curves for the baseline run were compared to those from the end of the progressive run (for all 101 points). The mean difference score was calculated to quantify kinematic change for the entire phase. Parvo metabolic testing was completed simultaneously to confirm that the progression run caused the heart rate and $\dot{V}O_2$ to increase significantly. A one-way ANOVA was used to test for joint differences. **RESULTS:** Kinematic change was calculated for the hip ($1.9 \pm 1.0^\circ$), knee ($3.4 \pm 2.7^\circ$) and ankle ($1.8 \pm 0.8^\circ$). There was a significant joint difference ($p < 0.05$). Post-hoc analysis revealed the knee kinematic change to be significantly greater than the hip and ankle. **CONCLUSIONS:** The submaximal progression run appeared to alter knee kinematics the most. Overall, the kinematic changes were minor, but it is important to note that the knee changes were approximately 80-85% greater than the hip and ankle. This analysis may help to better understand performance and/or injury.

2517 Board #181 May 31 9:30 AM - 11:00 AM
Effects Of Assistance And Resistance Elastic Bands On Short Distance Sprinting In Women

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Despite the prevalence using resistance bands to add resistance or assistance to sprinting, there is little research to validate the use as a training modality. **PURPOSE:** To determine the effects of elastic resistance and assistance on forward and backward sprinting velocity, stride time and stride length. **METHODS:** Eight high-school and college (19.9 ± 3.5 years) women soccer players voluntarily ran six maximal effort 10m forward and backward sprints under three conditions, resistance, assistance and body weight. During the resistance/assistance conditions, 3m elastic bands (Super Bungee Cordz, West Warwick, RI), marketed as providing 333N of force when fully stretched, were secured to a pelvic belt. During the sprints, bilateral lower extremity kinematic data was recorded with custom footswitches embedded in standardized laboratory shoes (Asics T2F9N) indicating ground contact/off. Sprinting velocity, stride time and stride length were computed for each sprint in the same 1.5m space relative to the start position. Separate direction by condition repeated measures analysis of variance for each outcome measure were followed by simple main effect post hoc tests. **RESULTS:** Sprint direction had significantly different effects on sprint velocity ($P < .001$, $\eta_p^2 = 0.746$), stride time ($P = .007$, $\eta_p^2 = 0.504$), and stride lengths ($P < .001$, $\eta_p^2 = 0.760$) between the three conditions. Post hoc results are provided in Table 1. **CONCLUSIONS:** When sprinting with only body weight, similar characteristics exist in each direction, whereas the effects of sprinting with resistance and assistance was different between the directions. By quantifying the changes in sprinting velocity and stride time/length with elastic resistance and assistance, these results provide practitioners with insight regarding training specificity.

	Backward			Forward		
	Body Weight	Resistance	Assistance	Body Weight	Resistance	Assistance
Velocity (m/s)	2.02 \pm 0.38	1.90 \pm 0.21*†	2.50 \pm 0.43*†	2.24 \pm 0.32*	1.62 \pm 0.25*†	3.14 \pm 0.38*†
Stride Time (s)	0.59 \pm 0.06	0.56 \pm 0.07	0.57 \pm 0.04†	0.54 \pm 0.11*	0.66 \pm 0.10	0.67 \pm 0.05*†
Stride Length (m)	1.39 \pm 0.25	1.26 \pm 0.28*	1.59 \pm 0.30*	1.35 \pm 0.24	1.24 \pm 0.09	2.27 \pm 0.21‡

* $p < .05$ for condition (same direction)

† $p < .05$ for sprint direction (same condition)

‡ $p < .05$ for conditions (same direction)

2518 Board #182 May 31 9:30 AM - 11:00 AM
Physiological and Biomechanical Differences Between a Traditional Treadmill and a 360 Degree Virtual Reality Treadmill

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Virtual reality opportunities are booming as technology has advanced to provide a truly immersive experience. Soon virtual reality exercise experiences may be readily available to the public; thus, the exercise equipment that companies produce need to be assessed for use and safety. **PURPOSE:** Fifteen college students (8 women, 8 men; 20 ± 1 years old) walked for 5 minutes on a traditional treadmill (TT) and a 360-degree virtual reality treadmill (VR) with no headset to determine the physiological [heart rate (HR), oxygen consumption ($\dot{V}O_2$), rate of perceived exertion (RPE), respiratory exchange ratio (RER)] and biomechanical [step rate (SR), step length (SL), knee angle (KA), tilt] differences at self-selected paces as well as to a pace of 97 steps per minute set by a metronome (TTM vs VRM). **RESULTS:** $\dot{V}O_2$ (TT: 11.6 ± 1.2 vs VR: 16.8 ± 1.7 ; 3.5 ml/kg/min , $p \leq 0.005$), RER (TT: 0.81 ± 0.17 ; 0.5 vs VR: 0.89 ± 0.17 ; 0.5 , $p \leq 0.005$), HR (TT: 91.3 ± 17.7 ; 16.3 vs VR: 113.1 ± 17.7 ; 22.3 bpm , $p \leq 0.005$) and RPE (TT: 2.1 ± 1.7 ; 0.8 vs VR: 4.7 ± 1.5 , $p \leq 0.005$) were all significantly lower while walking on a traditional treadmill (TT) compared with a VR360 treadmill (VR) at a self-selected pace. This same pattern was observed when asked to walk at a specific cadence (97 steps/min) except RER was not different between the traditional treadmill and the VR360 treadmill (TTM: 0.89 ± 1.7 ; 0.05 vs VRM: 0.94 ± 1.7 ; 0.06 , $p = 0.146$). SR was significantly higher on the traditional treadmill (TT: 107.1 ± 17.7 ; 6.0 vs VR: 76.9 ± 17.7 ; 14.8 steps/min , $p \leq 0.005$), as well as SL (TT: 0.42 ± 1.7 ; 0.07 vs VR: 0.22 ± 1.7 ; 0.14 m , $p \leq 0.005$). KA was significantly lower on the VR360 treadmill, forcing a more knock-kneed walking position (TT: 174.2 ± 1.7 ; 3.9 vs VR: 139.9 degrees, $p \leq 0.005$) The 360 treadmill induced a bent over position, causing a significantly greater tilt (TT: 175.8 ± 1.7 ; 3.0 vs VR: 156.5 , $p \leq 0.005$). **CONCLUSION:** Walking on a virtual reality treadmill is more strenuous from a physiological and biomechanical perspective than a traditional treadmill, at a self-selected and forced pace. Shorter exercise bouts using virtual reality treadmills may be a more practical use of this exercise modality.

2519 Board #183 May 31 9:30 AM - 11:00 AM
Not All Forefoot Striking Is Equal

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Rearfoot strike (RFS) runners typically exhibit an impact peak in their vertical ground reaction force caused by heel impact. This impact is associated with high load rates that have been linked to running injuries. The vast majority of forefoot strike (FFS) runners do not exhibit this impact peak and have significantly lower load rates compared with RFS runners. However, some FFS runners do exhibit an impact peak and load rates similar to RFS. The heel descent after initial contact in FFS could help further explain this phenomenon.

PURPOSE: To investigate the relationship between heel kinematics and vertical average loading rate (VALR) in FFS runners. **METHODS:** 30 habitual FFS runners from an ongoing study were included (5F, 25M; age: 35.6 ± 9.3). Ground reaction forces and heel kinematics were collected on an instrumented treadmill at $2.6 \pm 0.4 \text{ m/s}$. Pearson correlations between VALR and heel height at initial contact (HIC), time to heel contact (THC), heel descent acceleration

(HDA) and heel descent excursion (HDE) were extracted. These variables were also compared between runners who exhibit an impact peak ($n=9$) and those that did not ($n=21$).

RESULTS: VALR was significantly (all $p<0.01$) correlated with HIC ($r=-0.514$), THC ($r=-0.783$) and HDA ($r=0.612$). A trend was found for the correlation with HDE ($r=-0.33$, $p=0.08$). FFS runners with an impact peak exhibited significantly lower HIC, a shorter THC and higher HDA (Table 1). A trend for lower HDE was noted in this group as well.

CONCLUSIONS: Lower heel at initial contact, decreased time to heel contact, and higher heel descent acceleration were significantly correlated with greater VALR and were observed by FFS with vertical impact peaks. This suggests that FFS runners with these impacts should be trained to land with more plantarflexion and greater eccentric control of their heel descent to reduce their landing impacts. Supported by FAPESP (2017/26844-1).

Table 1. Mean (SD) of VALR and heel kinematics for FFS runners with and without Impact Peaks

	No Impact Peaks	Impact Peaks	p
n	21	9	
VALR (BW/s)	36.13 (10.33)	58.02 (18.56)	<0.001
HIC (mm)	77.15 (12.09)	63.18 (8.13)	0.004
THC (ms)	56.06 (11.70)	39.79 (9.55)	0.001
HDA (m/s/s)	17.62 (5.32)	21.77 (3.51)	0.042
HDE (mm)	18.65 (8.05)	13.67 (5.42)	0.102

2520 Board #184 May 31 9:30 AM - 11:00 AM Interaction Of Footwear And Strike Pattern Alter Skeletal And Muscular Contributions To Leg Stiffness

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(No relevant relationships reported)

Approximately 50% of runners sustain an injury each year that requires a cessation of training. Lower extremity stiffness has been identified as a potential contributor to lower extremity injury. However, recent research has suggested that the skeletal and muscular contributions to stiffness may be more indicative of injury mechanisms [1]. Research has also suggested that both footwear and foot strike pattern may also play a role in injury rates. **PURPOSE:** to assess the effect of footwear and strike pattern on skeletal and muscular contributions to leg stiffness. **METHODS:** Thirteen runners (aged 18 to 30) performed 8 over ground running trials at preferred running velocity in each of four experimental conditions: barefoot forefoot (BF-FF), barefoot rearfoot (BF-RF), shod forefoot (S-FF) and shod rearfoot (S-RF). Kinematics (240 Hz, Qualisys, Inc.) and ground reaction forces (GRFs, 960 Hz, AMTI Inc.) were collected simultaneously. Leg stiffness (kLeg) was calculated as the ratio of peak GRF magnitude divided by shortening of the limb. Skeletal (kSkel) and muscular contributions (kMusc) were calculated as previously described [1]. Three 2x2 repeated measures ANOVAs with Tukey's post-hoc tests were conducted to determine the effect of footwear and strike pattern on kLeg, kSkel and kMusc. **RESULTS:** Significant footwear by strike pattern interactions were observed for kLeg, kSkel and kMusc (Table 1). Post-hoc comparisons of kLeg, kSkel and kMusc revealed significant differences between S-RF and BF-FF, BF-RF, S-FF. **CONCLUSIONS/ DISCUSSION:** These data demonstrate that both footwear and strike pattern alter leg stiffness as well as muscular and skeletal contributions to stiffness. Though previous research has identified that stiffness may contribute to lower extremity injury, no clear relationship has been identified. Further research is necessary to determine how the components of leg stiffness may be related to injury mechanisms. [1] Powell, Paquette & Williams 2017.

Table 1. Mean stiffness values for leg stiffness (kLeg) as well as skeletal (kSkel) and muscular (kMusc) components of stiffness.

	BF-FF	BF-RF	S-FF	S-RF	Interaction	Footwear	Strike Pattern
kLeg	18.9±3.7	18.3±3.6	17.8±5.1	23.8±7.3 ^{abc}	<0.001	0.088	0.012
kSkel	15.4±3.6	14.8±3.1	14.2±4.4	19.2±6.6 ^{abc}	<0.001	0.174	0.028
kMusc	3.5±8.0	3.5±1.0	3.5±1.0	4.6±1.1 ^{abc}	<0.001	0.005	0.001

Note: a – denotes significantly different than BF-FF, b – denotes significantly different than BF-RF, c – denotes significantly different than S-FF.

2521 Board #185 May 31 9:30 AM - 11:00 AM

Impact of Fatigue on Stride to Stride Variability of Sagittal Plane Joint Kinematics

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(No relevant relationships reported)

With recent improvements in motion-analysis, it has now become much easier to assess multiple distance running strides to determine how consistent a runner's kinematics are. Thus, the impact of factors such as fatigue on running technique can now be evaluated. **PURPOSE:** To determine if stride-to-stride variability (SSV) of sagittal plane stance phase joint angles at the hip, knee, and ankle are altered by a 16-minute submaximal progression run. **METHODS:** Nineteen runners (18-45 yrs) participated in this study. Six Vicon Bonita cameras were used to collect kinematic data at 200 Hz. A Parvo metabolic cart was used to confirm the progression run caused fatigue. Baseline data were collected utilizing a 4 minute run at self-selected marathon race pace. After a 5-minute rest period the runners completed a 16-minute progression run, with increases in intensity at 4 minute intervals, which ended at marathon pace for the final data collection. Ten strides were used for SSV calculations. Stance phase joint angles were normalized to 101 data points. SSV was then determined for each joint by calculating the standard deviation (SD) across the 10 consecutive strides. The baseline and final SSV were compared using a 2-way ANOVA. **RESULTS:** The progression run increased the heart rate significantly (158.6±13.4 bpm to 169.6±14.3 bpm), thus confirming significant fatigue. Baseline and final SSV data were compared for the hip (1.23±0.37° vs. 1.17±0.37°), knee (1.47±0.39° vs. 1.51±0.44°), and ankle (1.20±0.50° vs. 1.21±0.40°). ANOVA and post-hoc testing revealed the knee to be the most variable joint overall. However, there were no significant increases in SSV between baseline and final measures. **CONCLUSIONS:** Despite experiencing metabolic and kinematic changes, the runners maintained the consistency of their running technique. Future research may want to evaluate SSV under greater to levels of fatigue to assess whether a fatigue threshold exists that will lead to an altered consistency of running technique.

2522 Board #186 May 31 9:30 AM - 11:00 AM

The Effects of Sampling Frequency on Studying Peak Tibial and Sacral Accelerations in Running

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Tibial impact (peak tibial acceleration, PTA) is often studied in relation to running injuries such as tibial stress fractures. The magnitude of impacts after initial contact give insight into how well the body is able to mitigate shock propagation. The ratio between PTA and peak sacral acceleration (PSA) is used for shock attenuation. Sample frequencies of 1000-1200 Hz are used to measure PTA and PSA in the lab. Considering the trend for using accelerometers in devices like cell phones and sport watches, measuring at a lower frequency is favorable for battery life, measurement duration, and monetary costs.

PURPOSE: To study the effects of reduced sampling frequency on PTA and PSA magnitudes during an exertive 20 min. treadmill run.

METHODS: A healthy subject (M, 23 yrs, 1.75 m, 75 kg) was equipped with two wired accelerometers (1200 Hz) and two inertial measurement units (IMU) (100 Hz) on the tibia and sacrum. The subject ran for 20 minutes at 3.8 m/s on a treadmill. RPE (Borg) at end of run was 17. PTA and PSA were obtained using a custom Matlab algorithm. The 1200 Hz signal was filtered using a low-pass filter (cutoff freq. = 60 Hz). Delta peak of PTA and PSA between the first and last interval of the run was calculated for each sensor. A T-test was used to test for the statistical difference.

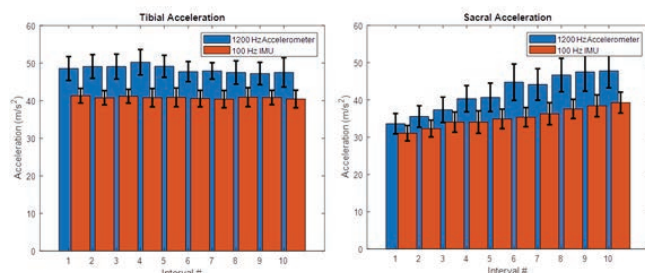
RESULTS:

PTA and PSA were greater over each interval during the run for the 1200 Hz sensor than the IMU (Figure 1a, 1b). Delta peak values of the IMU and 1200 Hz sensor were not different for PTA, but were for PSA ($p < 0.05$).

CONCLUSIONS:

The trend in PTA and PSA during the run was similar between higher and lower resolution devices. However, the IMU cannot be used for absolute impact values, given the underestimation. These data suggest wearable technology is suitable to measure signal changes in PTA and PSA out-of-the-lab measurements but we caution interpretation of absolute values. The subject did not have "high" PTA, thus more work is needed to assess if lower res. devices are appropriate for those with greater PTA.

Figure 1: Peak tibial (a) and sacral (b) acceleration for running 20 minutes on a treadmill

**E-38 Free Communication/Poster - Walking**

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2523 Board #187 May 31 9:30 AM - 11:00 AM
Differences in Indoor, Outdoor, and Treadmill Walking in Healthy Young Adults

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(No relevant relationships reported)

The ability to ambulate within one's environment is an important skill for everyday life, however, traditional methods of assessing gait involve walking in controlled settings that may not represent performance in real-world environments. Laboratory and clinically-based quantitative gait assessments are often conducted in a sterile and uniform environment and treadmill walking assessments, used to collect a large amount of walking data, are conducted with an externally driven speed and fixed environment. As such, gait demonstrated in these assessments may not reflect gait performance in the real-world environment. **PURPOSE:** To compare gait behavior among overground indoor, outdoor, and treadmill walking in healthy adults. **METHODS:** 16 healthy young adults (5M, 11F, 21±2yrs) performed three walking trials (500m each) at a self-selected pace: indoors around a gymnasium (IN), outdoors along a sidewalk (OUT), and on a treadmill (TM). Data were collected using wearable sensors and the following variables were calculated for each trial: cadence, gait velocity, double support %, step time, stride length. Two repeated-measures MANOVAs were used to compare mean values and variability (standard deviation (SD)) across conditions. **RESULTS:** Significant differences were found across the conditions for both mean values ($\Lambda^*=0.038$, $F(10,6)=15.18$, $p=.002$), and variability ($\Lambda^*=0.037$, $F(10,6)=15.41$, $p=.002$). Univariate tests showed differences in mean values between all three conditions for cadence, gait velocity, step time, and stride length ($p<.003$), and greater double support time in the TM condition than the IN or OUT conditions ($p=.006$). Univariate tests for variability measures failed to detect statistically significant differences ($p>.01$). The TM condition had a lower gait velocity SD than IN or OUT ($p=.001$). **CONCLUSION:** Healthy young adults adopt different walking strategies while walking indoors, outdoors, and on a treadmill.

	Outdoors	Treadmill	Indoors
Cadence (steps/min)	115.04 ± 7.23	104.53 ± 9.71	111.76 ± 7.36
Gait velocity (m/s)	1.30 ± 0.17	0.99 ± 0.26	1.19 ± 0.17
Double support %	18.22 ± 3.21	22.00 ± 3.89	19.18 ± 3.30
Step time (s)	0.52 ± 0.03	0.58 ± 0.05	0.54 ± 0.03
Stride length (m)	1.36 ± 0.13	1.13 ± 0.20	1.27 ± 0.14

2524 Board #188 May 31 9:30 AM - 11:00 AM
Effect of Mobile Texting and Walking Speed on Gait Characteristics of Normal and Obese Adults

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(No relevant relationships reported)

Studies have shown that obesity is associated with increased biomechanical loads, poorer motor control abilities, and impaired cognition. However, less is known if

there is an augmented effect on obese population when both biomechanical loads and cognitive function are required at the same time such as texting while walking. **PURPOSE:** To examine how usage of mobile devices while walking affects walking characteristics of normal and obese populations. **METHODS:** A total of 32 participants were recruited in this study: 16 normal-weight (NW; age = 26.6±4.2 years, BMI = 23.4±3.1 kg/m²) and 16 obese participants (OB; age = 27.3±6.1 years, BMI = 34.4±3.5 kg/m²). Two conditions were employed (No-texting and Texting). In each condition, subject performed two 60 sec walking trials at three speeds (90% (PSF-10), 100% (PSF), and 110% (PSF+10) of a preferred step frequency (PSF) measured in baseline) along a rectangular walkway (8 x 12 m). At each step frequency condition, participants were asked to walk while matching a preferred foot strike to the beat of an auditory metronome. Gait parameters including spatial and temporal step characteristics were measured from wireless inertial sensor system. Three-way repeated measures ANOVA's were performed for all dependent variables, with texting condition and walking speed as within-subjects variables and obesity as a between-subjects variable. **RESULTS:** A significant texting by walking speed interaction in matching the target step frequency was observed ($F(2,56)=39.85$, $p<.001$, $\eta^2=.58$) in both groups, showing the interference effects of texting on retaining cadence rhythm at fast walking speed (% change from target step frequency = No-texting: 2.1±.5 % at PSF-10, 2.8±.3 % at PSF, -1.5±.4 % at PSF+10; vs. Texting: 2.4±.7 % at PSF-10, -2.8±.8 % at PSF, -8.2±.8 % at PSF+10). OB exhibited longer double support time (NW=17.7±0.5, OB=22.0±0.5 % of the gait cycle time (%GCT); $p<.001$), stance time (NW=59.0±0.2, OB=61.1±0.2 %GCT; $p<.001$), and turn duration (NW=1.59±0.05, OB=1.78±0.05 sec; $p=.006$) compared to NW. **CONCLUSION:** Overall, the results provide further evidence of dual-task effects of texting on walking characteristics. The study further highlights the specificity of reduced gait function as a function of speed of walking as well as body composition under dual-task situation.

2525 Board #189 May 31 9:30 AM - 11:00 AM
Comparison of Brain Hemodynamic Responses to Forward versus Backward Walking among People Post-Stroke

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(No relevant relationships reported)

Hemiparetic gait is frequently observed in people post-stroke, which is characterized by gait asymmetry. Forward walking (FW) and backward walking (BW) are commonly used to restore gait in stroke rehabilitation. The two forms of locomotion have been investigated via physiological and biomechanical methods. Limited studies have incorporated neurocognitive methods to investigate the specific underlying neural mechanisms associated with FW and BW in people post-stroke. **PURPOSE:** To compare the cortical hemodynamic responses of the motor cortex to FW and BW in people post-stroke.

METHODS: 11 individuals post-stroke participated in this cross-sectional study. All participants completed two walking conditions on a treadmill. They performed the test conditions on separate days in a random order. After 30 seconds of quiet standing, participants completed 30-second walking trials five times for each condition at a matched speed. The functional near-infrared spectroscopy (fNIRS) system was utilized to measure oxyhemoglobin (oxyHb) levels during the walking trials.

RESULTS: Paired t-tests showed that there was a statistically significant difference in the level of oxyHb between FW and BW (p -value <.05). BW elicited a higher level of cortical hemodynamic activity by showing a 467% greater rate of change in oxyHb as compared to FW. In addition, regional comparisons of brain activity patterns demonstrated significant differences. During BW, participants post-stroke increased oxyHb levels in the primary motor cortex higher than the supplementary motor cortex. However, FW showed the opposite trend of brain activity patterns in the motor cortex.

CONCLUSIONS: Our findings suggest that walking backward can increase the levels of brain activity and stimulate different areas of the brain as compared to the conventional mode of walking forward. Our results indicate that BW can be incorporated into stroke rehabilitation which may help promote neuroplasticity. Future studies should examine the effects of BW training on cognitive functions in people post-stroke.

2526 Board #190 May 31 9:30 AM - 11:00 AM
Does Wearable Crutch Walking Excessively Load the Hip Joint?

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PURPOSE: As an alternative to using traditional axillary crutches for non-weightbearing, the use of a wearable crutch has been associated with better functional

outcomes. However, hip and back pain have been reported as side effects. This may be due to the reduced ability of the lower extremity to attenuate ground reaction forces. The primary objective was to compare compressive forces at the hip between wearable crutch walking, normal walking and axillary crutch walking. It was hypothesized that hip forces would be higher with wearable crutch walking compared with normal walking and axillary crutch walking.

METHODS: Three-dimensional kinematics and ground reaction forces were measured in 12 healthy subjects (11 men, 1 woman, age 36 ± 10 yr) during normal gait, axillary crutch ambulation and wearable crutch walking (iWalk 2.0). Hip and trunk range of motion, as well as peak vGRF and peak hip and low back compressive force during the stance phase, were compared for the three conditions using repeated-measures ANOVA.

RESULTS: Gait speed while wearing the wearable crutch was reduced 44% compared to normal gait and 33% compared to crutch ambulation ($P < 0.001$). Frontal and sagittal plane hip range of motion were both significantly reduced during both crutch conditions compared to normal gait ($P < 0.001$). Trunk range of motion in both planes was greatest during wearable crutch walking compared to both normal gait and crutch ambulation ($P < 0.001$). Peak vGRF while wearing the hands-free crutch was 12% lower than normal gait ($P < 0.001$) and 30% lower than crutch ambulation ($P < 0.001$). Peak compressive hip force during wearable crutch walking was 11% lower than during normal walking ($P = 0.026$) and 30% lower than during axillary crutch walking ($P < 0.001$). Low back compressive force during wearable crutch walking was 18% higher than during normal walking ($P = 0.03$) but not different than during axillary crutch walking (1.4 % difference $P > 0.05$).

CONCLUSIONS: Despite a reduction in the shock-absorbing ability of the lower extremity, vGRF and compressive hip forces were not increased during wearable crutch walking. Although low back compressive force did increase with this device, it did not exceed the forces during axillary crutch walking. Therefore, the wearable crutch seems to be safe for patients who are required to be non-weightbearing.

2527 Board #191 May 31 9:30 AM - 11:00 AM
Effect Of New Walking Exercise With Two Poles For Upright Posture In Back-knee Case

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Back-knee is knee deformation with hyperextension, and observed leaning forward, and adduction and internal rotation of hip joint during walking instead of hip and knee flexion. Therefore, we have adopted exercise with new walking style using two poles to avoid leaning forward. **PURPOSE:** To study the effect of the walking exercise using two poles on posture and gait in a back-knee case. **METHODS:** Subject: 70's female, with back-knee on both legs, using two T-canes in everyday life. Intervention: The walking exercise was conducted using two poles for 15 to 30 minutes once a week for 10 months. Same exercise was done every day at home. Equipment: A set of poles with the grips bending towards the thumb side (radial deviation), setting the length 10 cm or longer than the general Nordic walking pole. Walking style: (i) Stick the pole vertically at about 10 cm or more from the toe of the foot you stepped. (ii) Put the legs shoulder-width forward, land the step from the heel, kick out with a toe and walk. **MEASUREMENT:** The joint angles were measured during the walking using two T-canes before intervention and with this walking style after 45-week exercise. **RESULTS:** At the loading response, the trunk bending against a vertical axis was decreased from 20° (before intervention) to 8° (after 45 weeks). The hyperextension of the knee joint were decreased from 42° to 30°. Posterior hip joint extension was not observed before intervention, but it showed 17° extension after 45 weeks. Also, when raising the legs, the hip flexion angle against a vertical axis were 35° before intervention and 50° after 45 weeks, showing the motion range for hip flexion-extension extended. **CONCLUSION:** This walking style with two poles is thought to have the effect to gain the upright posture, making it easier to put forward the legs.



2528 Board #192 May 31 9:30 AM - 11:00 AM
The Effect Of Stride Length Training On Muscular Activity And Energy Cost During Walking

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Human bipedalism is the most unique locomotive form in the terrestrial environment and can be performed for a prolonged period of time. To maintain this form of locomotion humans have adopted physiological and mechanical strategies to minimize and conserve their stored energy. The self-selected locomotive pace in humans is that at which the most efficient energy cost can be maintained. **PURPOSE:** To study the effects of stride length alteration training on the electromyographic (EMG) activity of the quadriceps muscle group and hamstring muscle group and oxygen consumption. **METHODS:** Male (n=8) subjects (age =21years) recruited for this study. Heart rate, and oxygen consumption (VO_2), and EMG activity (quadriceps and hamstring) were continuously measured during walking at self-selected speed at the following stride length: (1) self-selected (s-s) (2) 10% below s-s, (3) 20% below s-s, (4) 10% above s-s, (5) 20% above s-s, and (6) 30% above s-s stride-length. Subjects then trained 3 days per week for 8 weeks on a treadmill starting at 20% above their s-s speed. Each week, speed was increased by 0.1 miles per hour (mph) until the subject was unable to maintain a walking gait (one foot must remain on the treadmill). Post-testing was conducted after completion of the training sessions. Repeated measures ANOVA were used to determine differences between sessions. **RESULTS:** Post s-s speed and length and $\text{VO}_{2\text{max}}$ were significantly higher than pre-test ($p=0.05$ for all). Both pre- and post- heart rate, VO_2 , and EMG activity were significantly lower at s-s stride length than all below and above s-s stride lengths ($p=0.05$ for all). Post- VO_2 and EMG activity at s-s stride length were significantly higher than pre-test ($p=0.05$). **CONCLUSIONS:** Oxygen consumption and EMG activity levels showed a U-shaped curve with the lowest at s-s stride lengths and higher at below and above s-s speed before and after 8 weeks of stride length alteration training. This indicates walking energy cost is optimal at s-s stride lengths regardless of the training-induced change in s-s stride length. Stride length alteration training shifted the U-shaped curve for oxygen consumption and EMG to the right indicating increased overall walking energy cost that is related to increased s-s stride length.

2529 Board #193 May 31 9:30 AM - 11:00 AM
Effects of Percent Body Fat on Foot Pressure Characteristics during Walking in Weight-Matched Male Adults

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 (No relevant relationships reported)

Increased body weight is associated with increased magnitude of pressures under the feet in obese population. Although body mass index (BMI) has been used in the assessment of overweight/obesity, BMI does not differentiate between muscle and adipose tissue, which may play a role in characterizing walking patterns. **PURPOSE:** To compare foot pressure characteristics during walking between obese and weight-

matched controls. **METHODS:** Sixty male adults were assigned to normal group (NG; n=30, age: 48.64 ± 6.24 years, percent body fat (%BF): 21.18 ± 3.51 %) and obese group (OG; n=30, age: 47.71 ± 6.45 years, %BF: 29.81 ± 4.12 %) based on %BF. Body compositions including %BF, fat mass, muscle mass, and BMI were measured by bioelectrical impedance method. Foot pressure and gait parameters were recorded with a force-distribution-measure treadmill system during walking at the preferred speed. An independent t-test was performed to compare the differences of dependent variables between the groups. A $p < .05$ was considered statistically significant. **RESULTS:** No differences were observed between the groups in weight (NG: 72.21 ± 9.04 kg, OG: 75.03 ± 8.52 kg, $p = .254$) and BMI (NG: 24.54 ± 2.17 kg/m², OG: 25.65 ± 2.59 kg/m², $p = .073$). OG showed significantly greater %BF (NG: 21.18 ± 3.51 % fat, OG: 29.81 ± 4.12 %, $p < .001$) and fat mass (NG: 14.18 ± 3.74 kg, OG: 21.64 ± 3.52 kg, $p < .001$), but lower muscle mass (NG: 31.64 ± 4.81 kg, OG: 28.56 ± 2.70 kg, $p < .05$) despite the same weight. The speed of walking did not differ between the groups (NG: 3.47 ± 0.86 km/h, OG: 3.20 ± 1.02 km/h, $p = .261$), but OG walked with a wider step width (NG: 14.29 ± 4.07 cm, OG: 16.66 ± 3.73 cm, $p < .05$). The line of the force application point was longer in NG for both stance-phase (NG: 250.88 ± 63.62 mm, OG: 213.13 ± 55.41 mm, $p < .05$) and single-limb support phase (NG: 130.38 ± 41.03 mm, OG: 106.42 ± 37.75 mm, $p < .05$). Maximum pressure at the heel was also greater in NG (24.64 ± 6.29 N/cm²) than OG (20.93 ± 6.56 N/cm²) ($p < .05$). **CONCLUSION:** The results demonstrated substantially different force application patterns during walking between obese and weight-matched control group, indicating a potential influence of %BF on foot pressure characteristics in walking. The comprehensive evaluation of obesity including %BF, therefore, should be administered for the prescription of safe physical activity.

2530 Board #194 May 31 9:30 AM - 11:00 AM
Response of Femoral Articular Cartilage Throughout a 5,000 Step Walking Protocol Using Ultrasound

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Femoral cartilage cross-sectional area (CSA) demonstrates changes following a standardized walking protocol of varying durations when assessed using ultrasonography (US). However, it is unclear if a certain step threshold exists beyond which no further changes in CSA are observed. Similarly, it is unclear how changes in cartilage CSA progress with an increasing number of steps.

PURPOSE: To evaluate changes in femoral cartilage CSA between baseline and 1,000, 2,000, 3,000, 4,000, and 5,000 steps, respectively using US.

METHODS: Thirty-two healthy individuals (63% female, age = 22 ± 3 yr, BMI = 24 ± 3 kg/m²) completed a single testing session. Habitual walking speed was assessed over a 6-meter walkway using infrared timing gates. Participants rested with their knees extended on an examination table for 45-minutes to unload their knee cartilage prior to the walking protocol. US was used to acquire images of the femoral cartilage prior to the walking protocol. Immediately following US acquisition, participants walked on a treadmill at their average, over ground walking speed for 1,000 steps, after which additional US images of the femoral cartilage were acquired. This process was repeated at 2,000, 3,000, 4,000, and 5,000 step time points. A one-way repeated-measures analysis of variance was used to compare femoral cartilage CSA across the 6 time points. Multiple Bonferroni corrected planned comparisons (0.05/5) were used to evaluate pair-wise comparisons if a statistically significant ANOVA model was identified.

RESULTS: Significant differences in femoral cartilage CSA were observed across time points ($F_5 = 23.60$, $p < 0.001$). Femoral cartilage CSA was significantly greater at the 2,000 (Mean Difference [MD] = +1.25mm, $p = 0.01$), 4,000 (MD = +0.95mm, $p < 0.001$), and 5,000 (MD = +2.14mm, $p < 0.001$) step points compared to baseline. Conversely, femoral cartilage CSA was significantly lesser at the 3,000 step point (MD = -1.12, $p = 0.001$) compared to baseline.

CONCLUSIONS: Changes in femoral cartilage CSA following walking may be dependent on the number of steps taken during a session of physical activity. Future research should determine mechanisms related to the increase and decrease in femoral cartilage CSA found in response to walking, as these mechanisms may be linked to the number of steps taken.

2531 Board #195 May 31 9:30 AM - 11:00 AM
Preliminary Analysis: The Effects of Gait Interventions on Knee Joint Contact forces in Healthy Adults

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The effects of gait modifications (GM) are of interest as a non-invasive strategy to slow the progression of knee osteoarthritis. Previous research has found a reduction in knee adduction moment (KAM) as a result of GM. However, there is conflicting research regarding the relationship between KAM and joint contact forces. **Purpose:** To compare the effects of two GMs on the estimated joint contact forces in the medial and lateral knee compartments. **Methods:** 5 healthy volunteers (27.8 ± 4.1 years, 1.74 ± 0.10 m, 74.98 ± 13.7 kg) completed 10 trials each of walking with a normal gait (NG) and with 2 different interventions: foot progression (FP) & lateral trunk lean (TL). During each trial GM parameter magnitude (1-5 SD relative to baseline) was estimated using Visual3D and real time visual feedback was provided to participants. Data was collected using a motion capture system (200Hz) while participants walked across a ~6-meter walkway; 4 in-line force plates (1000Hz) captured ground reaction force and speed was controlled for during each trial. Data was imported into OpenSim to estimate the joint contact forces in the knee of the dominant leg. Differences between the 3 GMs were analyzed using an ANOVA ($\alpha < 0.05$). **Results:** Average peak joint contact force for both the medial and lateral knee compartments are summarized in table 1. A one-way ANOVA found no statistical differences ($p > 0.05$) between gait strategies for all conditions. **Conclusion:** While no significant differences were found it may be due to the small preliminary sample size. It also plausible that the OpenSim model of the knee joint may not be able to accurately reflect the in-vivo biomechanics of the knee in the frontal plane due to the model's degree of freedom. Further research should be conducted to verify these findings in a larger sample.

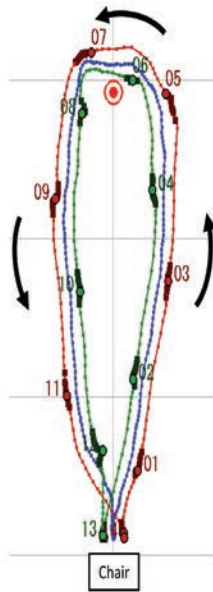
Table 1: Simulated Knee Joint Contact Forces Normalized by Bodyweight (mean±sd)

	NG	FP	TL
Medial Compartment (1st Peak)	2.38±0.58	2.58±0.95	2.44±0.94
Medial Compartment (2nd Peak)	3.95±0.58	3.34±1.86	3.25±1.85
Lateral Compartment (1st Peak)	0.73±0.20	0.80±0.33	0.93±0.24
Lateral Compartment (2nd Peak)	0.51±0.20	0.45±0.20	0.51±0.22

2532 Board #196 May 31 9:30 AM - 11:00 AM
Gait Analysis Of Patients With Distal Radius Fracture Using A Novel Laser-tug System

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BACKGROUND: Patients with distal radius fracture (DRF) are at risk of consequent fragility fracture. Gait analysis of patients with DRF can provide useful information to prevent a fall and resultant fracture. The timed up and go test (TUG) is a clinical test, most often used to evaluate functional mobility; however, the detailed information of steps during the test is not well assessed. **PURPOSE:** To analyze the gait characteristics of patients with DRF during TUG using a newly developed Laser-TUG system. **METHODS:** We developed the Laser-TUG system, which enables us to assess the detailed gait information during TUG without using any instruments on patients. The system uses a single laser range sensor, and can track both legs and measure the foot contact positions to obtain the walking parameters, such as stride length and step length. Using the Laser-TUG system, we compared the gait of 20 patients with DRF who had surgery up to 2 weeks prior (the fracture group), and 40 age-matched healthy non-fractured volunteers (the non-fracture group). **RESULTS:** The total time of TUG in the fracture group was lesser (8.5 vs. 7.4 seconds, $P = 0.03$). The length of stride was smaller (0.51 vs. 0.62 meter, $P < 0.01$), and the number of steps in total was greater (14.3 vs. 11.7, $P < 0.001$), especially at the turning around phase (3.2 vs. 2.3, $P = 0.04$) in the fracture group. The distance from the turning point (0.53 vs. 0.46 meter, $P = 0.02$) was also farther in the fracture group. **CONCLUSION:** With this system, gait can be visualized without the use of a sensor on the patients. The time of TUG in the fracture group was less than 10 seconds, which implies normal gait speed; however, they walked with more steps and experienced difficulty turning around during TUG. These results suggest the cause underlying the tendency to fall in patients with DRF.



2533 Board #197 May 31 9:30 AM - 11:00 AM
Single-Parameter Gait Modifications Cause Involuntary Secondary Gait Changes

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Gait modification (GM) using real-time biofeedback (RTB) has shown success reducing 1st peak knee abduction moment (KAM) which is associated with knee osteoarthritis. Most studies have used single parameter GMs; though, evidence suggests that GMs can induce additional involuntary gait changes. **PURPOSE:** To compare the effects of 3 single parameter GMs [foot progression (FP), medial knee thrust (MKT), and trunk lean (TL)] designed to reduce KAM on secondary gait variables. **METHODS:** 10 healthy individuals volunteered for this study (26.7 ± 4.7 years, 1.75 ± 0.1 m, 73.4 ± 12.4 kg) with the dominant limb being used for analyses. Mean and standard deviation (SD) for KAM and frontal plane trunk, knee, and transverse plane foot angles were calculated from 10 baseline trials. Joint angles were used to provide RTB for corresponding GMs (i.e. foot angle and FP). Five trials were completed for each GM using RTB with the joint angle falling within a range (3-5 SD) relative to baseline. Visual 3D was used to calculate KAM (Nm/kgm) and angles ($^{\circ}$) at KAM. Repeated measures ANOVA were conducted to assess differences in dependent measures ($p < 0.05$). **RESULTS:** All GMs reduced KAM, with some causing involuntary changes to secondary gait variables (Table 1). Specifically, FP increased peak knee abduction angle, MKT reduced foot angle and increased trunk angle, and TL increased stride width ($P < 0.05$). **CONCLUSIONS:** All single parameter GMs reduced PKAM but resulted in additional involuntary gait changes such as increased knee abduction, internal foot rotation and trunk lean, and stride width during FP, MKT, and TL, respectively. Hence, a modification scheme that employs multiple GMs at once is likely more beneficial to reduce KAM.

Table 1. Means \pm SD for dependent measures. Kinetic and kinematic variables were measured at KAM.

	Group Main Effect		Gait Modification						
	F	P	Base-line	FP	d	MKT	d	TL	d
KAM (Nm/kgm)	15.43	<0.001	-0.27 (0.05)	-0.25 (0.06)*	0.52	-0.17 (0.09)*	1.43	-0.25 (0.09)	0.27
Foot Angle ($^{\circ}$)	25.04	<0.001	-3.54 (4.32)	4.59 (5.20)*	1.70	2.10 (9.90)*	0.74	-4.10 (4.90)	-0.12
Knee Angle ($^{\circ}$)	8.31	<0.001	3.41 (2.61)	2.87 (2.60)*	-0.21	2.23 (3.05)*	-0.41	3.59 (3.08)	0.06
Trunk Angle ($^{\circ}$)	40.37	<0.001	1.48 (3.01)	1.48 (3.06)	0.00	2.77 (4.07)*	0.36	6.91 (2.21)*	2.06
Stride Width (m)	1.69	0.02	0.13 (0.03)	0.14 (0.03)	0.28	0.14 (0.04)	0.24	0.15 (0.04)*	0.56
Stride Length (m)	3.54	0.18	1.41 (0.19)	1.40 (0.20)	-0.07	1.45 (0.16)	0.21	1.42 (0.17)	0.09

*Indicates statistically significant difference from baseline ($p < 0.05$). Reduced foot angle and trunk lean towards the dominant limb is positive while knee abduction is negative.

2534 Board #198 May 31 9:30 AM - 11:00 AM
Case-Control Investigation Of Speed And Gait After An Incomplete Spinal Cord Injury

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 (No relevant relationships reported)

Individuals with an incomplete spinal cord injury (iSCI) present with an array of compensatory gait mechanicanisms. Appraising these changes may help clinicians better prescribe treatment plans to improve quality of movement. **PURPOSE:** The primary purpose of this investigation was to compare gait measures between someone with an iSCI and an age-, sex-, and height-matched non-limited control (CON). A secondary purpose was to quantify changes in movement when walking at different speeds. **METHODS:** This case-control study included a participant with iSCI and a CON. Three-dimensional motion analysis was used to determine gait speed and lateral deviation (LD) for preferred normal walking (NW) and fast walking (FW) tests. LD was determined by movement of 7th cervical spinal process (C7) marker along the frontal plane. **RESULTS:** Case-control differences were observed: gait speed NW (iSCI: 0.20m/s; CON: 1.37m/s), gait speed FW (iSCI: 0.33m/s; CON: 1.91m/s), LD NW (iSCI: 0.43m; CON: 0.09m), and LD FW (iSCI: 0.39m; CON: 0.10m). **CONCLUSIONS:** In the clinical setting, LD is often indicative of an abnormal walking pattern, but is not typically quantified for objective reassessments. The participant with iSCI and CON increased gait speed from a NW to FW 26.92% and 38.72%, respectively. LD did not change as expected, with iSCI decreasing (-7.85%) and CON increasing (4.99%) when increasing speed. These preliminary data may reflect the need to evaluate more segmental responses in addition to C7 deviation to fully gain insight on compensatory mechanisms adopted during NW and FW after iSCI. Future investigations may consider evaluating the relationship between C7, pelvic response, trunk flexion, and metabolic cost as walking speed changes to better direct therapeutic attention to the component most responsible for the dysfunction. Although not fully explanatory, it is common for clinicians to view crude LD as reflective of sub-optimal walking. Rehabilitation specialists may consider implementing a more objective view of C7 movement when assessing pathologic gait, as it is clearly impacted by altering walking speed.

2535 Board #199 May 31 9:30 AM - 11:00 AM
Hip Mechanics during Gait in Sedentary Adults

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Obesity is a known risk factor for osteoarthritis (OA). Studies investigating how gait changes that are associated with obesity lead to the development of OA often lack a measure of level of physical activity. It is well established that sedentary behavior leads to obesity and therefore it may also influence the progression of OA. Investigating hip mechanics during gait in sedentary obese and sedentary normal weight adults may offer insight into the effect of physical activity behavior on

biomechanical factors associated with the development of hip OA. **PURPOSE:** To assess hip biomechanics during gait in normal weight and obese adults to explore the effect of a sedentary lifestyle on the progression of hip OA. **METHODS:** Gait analyses were performed on 18 sedentary young adults. Participants were separated into two groups based on body mass index. Group 1 consisted of sedentary normal weight adults ($n=9$) and group 2 consisted of sedentary obese adults ($n=9$). Three-dimensional kinematic and kinetic data were collected at 200 Hz and 1000 Hz respectively as participants walked 12 meters at their preferred velocity. Hip joint angles and moments were calculated. Average range of motion and peak moments were determined and assessed for statistically significant differences between groups using independent t-tests with the alpha level set at 0.05. **RESULTS:** The two groups walked at similar preferred velocities ($3.15 \pm .30$ m/s; $3.16 \pm .25$ m/s; $p = 0.96$). Range of motion in the sagittal ($40.31 \pm 4.68^\circ$; $41.11 \pm 6.05^\circ$; $p = 0.48$) and transverse planes ($13.48 \pm 3.29^\circ$; $13.27 \pm 4.15^\circ$; $p = 0.78$) were similar between groups. Coronal plane range of motion was significantly greater in group 1 than group 2 ($13.94 \pm 2.68^\circ$; $12.63 \pm 2.60^\circ$; $p = 0.02$). Average peak hip extension moments were also similar between groups (50.60 ± 13.72 Nm/kg; 51.44 ± 14.63 Nm/kg; $p = 0.78$). **CONCLUSIONS:** Sedentary normal weight and sedentary obese individuals had similar sagittal range of motion and peak extension moment at the hip. The literature shows that individuals with hip OA experience limited sagittal range of motion and reduced extension moment. Taken together, current results suggest that sedentary behavior, regardless of body weight, may contribute to the development of hip OA.

2536 Board #200 May 31 9:30 AM - 11:00 AM
Gait Mechanics between a Lower Body Positive Pressure and Regular Treadmill

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Lower Body Positive Pressure Treadmills (LBPTT) allow for unweighted running and are often used as a tool for gait re-training or running load management. To our knowledge no study has examined differences in gait mechanics during walking and running between LBPTT 100% WB and a regular treadmill (TM). **PURPOSE:** The purpose of this study is to examine differences in cadence, stance time, maximal heel strike force (HS), and maximal metatarsal force (MT) between a LBPTT at 100% BW and a regular treadmill as measured through a in-shoe pressure sensor system (PSS). **METHODS:** 7 participants (mean age: 31.14 ± 6.03 , mean weight: 83.89 ± 10.61) donned the PSS and were set-up in the LBPTT. The subjects performed a running protocol which had stages from 3 mph to 6 mph at 1 mph increments at 100% BW. Following the running protocol on the LBPTT the participants completed the same running protocol on the TM. Cadence, average stance time between both legs, HS, and MT were recorded with the PSS at each stage of the test with each stage lasting 15 seconds. **RESULTS:** A 2x4 repeated measure ANOVA and Intra-class correlations were run to examine the data for any significant differences and level of agreement. For cadence, there was no significant main effect of device ($F(1,5) = 5.68$, $p = .06$) and both devices showed a good level of agreement ($ICC = .83$). For stance time, there was a significant main effect of device ($F(1,5) = 8.69$, $p = .03$), a significant main effect of speed ($F(3,15) = 39.59$, $p \leq .0005$), and both devices showed an excellent level of agreement ($ICC = .93$). For HS, there was a significant interaction of device and speed ($F(3,15) = 3.58$, $p = .04$) with post-hoc comparisons with Bonferroni adjustment showing a difference between 3 and 4 mph on the TM (mean difference = 24.33 , $p = .04$). HS showed an excellent level of agreement between devices ($ICC = .93$). For MT, there was a significant effect of speed ($F(3,15) = 5.67$, $p = .01$) but no significant effect of device ($F(1,5) = .31$, $p = .60$). MT showed a good level of agreement between devices ($ICC = .89$).

CONCLUSIONS: Our results show that while there was a significant difference between LBPTT and TM for ST, the overall level of agreement and lack of difference between devices for cadence, MT and HS show that the LBPTT can be used at 100% BW with little deviation in gait mechanics compared to a TM.

2537 Board #201 May 31 9:30 AM - 11:00 AM
Validation of a Built-In Gait Analytics System for Lower Body Positive Pressure Treadmills

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Lower Body Positive Pressure Treadmills (LBPTT) allow for unweighted running, giving the user the choice to adjust their bodyweight from 100% to 20%. Some LBPTT's have added the option for a built-in gait analytics system (GAS) which provide real-time gait analysis data including weight bearing symmetry, step length, stance time, and cadence.

PURPOSE: To validate the LBPTT GAS compared to an in-shoe pressure sensor system (PSS).

METHODS: 8 subjects (mean age: 30.80 ± 6.98 , mean weight: 69.54 ± 15.53) donned the PSS and were set-up in the LBPTT. The subjects performed a running protocol which had stages from 3 mph to 6 mph at 1 mph increments from 80% bodyweight to 20% body weight (20% increments) at each speed setting. Weight bearing symmetry, stance time, and cadence were recorded with the PSS and GAS at each stage of the test with each stage lasting 15 seconds.

RESULTS: Pearson correlations and Intra-class correlations were used on weight bearing symmetry, stance time on both the left and right leg, and cadence acquired from the GAS and PSS. Weight bearing symmetry was not correlated between devices, $r = -.06$, $p = .53$, $r^2 = .01$, $ICC = -.13$. Right stance time was found to have a small significant correlation, $r = .37$, $p \leq .001$, $r^2 = .14$, $ICC = .40$. Left stance time was found to have a small to moderate significant correlation, $r = .43$, $p \leq .001$, $r^2 = .19$, $ICC = .37$. Cadence was found to have a small significant correlation, $r = .37$, $p \leq .001$, $r^2 = .14$, $ICC = .18$.

CONCLUSIONS: These findings are unable to support the LBPTT GAS as a valid gait analysis tool related to weight bearing symmetry, stance time and cadence due to relatively poor agreement and correlations when compared to direct measures from a in-shoe pressure sensor system.

2538 Board #202 May 31 9:30 AM - 11:00 AM
Effects Of Arm Weight On Gait Performance In Hemiparetic Stroke And Healthy Subjects

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 (No relevant relationships reported)

PURPOSE: The purpose was to investigate the effects of arm weights on arm swing amplitude, gait performance, and muscle activity in stroke patients and healthy subjects.

METHODS: Nine hemiparetic stroke and nine healthy subjects participated. Subjects walked at their preferred speed under different weight carriage conditions (stroke/healthy group; C1: no weight; C2: uninvolved/dominant arm weight; C3: involved/non-dominant arm weight; C4: bilateral arm weights).

RESULTS: In stroke patients, gait speed ($P = 0.048$, C1: 0.639 ± 0.259 (M \pm SD); C2: 0.662 ± 0.259 ; C3: 0.700 ± 0.246 ; C4: 0.689 ± 0.267 m/s) and involved side tibialis anterior integrated EMG (iEMG) values ($P = 0.018$, C1: 49.588 ± 13.300 ; C2: 44.998 ± 12.713 ; C3: 43.291 ± 13.961 ; C4: 44.876 ± 13.892 μ V) exhibited changes with the arm weights that were statistically inconclusive ($\alpha_{adjusted} < P < 0.05$) using Hochberg correction. In healthy subjects, non-dominant side posterior deltoid iEMG was statistically inconclusive ($P = 0.022$, C1: 24.985 ± 29.955 ; C2: 25.374 ± 28.518 ; C3: 30.126 ± 31.652 ; C4: 28.877 ± 33.346 μ V). When individual subject gait speeds were explored using descriptive statistics and effect sizes, some subjects exhibited a potentially clinically meaningful improvement.

CONCLUSIONS: The observed increases in gait performance demonstrated encouraging results for higher functioning stroke patients who exhibit gait impairment and asymmetry. The addition of arm weights merits further investigation as a potential rehabilitation intervention in people with stroke-related gait disturbances.

2539 Board #203 May 31 9:30 AM - 11:00 AM
Application of the Cervical Flexion Relaxation Ratio to Investigate the Impact of Torso-borne Load Redistribution

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Students and military personnel often carry heavy torso loads (e.g. backpacks) which can lead to pain in the shoulders and back. To minimize pain associated with torso loads, load redistribution devices have been developed to off-load weight from the shoulders to the hip. Previous studies have used the cervical flexion relaxation ratio (cFRR), a measure of muscle activity between the extension and flexion phase of forward head motion, to correlate backpack loads with the potential of developing neck pain.

PURPOSE: Using the cFRR, assess the impact of redistributing torso-borne loads and whether changes in cFRR are observed following prolonged load carriage.

METHODS: Twelve volunteers walked at $1.34 \text{ m} \cdot \text{s}^{-1}$ at 0% grade for 40 min while wearing a torso-borne baseline load of 27 kg and two load distribution conditions to offload shoulder pressure. Flexible pressure sensors monitored pressure distribution at the shoulders and hips. To capture cFRR, bilateral EMG sensors with integrated tri-axial accelerometers were placed on the cervical erector spinae muscle bellies. EMG data were sampled at 2 kHz, demeaned, and band pass filtered from 30 to 500 Hz, and full

wave rectified. cFRR (Table 1) was measured pre-walk and post-walk and outcomes were submitted to repeated measures ANOVA based on load conditions, side of body and time. **RESULTS:** The average pressure measured at the shoulders for the baseline load ($3.76 \pm .90$ kPa) was significantly higher than the two load distribution conditions (1.55 ± 1.68 kPa, $p = .001$; 1.72 ± 1.12 kPa, $p < .0005$, respectively). There were no main effects due to load condition or body side ($p > .074$). However, there was a significant main effect of time ($p = .033$).

CONCLUSION: The load distribution equipment successfully shifted pressure from the shoulders to the hips, however this did not correlate with an improvement in cFRR. Changes in cFRR were observed pre- vs. post-walk indicating that the cFRR measure is sensitive to load carriage over time.

Table 1. cFRR.

FRR	Baseline Load		Load Distribution 1		Load Distribution 2	
	Pre	Post	Pre	Post	Pre	Post
Right Side	1.74 ± .66	1.55 ± .66	1.49 ± .36	1.3 ± .36	1.52 ± .35	1.4 ± .37
Left Side	1.7 ± 1	1.57 ± .71	1.35 ± .3	1.27 ± .37	1.35 ± .17	1.23 ± .22

2540 Board #204 May 31 9:30 AM - 11:00 AM
Functional Sarcopenia Biomarkers In 56 To 80 -Yr Old-Men And Women

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PURPOSE: Age-associated loss of skeletal muscle mass and function has considerable importance for those activities related with disease prevention, health promotion, and care planning. The aim of the study was to examine several biomarkers of sarcopenia in older women, and its relation to functional deterioration

METHODS: Body composition, muscle strength, and gait performance indicators were measured in 179 healthy women (56 to 76 -yr- old) to examine the relationship among those parameters as biomarkers of functional sarcopenia. All subjects were carefully familiarized with the evaluation tests. First, morphological variables such as lean/ height² (kg/m²), appendicular lean/ height² (kg/m²), lean body mass (% LBM), and others were estimated by Dual-energy X-ray absorptiometry (DXA). Second, functional indicators related to explosive force (power, take-off time, flight time, and maximum height achieved) were evaluated using a contact equipment. Third, isometric strength was tested by handgrip dynamometer. Finally, fast gait performance was evaluated using different indicators (distance, velocity, stride length, double support, contact phase, propulsion phase, velocity displacement) by photocell system.

RESULTS: Using two criteria, prevalences of sarcopenia were 57% (Lean/ Height² (kg/m²); 95%-CI: 0.48-0.65), and 42% (Appendicular Lean/ Height² (kg/m²); 95%-CI: 0.34-0.51). Nevertheless, a low prevalence to handgrip strength (16%, 95%-CI: 0.10-0.24) and gait performance (8.72%, 95%-CI: 0.05-0.14) were observed, contrary to power deterioration of lower limbs (31%, 95% CI: 0.22-0.41). Also, those subjects with lower levels of explosive strength (odds ratio (OR): 4.66 (95% CI: 1.098 to 12.561; P<0.05) had risk of having a higher adiposity level (≥25%), and lower results of fast gait performance.

CONCLUSIONS: Despite a wide variety of tests and tools is now available for characterization of sarcopenia in practice and in research, health professionals must be careful to avoid an inadequate clinical and functional diagnosis.

E-39 Free Communication/Poster - Sports Injury

Friday, May 31, 2019, 7:30 AM - 12:30 PM

Room: CC-Hall WA2

2541 Board #205 May 31 11:00 AM - 12:30 PM

Comparison of Injury in Male and Female Amateur Rugby Union

Ian C. Kenny, Caithriona Yeomans, Roisin Cahalan, Giles Warrington, FACSM, Liam G. Glynn, Mark J. Campbell, Mark Lyons, Andrew J. Harrison, Kevin Hayes, Thomas M. Comyns. *University of Limerick, Limerick, Ireland.* (Sponsor: Giles Warrington, FACSM)

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PURPOSE: Despite recent growth in game popularity worldwide, Women's Rugby Union is currently lacking rigorous, comprehensive injury surveillance programs (World Rugby). This long-term study aimed to monitor injury trends, that may emerge, which will aid future implementation of evidence-based injury prevention strategies to minimize injury risk and enhance player welfare, for the female and male game.

METHODS: Using a bespoke web-based injury recording system (IRISweb), 15 male and 4 female national league clubs were recruited for a full season of monitoring in Ireland, representing 479 male and 129 female players. Each club nominated an 'injury recorder', who was a team physician or physiotherapist trained in use of the IRISweb system. In 10% of clubs the head coach, qualified in first aid, recorded injuries.

In all cases the team physician reviewed all injuries for 'return to play' ensuring classification validity. Measures included injury incidence, type, timing, severity, and playing position.

RESULTS: The most commonly reported match injuries for men's clubs were concussion (12%), followed by ankle ligament sprains (11%); for women, it was ankle ligament sprains (11%) and concussion (11%). Concussion injuries resulted in an average of 30 days absence from Rugby match or training activities for men and 23 days for women. Timing of all injuries showed incidence rate (per 1000 player hours) for men of 7.6/10.6/19.1/11.5 for 1st/2nd/3rd/4th match quarter respectively, and 7.1/12.8/12.8/11.5 for women, showing an early 2nd quarter peak for women. The position with the highest proportion of injury was openside flanker forward (no.7) for men and inside centre back (no.12) for women. The majority of injuries for both sexes were moderate or severe (greater than eight days absence). Women presented with a significantly lower rate (13.5 Vs 18.5; $p < 0.05$) of severe injuries.

CONCLUSIONS: The amateur women's game in Ireland has presented with both similarities and differences in injury occurrence compared to the men's game. Marked differences surround an earlier match timing of women's injury, and less severe occurrence of women's injury. Practitioners should note the most common injuries occurring and the playing positions most frequently injured and develop welfare and prevention strategies around this knowledge.

2542 Board #206 May 31 11:00 AM - 12:30 PM

The Prevalence of Sickle Cell Trait in a Division I University Athletic Program

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(No relevant relationships reported)

Incoming NCAA athletes must be tested for the presence of hemoglobin (Hb) S but the prevalence with positive sickle cell trait (SCT) status at Division I institutions and their prior knowledge of status is unknown. **PURPOSE:** Determine the prevalence of athletes with SCT at a Division I university and describe their demographics, prior knowledge of status, and Hb profile. **METHODS:** A retrospective chart review of the 2010/11-18/19 academic years at one university. Main outcome measures included: actual and expected prevalence of SCT positive athletes, sex, race, sport, prior knowledge of SCT status and family history, and Hb profile (HbA, HbA2, HbS, HbF, and HbC) proportions. Expected prevalence was calculated from CDC statistics and applied to the known athlete racial breakdown per year with Fisher's Exact test utilized for comparison. **RESULTS:** Twenty-six SCT positive athletes (6±1 per academic year) were identified, accounting for ~1% of the athlete population each year. The majority were Black/African-American (n=24, 92.31%) males (n=23, 88.46%). There were less SCT positive Black/African-American athletes than expected on average per year (4 vs 13, $p=0.044$). Football had the greater part (n=18, 69.23%) of SCT athletes followed by men's track and field (n=3, 11.54%). Other sports included women's track and field, volleyball, baseball, men's basketball and cheerleading. Five athletes (19.23%) reported prior knowledge of their SCT status. Seven athletes (26.92%) reported a family history of SCT or sickle cell disease, three of which did not know

their own status. One athlete provided a newborn screen. Results of Hb electrophoresis testing were available for 25 (96.15%) athletes. Average values for HbA, HbA2, HbS, HbF and HbC were $57.10 \pm 2.70\%$, $3.13 \pm 0.47\%$, $39.72 \pm 2.84\%$, $0.23 \pm 0.83\%$ and $0.00 \pm 0.00\%$, respectively, excluding one unique case with 0.00% HbA, 1.40% HbA2, 59.70% HbS, 38.90% HbF and 0.00% HbC. **CONCLUSIONS:** Athletes with SCT accounted for a small proportion of the athlete population at a Division I university and were lower than expected prevalence. The majority had no prior knowledge of personal or family history. Obtaining Hb profiles beyond solubility testing can provide health care providers with information that may affect clinical manifestation and management.

2543 Board #207 May 31 11:00 AM - 12:30 PM

Seasonal Incidence of Game-Related High School Football Trauma on Artificial Turf and Natural Grass

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Reported Relationships: M.C. Meyers: Industry contracted research; Partial funding by FieldTurf USA.

It is commonly surmised that environmental conditions and concomitant sport use dictate the quality and degree of decline of natural grass over a season of competitive football. Although artificial turf infill systems have been purported to duplicate the playing characteristics of natural grass while maintaining surface quality throughout a season of play, no long-term studies have specifically compared injury incidence rates between the two surfaces at the high school level of competition. **PURPOSE:** To quantify seasonal incidence of game-related high school football trauma on artificial turf versus natural grass. **METHODS:** 77 high schools (4A-6A) from six states (CA, GA, MI, MT, PA, TX) were evaluated from August to December over 8 competitive seasons (2010-2017). Injury incidence rates (HIR) were calculated using injuries per 10 games = (number of injuries ÷ number of games) x 10. **RESULTS:** Of the 665 games documented, 343 games (51.6%) were played on artificial turf versus 322 games (48.4%) played on natural grass. A total of 1,241 injuries were documented with 514 (41.4%) occurring on artificial turf, and 727 (58.6%) on natural grass. Analyses per 10 games indicated a significant main effect (Wilks' Lambda $F = 18.925$; $p < 0.0001$) between surfaces by month. Subsequent post hoc analyses indicated a significant lower incidence of injury while competing on artificial turf ($p < 0.05$) during August [5.6 (95% CI, 2.7-8.1) vs 23.1 (19.9-24.8)], September [11.8 (95% CI, 10.4-12.9) vs 29.3 (27.8-29.7)], October [6.0 (95% CI, 4.9-7.0) vs 26.6 (24.5-27.6)], November/December [8.0 (95% CI, 6.6-8.9) vs 36.0 (31.4-37.4)], and by total seasonal trauma [26.6 (95% CI, 25.5-27.3) vs 31.3 (30.4-31.8)] when compared to injuries reported on natural grass, respectively. **CONCLUSION:** A significantly lower incidence of trauma was documented on artificial turf when compared to natural grass throughout all months of the competitive high school season. Further investigation is warranted to quantify seasonal surface influence across severity of injury, surface impact trauma, shoe surface-contact and noncontact trauma, specific extremity joints/muscles, and elective medical procedures in high school football. The findings of this study may be generalizable only to this level of football competition and this specific artificial surface.

2544 Board #208 May 31 11:00 AM - 12:30 PM
Injury Surveillance in Amateur Rugby Union in Ireland

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(No relevant relationships reported)

Rugby Union is a physically demanding, full-contact team sport that has grown in popularity. To reduce injury risk a comprehensive understanding of the incidence and nature of injuries is required. Injury surveillance systems are currently lacking in the amateur rugby game worldwide. The use of consistent injury definitions and methods of data collection are needed to provide robust epidemiological information for this cohort. **PURPOSE:** To assess the match injury incidence, nature, location and burden amongst male amateur adult players in Ireland. **METHODS:** A bespoke web-based injury surveillance system was used with 15 male adult Irish amateur national league clubs (479 players) across a full rugby season. Each club nominated an 'injury recorder', either a medical physician or physiotherapist, who was trained in use of the system. The injury definition used in this injury surveillance system aligned to the World Rugby consensus guidelines on injury definitions. Measures included match injury incidence, nature, location and injury burden, which assesses the frequency of an injury in relation to the severity of the injury (measured as the number of days absent). **RESULTS:** The match injury incidence for male adult amateur players was 49.7/1,000 player hours. The most common lower limb location of injury was the ankle (6.3/1,000 player hours), while the shoulder had the highest upper limb injury incidence rate

(9.1/1,000 player hours). Regarding the nature of match injury, strains (15.4/1,000 player hours) had the highest incidence rate followed by sprains (12.9/1,000 player hours) and haematomas/contusions (6.2/1,000 player hours). The top three injuries with the highest injury burden were hamstring strains (756 cumulative days absent), concussion (611 days absent) and anterior talo-fibular ligament sprains (605 days absent). **CONCLUSIONS:** The results from this comprehensive and robust web-based surveillance system provide detail on the incidence, nature, location and burden of match injury for male adult amateur players. This information can inform practice so that appropriate injury prevention strategies and policies can be derived to reduce injury risk in male amateur rugby and thus enhance player welfare.

2545 Board #209 May 31 11:00 AM - 12:30 PM

Relationship between Physical and Wellness Baseline Screening Measures and Seasonal Amateur Rugby Injury

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There is an inherent risk of injury in Rugby, due to the physical demands and exposure to collisions. While injuries in professional Rugby are widely reported, little is known about the amateur game. Investigating relationships between physical and wellness screening measures may identify injury causal factors and aid the development of targeted injury prevention strategies.

PURPOSE: To investigate the relationship between physical and wellness screening measures, and seasonal injury in Irish amateur Rugby.

METHODS: One hundred and thirty-seven amateur Rugby players [male $n = 113$ (mean age = 22.7 ± 3.9), female $n = 24$ (mean age = 25.6 ± 4.9)] were screened in pre-season and monitored throughout the season for injury. Questionnaires included: player background history and wellness; Pittsburgh Sleep Quality Index (PSQI); Athletic Coping Skills Inventory (ACSI-28) and Perceived Available Support in Sport (PASS-Q). Physical tests included: anthropometric measurements, knee-to-wall test, straight leg raise test and adductor squeeze test. Injury incidence data were gathered using a comprehensive Rugby-specific web-based surveillance system. Data were collected and analyzed in SPSS (Version 22, IBM Corp., Armonk, N.Y., USA). Logistic regression were used to estimate odds of sustaining an injury. Baseline measurements were compared between males and females and 'Forwards' (position 1-8) and 'Backs' (position 9-15) using Student's t-tests. Significance was set a-priori at $P = 0.05$. **RESULTS:** Males had a higher incidence of injury than females with respective incidence rates of 51.2/1,000 player hours and 42.9/1,000 player hours ($P < 0.05$). In the 'Backs', an inverse relationship between adductor strength at 0° knee flexion and groin injury was found (-0.307 , $P < 0.05$). No correlations between questionnaires and other physical measurements and injury were found.

CONCLUSIONS: The Irish Rugby Injury Surveillance (IRIS) project is the first long-term injury surveillance system monitoring injury trends in Irish amateur Rugby. Reduced groin strength at pre-season was associated with more groin injuries during the season for 'Backs'. Further investigation of groin strength and injuries in Rugby may inform future injury prevention strategies.

Funding: The IRIS Project is funded by the Irish Rugby Football Union.

2546 Board #210 May 31 11:00 AM - 12:30 PM
Resiliency in Collegiate Athletes: A Cross-sectional Study

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Resiliency, the ability to recovery from a difficult circumstance, is known to impact health and well-being. It may be related to sports-related injury in athletes, but this has not been previously investigated. **PURPOSE:** To assess resiliency levels in varsity collegiate athletes and investigate possible relationships between resiliency and other factors, including previous sports-related injuries.

METHODS: This cross-sectional study surveyed varsity collegiate athletes, from 13 different sports, enrolled in two Division III institutions. Resiliency was assessed via the Connor Davidson Resilience Scale, a validated measure. Descriptive statistics were used to describe the study population, and bivariate analyses via Chi-square and Fisher's exact where appropriate, were used to examine differences among covariates across levels of resiliency.

RESULTS: A total of 403 athletes participated, the majority were male (58.7%) and white (81.7%) and 72.0% were team sport athletes. Average resiliency score was 74.7 (± 13.0 , range 24-100). Analysis of the cohort demonstrated that level of

resiliency significantly differed across year in school ($\chi^2=20.2$, $p=0.001$), type of school (public/private, $\chi^2=17.4$, $p=0.002$) and type of sport (team/individual, $\chi^2=12.5$, $p=0.002$), but not across gender ($\chi^2=4.9$, $p=0.08$). Levels of resiliency did not differ by race, irrespective of gender. Among female athletes, resiliency level differed by type of sport played ($\chi^2=9.1$, $p=0.01$), however, this relationship was not observed among male athletes ($\chi^2=3.5$, $p=0.2$). Resiliency level did differ significantly by type of institution attended, for both female athletes ($\chi^2=8.1$, $p=0.02$) and male athletes ($\chi^2=8.1$, $p=0.02$). Resiliency differed by year in school for female athletes, with freshman female athletes reporting low levels of resiliency more frequently as compared to senior female athletes (14.2% vs. 6.2%, respectively; $\chi^2=16.5$, $p=0.04$). There was no statistically significant difference in resiliency levels when analyzed by previous sports-related injuries or surgeries in the overall cohort or when stratified by gender. **CONCLUSIONS:** Resiliency levels differed by type of sport, type of school and year in school. Further research is needed to investigate how resiliency may impact the injury risk of collegiate athletes.

2547 Board #211 May 31 11:00 AM - 12:30 PM
Developing a Rugby-Specific Injury Surveillance System

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(No relevant relationships reported)

Rugby Union is one of the most played and watched team sports worldwide. Despite high injury incidence rates widely reported in the literature, no long-term injury surveillance system monitoring of the incidence of injury in both male and female amateur Rugby currently exists. Unlike the professional code, amateur cohorts often have limited resources and infrequent access to medical professionals, thus the effective implementation of such systems present additional challenges. **PURPOSE:** To describe the design, development, implementation and evaluation of a comprehensive Rugby-specific injury surveillance system. This paper serves to inform the international community to help develop uniform high quality approaches to injury surveillance.

METHODS: The four phases involved in the Irish Rugby Injury Surveillance (IRIS) Project: i) A survey establishing the current injury monitoring practices in operation in the top 58 amateur Irish clubs. These 58 clubs represent 26% of all amateur clubs in Ireland. ii) The design of a comprehensive web-based surveillance system (IRISweb) to monitor injury incidence, nature and severity. iii) Recruitment of 15 male and 5 female teams out of the top 58 amateur clubs to participate in the IRIS project. iv) A survey to evaluate the usefulness of the IRISweb system, after one season. **RESULTS:** Twenty-one clubs agreed to participate, however 2 clubs failed to provide a full season of injury data and therefore were excluded from the final analysis, giving 90% compliance. Nineteen clubs completed the evaluation survey (response rate = 90%). The overall rating and usefulness of IRISweb was rated 'good' or 'very good' by 82% of clubs. The main facilitators to injury surveillance were: increased player adherence (65%) and notifications to update the system (59%). In contrast, poor player adherence (71%) and medical staff availability (24%) were the main barriers to injury surveillance. **CONCLUSIONS:** The IRIS project is the first prospective long-term injury surveillance system in Irish amateur Rugby, effectively tracking injuries to guide evidence-based injury prevention strategies. This study outlines the development of the system, highlighting facilitators and barriers to injury surveillance within amateur sport.

Funding: The IRIS Project is funded by the Irish Rugby Football Union.

2548 Board #212 May 31 11:00 AM - 12:30 PM
A Systematic Review And Meta-analysis Of The Incidence Of Injury In Professional Female Soccer

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The epidemiology of injury in male professional football is well documented and has been used as a basis to monitor injury trends and implement injury prevention strategies. There are no systematic reviews that have investigated injury incidence in women's professional football. Therefore, the extent of injury burden in women's professional football remains unknown. **PURPOSE:** The primary aim of this study was to calculate an overall incidence rate of injury in senior female professional soccer. The secondary aims were to provide an incidence rate for training and match play. **METHODS:** PubMed, Discover, EBSCO, Embase and ScienceDirect electronic databases were searched from inception to September 2018. Two reviewers independently assessed study quality using the Strengthening of Reporting of Observational Studies in Epidemiology statement using a 22-item STROBE checklist.

Seven prospective studies ($n=1137$ professional players) were combined in a pooled analysis of injury incidence using a mixed effects model. Heterogeneity was evaluated using the Cochrane Q statistic and I^2 . **RESULTS:** The epidemiological incidence proportion over one season was 0.62 (95% CI 0.59 - 0.64). Mean total incidence of injury was 3.15 (95% CI 1.54 - 4.75) injuries per 1000 hours. The mean incidence of injury during match play was 10.72 (95% CI 9.11 - 12.33) and during training was 2.21 (95% CI 0.96 - 3.45). Data analysis found a significant level of heterogeneity (total Incidence, $X^2=16.57$ $P<0.05$; $I^2=63.8\%$) and during subsequent sub group analyses in those studies reviewed (match incidence, $X^2=76.4$ (d.f. = 7), $P<0.05$; $I^2=90.8\%$, training incidence, $X^2=16.97$ (d.f. = 7), $P<0.05$; $I^2=58.8\%$). Appraisal of the study methodologies revealed inconsistency in the use of injury terminology, data collection procedures and calculation of exposure by researchers. Such inconsistencies likely contribute to the large variance in the incidence and prevalence of injury reported. **CONCLUSIONS:** The estimated risk of sustaining at least one injury over one football season is 62%. Continued reporting of heterogeneous results in population samples limits meaningful comparison of studies. Standardising the criteria used to attribute injury and activity coupled with more accurate methods of calculating exposure will overcome such limitations.

2549 Board #213 May 31 11:00 AM - 12:30 PM
Head Impacts In Women'S Collegiate Rugby: Incidence And Force Application

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With the growth in women's rugby participation, there is a need to enhance our understanding of the potential for subconcussive and concussive risk in such a physical sport. Investigating head impact exposure in women's rugby is important for understanding potential concussive risk and to develop interventions that minimize this risk. **PURPOSE:** The purpose of this study was to quantify incidence, magnitude, and distribution of head impacts throughout a collegiate women's rugby season. **METHODS:** Twenty-three collegiate female rugby athletes wore Smart Impact Monitors (SIM) within headbands during practices and games. Head impact data including number of head impacts, peak linear acceleration, peak rotational acceleration, peak rotational velocity, and location of head impacts were collected. Analyses were performed to compare these data in practices and games, first and second half of game play, and by athlete position group, including hit up forwards, outside backs, and adjustables. Paired sample t-tests, repeated measure ANOVAs, and 3-way ANOVAs with a set level of significance at $p \leq .05$ were utilized in the analysis. **RESULTS:** Players sustained 120 head impacts $\geq 15g$ (range 18.1g - 78.9g) with 1199 total athlete exposures in practices and games combined. In games, 67 head impacts were recorded with a mean of 0.40 ± 0.22 impacts per-player per-game. There were 53 head impacts recorded in forty-seven practices with a mean of 0.05 ± 0.04 impacts per-player per-practice. There were no significant differences in number or magnitude of head impacts between practices and games, first half and second half of games, or by position group ($p > 0.05$). The front and the back of the head locations had significantly more head impacts than the crown and the right side of the head ($p \leq 0.05$). **CONCLUSIONS:** Collegiate women's rugby athletes endured the same number and magnitude of head impacts in both practices and games, regardless of position or time of match. These findings give insight into the subconcussive impacts that female collegiate rugby athletes sustain during competition. Further research is necessary to develop interventions that minimize head impacts and ultimately reduce risk of head injury in women's rugby.

2550 Board #214 May 31 11:00 AM - 12:30 PM
One-year Test-retest Properties Of Binocular Vision Tests

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PURPOSE: Binocular vision tests (BVTs) are increasingly recommended for use in concussion management, but their reliability remains unknown. Our objective was to determine the one-year test-retest reliability of 10 BVTs proposed for use in concussion management, where concussions may occur months after a baseline measure.

METHODS: We used routinely collected data on young athletes who had two sessions of pre-season baseline testing of 10 BVTs at least 11 months apart with no intervening concussion or training that might influence BVT scores. The tests assessed: 3D vision (gross stereoscopic acuity, GSA), saccades, anatomic deviation (AD) at 30cm and 3m,

ability of eyes to move/fixate in-sync (positive fusional vergence [PFV] and negative fusional vergence [NFV] at 30cm and 3m, near point of convergence [NPC], and near point of convergence - break [i.e. double vision, (NPCb)]).

RESULTS: There were 8 males and 9 females with a mean age of 22.4 (SD = 4.6) years. The intraclass correlations (ICC) suggest good reliability for PFV (0.94) and NPV (0.72) at 30cm. There was moderate reliability for NPCb (0.58), saccade (0.57), and PFV at 3m (0.58). There was poor reliability for AD 30cm (0.34) and NPC (0.45). Reliability was essentially 0 for NPV at 3m, and GSA (0.0). Limits of agreement (LoA) were best for saccade ($\pm 25\%$) and worst for AD 30 cm ($\pm 172\%$), and ranged from $\pm 40\%$ to $\pm 114\%$ for 7 of the 8 other tests. For AD 3m, the distribution was highly skewed leading LoA to be uninformative.

CONCLUSIONS: The results indicate one-year test-retest reliability of the BVTs ranged from poor to good, with the majority being moderate. The effect of concussion must have a moderate to large effect on the scores of most BVTs to be clinically useful.

2551 Board #215 May 31 11:00 AM - 12:30 PM

The Epidemiology of Sports Related Dislocations among Collegiate and High School Athletes

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(No relevant relationships reported)

Athletes are at risk of sustaining a dislocation, ranging from relatively minor with minimal time lost from play to more severe with long recovery times and costly treatments. Previous studies have examined dislocations; however, most focused on specific sports or joints.

PURPOSE: To describe dislocations sustained by collegiate and high school athletes.

METHODS: Athletic trainers (ATs) participating in the National Collegiate Athletic Association (NCAA) Injury Surveillance Program reported athlete-exposure (AE) and injury data for 25 sports during the 2009/10-2016/17 academic years. ATs participating in the National Athletic Treatment Injury and Outcomes Network (NATION) reported AE and injury data for 27 sports during 2011/12-2013/14. Dislocations occurred during a school-sanctioned practice or competition and required medical attention. Along with dislocation characteristics, injury rates per 10,000 AEs were reported with 95% confidence intervals (CIs).

RESULTS: From 2009/10-2016/17, ATs reported 542 dislocations among NCAA athletes for an injury rate of 0.81/10,000 AEs (95% CI:0.74-0.87). Men's football (1.74; 95% CI:1.53-1.94), men's wrestling (1.53; 95% CI:0.91-2.16), and women's gymnastics (1.31; 95% CI:0.54-2.09) had the highest rate of dislocations. From 2011/12-2013/14, ATs reported 149 dislocations among high school athletes for an injury rate of 0.29/10,000 AEs (95% CI:0.24-0.34). Boys' football (0.79; 95% CI:0.62-0.95), girls' basketball (0.52; 95% CI:0.26-0.78), and boys' wrestling (0.50; 95% CI:0.22-0.79) had the highest rate of dislocations. For NCAA and high school athletes, the most commonly dislocated body parts were the hand/finger (40.2% and 25.8%) and shoulder/clavicle (36.7% and 40.3%). A greater proportion of dislocations resulted from player contact (55.8%) and were non-time loss (40.9%) in NCAA athletes than high school athletes (39.6% and 25.9%). A similar proportion of NCAA and high school dislocations were recurrent (20.6% and 18.8%) and required surgery (21.4% and 15.8%).

CONCLUSION: Some characteristics of dislocations vary across collegiate and high school athletes including mechanism of injury and time loss. More research is needed to determine how to effectively reduce the incidence of dislocations among all collegiate and high school athletes.

2552 Board #216 May 31 11:00 AM - 12:30 PM
Evaluation Of Rule Modifications On The Reduction Of Injuries In High School Boys' Lacrosse

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(No relevant relationships reported)

The National Federation of State High School Associations previously modified two lacrosse rules: Rule 5.4 in the 2012/13 academic year to heighten the penalty for any hits to the head/face/neck (HFN); and Rule 5.3.5 in the 2013/14 academic year to minimize body checking.

Purpose: To determine if the rate of overall injury, HFN injuries, and concussions due to intentional contact (checking) differed for boys' high school lacrosse players after two rule modifications were enacted.

Methods: Data were collected from the High School RIO (Reporting Information Online) sports injury surveillance system. During the 2008/09-2016/17 seasons, athletic trainers collected injury and athlete-exposure (AE) data for high school boys' lacrosse teams. Overall and checking-related injury rates were calculated and stratified

by competition and practice settings. Overall, HFN, and concussion injury rates were further analyzed by checking mechanism (e.g., being body/stick checked or delivering body/stick check). Incidence rate ratios (IRR) with 95% confidence intervals (CI) compared rates prior to and after the enactment of the rule modifications (Rule 5.4 – 2012/13 vs. 2008/09-2011/12; Rules 5.4 and 5.3.5 – 2013/14-2016/17 vs 2008/09-2011/12).

Results: There was a significant decrease in checking-related HFN injuries (IRR, 0.29; 95% CI, 0.13-0.65) and checking-related concussions (IRR, 0.29; 95%CI, 0.12-0.70) during practice in the seasons after both rule modifications were imposed, but there were no significant decreases in any checking-related injuries during competition. When both rules were enacted together, concussion risk due to delivering body check (IRR, 0.51; 95% CI 0.29-0.91) and overall injury risk due to being body checked (IRR, 0.72; 95% CI, 0.53-0.97) decreased. By injury mechanism, there were no significant decreases after only the Rule 5.4 modification took place.

Conclusion: When both the Rule 5.4 and 5.3.5 modifications were in effect, concussion and overall injury risk decreased for the player initiating the body check and the player being body checked, respectively. However, concussion risk due to being body checked during games was not affected.

2553 Board #217 May 31 11:00 AM - 12:30 PM

Gastrointestinal Illness Accounts for Most Days Lost per Single Illness During the Super Rugby Tournament

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(No relevant relationships reported)

Purpose: Respiratory tract (RT) and gastrointestinal (GI) illness is commonly reported in elite athletes. The purpose of this study is to determine the incidence rate, illness burden (IB), and mean training / match days lost (per single illness) for RT and GI illness in rugby union players participating in the annual Super Rugby tournaments.

Methods: A total of 868 elite rugby players from 5 South African teams that participated in the Super Rugby tournament from 2013 to 2016, were followed daily over the 20-week competition period for each year (80 167 player days over 4 years). Team physicians were 100% compliant in completing the illness log. Information included the daily squad size and illness details including the system affected and training/match days lost. We report illness incidence rate (IR=illness per 1000 player days; 95% CI), illness burden (IB=days lost per 1000 players days; 95%CI), and mean training / match days lost (per single illness) for the RT and GI systems. **Results:** 389 illnesses (RT=271; GI=78, Other=40) were reported, with an overall crude IR of illness of 4.85 (4.38-5.36). The IR of illness was significantly higher in the RT system (3.38; 2.97-3.85) vs. the GI system (0.97; 0.75-1.23) ($p<0.0001$). The IB for all systems over the 4-year period was 5.93 (5.40-6.48), and this was significantly higher in the RT (3.36; 2.97-3.78) compared with the GI system 1.73 (1.46-2.05) ($p<0.0001$). However, the days lost to a single illness was significantly higher in the GI system (1.78; 1.51-2.10) compared to the RT system (0.99; 0.88-1.12) ($p<0.0001$). **Conclusion:** In the elite Super Rugby tournament, illness in the RT system accounts for the highest IR and burden of illness. However, days lost per single GI illness is highest; therefore, a GI illness is more serious, resulting in more days lost to training / matches. Future studies should therefore determine specific risk markers for GI illness, so that preventative measures can be designed and implemented to protect the health of these Super Rugby players.

2554 Board #218 May 31 11:00 AM - 12:30 PM

The Prevalence of Obesity and its Association with Previous Musculoskeletal Injury in Probation Officers

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(No relevant relationships reported)

Probation officers are responsible for the supervision of criminal offenders released into the community with the high risk of violent and physically demanding interactions. Despite obesity reaching epidemic levels in many public safety occupations, probation officers remain understudied. **PURPOSE:** The purpose of the current study was to examine the prevalence of obesity and its association with previous musculoskeletal injury in probation officers. **METHODS:** The current study used data from a survey administered to all North Carolina probation officers in 2015, with 1,323 completing the entire survey (70.9%). The survey included questions on demographics, injury history, physical activity, geographical location of work, and years of employment. Body mass index (BMI) was calculated and classified per the National Heart, Lung, and Blood Institute's guidelines. A logistic regression model

estimated the odds ratios (OR) of musculoskeletal injury history within the past year. Predictor variables were age, sex, employment history, geographical location, physical activity within the past month, and BMI classification. **RESULTS:** The majority (80.8%) of the respondents were classified as overweight or obese (BMI > 25.0 kg/m²), with 49.9% classified as obese (BMI > 30 kg/m²) and 9.5% classified as severely obese (BMI > 40 kg/m²). Multivariable logistic regression modeling suggested that workers categorized as being severely obese (BMI > 40 kg/m²) were 2.5 times more likely (OR=2.56; 95% CI=1.19-5.51) to sustain a musculoskeletal injury within the past year than their normal weight colleagues. **CONCLUSION:** Given the prevalence of obesity in our sample of probation officers, and its association with previous musculoskeletal injury, public safety administrators may wish to consider workplace interventions designed to combat obesity.

2555 Board #219 May 31 11:00 AM - 12:30 PM
Graft Type And Previous ACL Injury Influence Re-rupture Rates In 1478 ACL Reconstructions With 95% 2 Year Follow-up

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 (No relevant relationships reported)

Purpose

The aim of this study was to report outcomes relating to the patient reported outcome measure International Knee Documentation Committee questionnaire (IKDC), return to play rates and second ACL injury rates at 2 year follow up, while examining differences in second ACL injury rate relating to gender, graft type and previous ACL reconstruction (ACLR).

Methods

Prospective data was collected on 1478 consecutive ACL reconstructions for a single surgeon between 1st January 2014 and 1st October 2016. Data was collected at pre-op, intra-op, and 2 year follow up relating to IKDC, RTP and second ACL injury. ACLR was carried out with bone patellar tendon bone (BPTB, n = 1335) or 4 strand double bundle hamstring autograft (HT, n = 130). Isokinetic dynamometry and 3D biomechanical analysis of jump and change of direction tests were carried out at 3, 6 and 9 months post-surgery as able. Chi Squared test was used to analyse differences in ipsilateral and contralateral ACL injury rates relating to gender, previous ACLR and graft type.

Results

1072 male and 393 female patients with an average age of 25.6 years (± 8.7) formed the cohort. 90 had previous ACLR with 1375 no previous ACL injury. Pre-op 1262 (86.1%) stated their intention to return to the same level of sport or higher after surgery. There was 2 year follow up on 94.5% of subjects. RTP rate was 78% with 11.1% not returning because of the operated knee and 10.8% because of other reasons. The mean IKDC score was 86.2 (± 10.4). There were 40 ipsilateral injuries (2.7%) and 84 contralateral injuries (5.7%). There was a significant difference in ipsilateral injury rate between those with previous ACLR (8.5%) and those without (1.6%) (p < 0.001) with no difference in contralateral injury rates between groups. There was a significant difference in ipsilateral injury rate between graft types with higher rates in HT(9.2%) than BPTB grafts (2.1%) (p < 0.001) with no difference in contralateral injury rates. There was no difference in ipsilateral (p = 0.531) or contralateral (p = 0.370) injury rates between male and female patients.

Conclusion

This study reports excellent re-injury, RTP and IKDC scores for a single surgeon in a large cohort with 95% follow up at 2 years post reconstruction. Those with HT graft and previous ACLR had higher rates of re-injury of the ACLR limb.

2556 Board #220 May 31 11:00 AM - 12:30 PM
Frequency, Magnitude, And Location of Head Impacts In Collegiate Water Polo

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 (No relevant relationships reported)

Water polo is a contact sport that carries a risk of head injury, well documented in epidemiological surveys of USA Water Polo members and physician reports from international competition. However, a growing body of evidence suggests that head impacts—even those that are asymptomatic and go unreported—can produce brain injury. We know from both survey data and prospective monitoring of NCAA Division I athletes that the risk for head impacts is dependent on player position. It is unknown if these patterns extend to other levels of competition. **PURPOSE** To describe patterns of head impacts in intercollegiate club water polo (ICWP) competition. **METHODS** ICWP players (9 Men; 14 Women) were monitored during

competition for head impacts using cap-worn inertial sensors to record impact time, head locations, peak linear acceleration (PLA), and peak rotational acceleration (PRA). Video recordings of competitions were reviewed to rule out false positives. The null hypotheses that impact frequencies were equally distributed among (i) player positions, (ii) game scenarios, and (iii) head locations were tested using Chi-square 'goodness-of-fit' tests. Significant differences were decomposed by chi-square tests. T-tests were used to test for differences in PLA and PRA between men and women. All results presented are corrected for multiple comparisons. **RESULTS** Men sustained 52 head impacts and women sustained 43 head impacts over 12 games, mostly on offense [71.2%, 62.8%; p<.001] and mostly at the center position relative to perimeter positions [p<.0001]. Impacts were most often sustained at the back of the head among men and women [p<.03]. Impacts ranged from low to high magnitude for men [means(range): PLA=39.7 (17.7-94.1)g; PRA=5.21 (1.00-17.40) krads/sec²] and women [means(range): PLA=33.7 (16.2-72.6)g; PRA=4.02 (.20-14.00) krads/sec²]. Magnitudes did not differ between men and women [t(93)<1.98, p>.051]. **CONCLUSION** We observed a pattern of risk among male and female ICWP players similar to a pattern previously reported in Division I men's water polo players. Considering the growing body of evidence suggesting adverse effects of repeated head impacts, our data suggest that players, particularly at the center position, might benefit from wearing protective headgear that attenuates the forces of these head impacts.

2557 Board #221 May 31 11:00 AM - 12:30 PM
The Epidemiology Of Ankle Sprains In Youth, High School, And College Lacrosse

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Reported Relationships: A.K. Nedimyer: Other (please describe); The NCAA Injury Surveillance Program was funded by the NCAA., HS NATION was funded by the National Athletic Trainers' Association Research and Education Foundation (NATA REF), and the Central Indiana Corporate Partnership (CICP) Foundation., Data collection for youth lacrosse was funded by National Operating Committee on Standards for Athletic Equipment (NOCSAE) and US Lacrosse..

Understanding how ankle sprain injury incidence varies by level of play in male and female lacrosse players is important in informing level- and sport-specific injury prevention strategies.

Purpose: Describe the epidemiology of ankle sprains in youth, high school (HS), and college lacrosse in the 2014/15-2016/17 seasons.

Methods: Youth data originated from 10 leagues in 5 states (21 boys' and 21 girls' team-seasons). HS data originated from the National Athletic Treatment, Injury and Outcomes Network (22 boys' and 15 girls' team-seasons). College data originated from the National Collegiate Athletic Association Injury Surveillance Program; 20 men's and 47 women's team-seasons). Athletic trainers (ATs) reported athlete-exposure (AE) and injury data from practices and competitions. Injury rate ratios (IRR) compared injury rates by level of play. Sex differences were not examined as these sports have different rules. IRRs with 95% confidence intervals (CI) excluding 1.00 were considered significant. We calculated the proportions of time loss (TL) injuries (resulting in participation restriction time ≥24 hours) and injury mechanism distributions.

Results: Ankle sprain rates per 1000AE were 0.77 (n=20), 0.36 (n=13), and 0.54 (n=62) in youth, HS, and collegiate male players, respectively, and 1.20 (n=11), 0.90 (n=20), and 0.56 (n=55) in youth, HS, and collegiate female players, respectively. Ankle sprain rates were higher in youth girls versus college women (IRR=2.15, 95%CI: 1.12-4.11), and youth boys versus HS boys (IRR=2.14, 95%CI: 1.07-4.31). Overall, 50% of ankle sprains in female lacrosse players were TL injuries; proportions of TL injuries in male lacrosse players increased with level of play (40.0%, 62.9% and 71.2%, respectively). Also, 56.2% of male ankle sprains and 39.2% of female ankle sprains were due to non-contact mechanisms. Overall, proportions of player contact-related ankle sprains increased with level of play (6.5%, 18.2%, and 29.1%, respectively).

Conclusions: Ankle sprain rates varied by level of play in male and female lacrosse players. Variations associated with TL injuries and player contact-related injuries may highlight the need for level-specific injury prevention strategies. Future research should target reducing the incidence of non-contact ankle sprains.

2558 Board #222 May 31 11:00 AM - 12:30 PM
PROMIS Physical Function Two Weeks Following Orthopaedic Surgery

Gregory Perraut, Ali Aneizi, Vidushan Nadarajah, Patrick Sajak, Michael P. Smuda, Min Zhan, Jonathan D. Packer, R. Frank Henn, III. *University of Maryland School of Medicine, Baltimore, MD.*

(No relevant relationships reported)

Many patients opt for elective orthopaedic procedures to regain physical function. However, little data exist describing early postoperative function, which limits surgeons' ability to appropriately manage their patients' expectations and recovery. **PURPOSE:** To characterize physical function level two weeks postoperative from upper and lower extremity orthopedic surgery and to determine pre-operative factors that are associated with change in physical function two weeks following surgery. **METHODS:** Patients 17 years and older undergoing elective orthopaedic surgery at one institution were enrolled prospectively and completed various questionnaires prior to surgery and again two weeks postoperatively. The questionnaires included: six of the PROMIS computer adaptive questionnaires: Physical Function (PF), Pain Interference, Fatigue, Social Satisfaction, Anxiety, and Depression; a joint-specific function questionnaire, a joint numeric pain scale, and a body numeric pain scale. Physical activity levels were measured using three legacy PRO questionnaires (Tegner, IPAQ, and Marx). Responses were analyzed using Spearman's correlation coefficient, ANOVA, and multivariate linear stepwise regression with PF as the dependent variable. **RESULTS:** 435 patients (47% female) with mean age 41.1 ± 15.7 were included in our final analysis. Mean baseline PF score was 42.1 and mean two-week PF score was 35.5 ($p < .0001$). Patients undergoing upper extremity surgery had higher PF at two weeks than those undergoing lower extremity surgery (39.1 vs 32.2 , $p < .0001$). Ethnicity, preoperative narcotic use, operative joint, injury prior to surgery, and baseline IPAQ category all had significant impact on 2 week postoperative PF score ($p < .05$). Numerous baseline and 2-week measures were correlated with postoperative PF score, with 2-week Social Satisfaction demonstrating the strongest correlation ($r = 0.604$, $p < .0001$). Multivariate regression demonstrated several independent predictors of 2-week PF score. **CONCLUSIONS:** Patients have a significant decline in physical function following orthopaedic surgery, with those undergoing lower extremity surgery having a significantly greater decline. This information can be used to properly manage patients' short-term expectations and increase patient satisfaction.

2559 Board #223 May 31 11:00 AM - 12:30 PM
State Regulations and Region Are Associated With High School Football Preseason Heat Acclimatization Guidelines Compliance

Zachary Y. Kerr¹, Samatha E. Scarneo², Andrew J. Grundstein³, Riana R. Pryor⁴, Yuri Hosokawa⁵, Douglas J. Casa, FACSM², Johna K. Register-Mihalik¹. ¹*University of North Carolina at Chapel Hill, Chapel Hill, NC.* ²*University of Connecticut, Storrs, CT.* ³*University of Georgia, Athens, GA.* ⁴*California State University - Fresno, Fresno, CA.* ⁵*Ritsumeikan University, Kusatsu, Japan.* (Sponsor: Douglas Casa, FACSM)
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Reported Relationships: Z.Y. Kerr: Other (please describe); This research was funded by a grant from the National Athletic Trainers' Association Research and Education Foundation, on which Kerr and Register-Mihalik served as co-PIs, The Korey Stringer Institute (at which Casa and Scarneo are employed) were involved in the development of the preseason heat acclimatization guidelines examined in this study.

In 2009, the National Athletic Trainers' Association Inter-Association Task Force (NATA-IATF) created preseason heat acclimatization guidelines to reduce exertional heat illness (EHI) risk. **PURPOSE:** Examine how United States (US) high school (HS) football programs' compliance with NATA-IATF guidelines in the 2017 preseason was associated with state regulations and region. **METHODS:** A sample of 1000 athletic trainers (ATs) completed an online survey assessing their HSs' compliance with 17 NATA-IATF guidelines in the 2017 preseason. ATs provided HS zip codes to generate our main exposures: (1) whether their state HS athletic associations mandated the guidelines; and (2) region based on warm season wet bulb globe temperature (WBGT). The mild Region 1 included the Pacific Coast and northern US; moderate Region 2 included the midsection of the US; and hot Region 3 included the Southern US. Our two main outcome measures were: reporting compliance with all 17 and ≥ 10 NATA-IATF guidelines. Multivariable binomial regression models estimated prevalence ratios (PR) with 95% confidence intervals (CI). Characteristics of ATs (age, sex, years experience) and HSs (student enrollment, football squad size) were considered for model inclusion via forward model building; only age was retained. **RESULTS:** Most ATs were female (54.9%), aged < 40 years (65.5%), and with < 10 years of experience (50.3%). The HSs were mostly located in Region 3 (43.8%), with 16.0% in states with

mandates. Overall, 4.0% reported compliance with all 17 NATA-IATF guidelines; 74.2% complied with ≥ 10 . Controlling for age, the prevalence of reporting compliance with all 17 guidelines was higher in states with versus without mandates (PR=2.89, 95%CI: 1.53-5.45), and in Region 3 versus Region 1 (PR=4.86, 95%CI: 1.48-16.01). Similar results were found when examining compliance with ≥ 10 guidelines (states with versus without mandates PR=1.21, 95%CI: 1.11-1.30; Region 3 versus Region 1 PR=1.31, 95%CI: 1.19-1.44). **CONCLUSIONS:** Compliance with all 17 NATA-IATF guidelines is low, though many HSs complied with ≥ 10 . Findings highlight the need to identify facilitators of proper implementation, particularly in relatively cooler areas (i.e., Region 1) where there may be less concern for EHI. State-level mandated NATA-IATF guidelines may help increase compliance.

2560 Board #224 May 31 11:00 AM - 12:30 PM
Association Between Running Shoe Characteristics and Lower Extremity Injuries in United States Military Academy Cadets

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(No relevant relationships reported)

PURPOSE: Prospectively investigate the relationship between running shoe characteristics and lower extremity musculoskeletal injury. **METHODS:** The study included 1025 of 1308 incoming United States Military Academy (USMA) cadets. Shoe length and stiffness were recorded to calculate shoe torsional stiffness while shoe heel height was also recorded. Demographic data and Army Physical Fitness Test (APFT) data were also recorded. Lower extremity injuries sustained over nine weeks during cadet basic training were documented using the Armed Forces Health Longitudinal Technology Application (AHLTA) and the Cadet Illness and Injury Tracking System (CIITS). Kaplan-Meier survival curves were estimated with time to incident of lower extremity injury as the primary outcome by level of the independent predictor variables. Risk factors and known or potential covariates were carried forward into multivariable Cox Proportional Hazards Regression Models. **RESULTS:** Approximately 18.1% of participants incurred a lower extremity injury. Cadets wearing shoes with moderate lateral torsional stiffness were 49% less likely to incur any type of lower extremity injury and 52% less likely to incur a lower extremity injury due to overuse than cadets wearing shoes with minimal lateral torsional stiffness. Risk of injury was similar among cadets wearing shoes with minimal and extreme lateral torsional stiffness. **CONCLUSIONS:** Shoes with mild to moderate lateral torsional stiffness may be appropriate in reducing risk of lower extremity injury in cadets. Shoes with minimal lateral torsional stiffness should be discouraged in this population.

E-40 Free Communication/Poster - Caffeine Supplementation

Friday, May 31, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

2561 Board #225 May 31 11:00 AM - 12:30 PM
Effects of Pre-exercise Caffeinated Energy Drink Consumption on Running Performance.

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 (No relevant relationships reported)

Purpose: The purpose of this study was to examine the effects of pre-exercise consumption of a commercially available caffeinated energy drink on running performance in healthy adult subjects. **Methods:** Eight adult subjects (50% female; Age: 31.1 ± 6.0 y, Ht: 175.3 ± 46.8 cm, Wt: 77.7 ± 7.5 kg, BMI: 25.30 ± 2.2 kg/m²) provided their informed consent for participation. All subjects had at least a 3-month history of regular running (at least 30 min, 3 times per week) and were typical consumers of caffeine (at least weekly). Subjects first completed a progressive treadmill running protocol to determine $\dot{V}O_2$ peak, with continuous measurement of $\dot{V}O_2$ (indirect calorimetry) and HR (wireless heart monitor). Blood pressure (auscultation) and RPE (Borg ratio scale) were assessed at each workload. Subjects

returned for two performance-running trials, staged at least one week apart. One hour prior to each run, subjects consumed a commercially available caffeinated drink (CAF) (Monster® Rehab®, containing 1.48 mg caffeine/kg body weight), or a similar tasting, non-caffeinated placebo drink (PLA). Both drinks contained an equal amount of carbohydrate (3 gm) per serving. Drinks were administered in a double-blind fashion. Subjects then completed a 30-minute run at a pace corresponding to 70-75% $\dot{V}O_2$ peak, and then ran at 90% $\dot{V}O_2$ peak until volitional fatigue. $\dot{V}O_2$ and HR were monitored continuously throughout the performance run. BP and RPE were obtained every 5 minutes of the first 30 minutes and at conclusion of the run. Performance time at 90% $\dot{V}O_2$ peak was recorded. Mean values for all measured variables between trials were assessed for differences ($p < 0.05$) via repeated measures ANOVA. **Results:** During the run trials, no significant differences were seen in $\dot{V}O_2$, METS, %fat used, %carbohydrate used, HR, RPE, and BP. RER at 5 min of the run was significantly ($p = 0.046$) reduced in the CAF trial. Mean run time at 90% $\dot{V}O_2$ peak (8.96 min PLA, 9.46 min CAF) was not significantly different ($p = 0.37$) or clinically meaningful (effect size = 0.08). **Conclusions:** Pre-exercise consumption of a commercially available caffeinated energy drink failed to significantly impact metabolic / cardiovascular function and performance run time in recreational adult runners.

2562 Board #226 May 31 11:00 AM - 12:30 PM
Effects of Acute Consumption of Caffeinated Gum on Anaerobic Exercise Performance

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Athletes commonly consume caffeine to enhance sports performance. Caffeine is ingested from a variety of sports nutrition products such as sports drinks, energy drinks, gels, and bars. **PURPOSE:** The purpose of this study was to investigate the effect of caffeinated chewing gum on anaerobic exercise performance. **METHODS:** Using a double-blind, counter-balanced, repeated measures crossover design, 22 recreationally-active college-aged males and females (mean \pm SD: age = 21.0 ± 1.1 yr; height = 172.5 ± 9.9 cm; body mass = 74.6 ± 13.8 kg) consumed either 200 mg of caffeinated chewing gum (CAFF, Military Energy Gum, MarketRight Inc, Plano, IL) or placebo (PL) approximately 30 minutes prior to performing the Wingate bike test. Paired-samples t tests were used to compare differences between the following dependent variables; mean power (MP), peak power (PP; highest power output in 5 s), fatigue index (FI), and total work (TW). **RESULTS:** There were no statistically significant differences in MP (CAFF; 7.44 ± 1.16 vs. PL; 7.47 ± 1.37 watts \cdot kg⁻¹, $p = 0.720$), PP (CAFF; 10.40 ± 1.52 vs. PL; 10.52 ± 1.34 watts \cdot kg⁻¹, $p = 0.659$), FI (CAFF; 11.80 ± 4.58 vs. PL; 13.21 ± 4.44 watts \cdot sec⁻¹, $p = 0.059$), or TW (CAFF; 16921.81 ± 4943.71 vs. PL; 16971.98 ± 5036.38 kJ, $p = 0.823$) between treatments. **CONCLUSIONS:** These results suggest that 200 mg of caffeine consumed approximately 30 min prior to the Wingate bike test does not improve anaerobic performance in recreationally-active college-aged males and females.

2563 Board #227 May 31 11:00 AM - 12:30 PM
Effects of Caffeinated Chewing Gum on Repeated Sprint Performance in Recreationally Active Individuals

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Caffeine is frequently consumed by athletes as an ergogenic aid during training and competition. It has been shown to improve performance in moderately intense-long duration endurance exercise. The mechanisms to explain caffeine's performance enhancing effects include improving nervous system activation, muscle contraction, and fuel delivery to the muscle. However, the effects of caffeine on singular or repeated bouts of short term high-intensity exercise are less clear. **PURPOSE:** To investigate the effects of caffeinated chewing gum on performance during repeated high-intensity sprints in active individuals. **METHODS:** Six recreationally active subjects (Age = 21 ± 1 yr) completed two high-intensity experimental sessions, consisting of two sets of 60 meter sprints with three sprints per set. Caffeine (240 mg) or placebo was administered via chewing gum following the first set of sprints of each experimental session. Middle 20 meter sprint times, post sprint heart rates and post sprint ratings of perceived exertion (RPE Scale 1-10) were measured. **RESULTS:** There were no significant changes in 20 meter sprint times between the two experimental conditions across the six sprints; 2.69 ± 0.08 secs (placebo) vs. 2.74 ± 1.6 secs (caffeine). However, sprint times were maintained in the caffeinated trial when compared to the

placebo condition across the six sprints. There was a trend for post sprint heart rates to be lower following the fourth sprint performed (144 ± 13 bpm placebo vs. 125 ± 11 bpm caffeine, $P = 0.07$) but the effect did not carry over into the fifth and final sprint. There was a trend for RPE to be lower following the fifth sprint (6.33 ± 0.5 placebo vs. 4.83 ± 0.3 caffeine, $P = 0.06$) and it was significantly lower (6.5 ± 0.5 placebo vs. 5.1 ± 0.4 caffeine, $P \leq 0.05$) following the final sprint. **CONCLUSIONS:** The acute ingestion of caffeine via chewing gum appears to maintain speed during repeated, high-intensity sprints in recreationally active individuals. Furthermore, caffeinated chewing gum seems to lower post sprint heart rates and ratings of perceived exertion. Further research with additional subjects is needed to ascertain if caffeinated chewing gum taken during the later stages of high-intensity exercise helps to maintain exercise performance and attenuate fatigue.

2564 Board #228 May 31 11:00 AM - 12:30 PM
Effect of Caffeinated Gum on Choice Reaction Time

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Caffeine ingestion is a common practice for individuals seeking to feel more awake or trying to improve performance. Rather than consuming caffeinated drinks, a more recent trend is that of chewing caffeinated gum. Published research in this area, particularly in support of benefits to fine motor performance, is limited. **PURPOSE:** To determine if chewing Military Energy Gum (MEG, MarketRight Inc, Plano, IL) compared to a placebo can improve choice reaction time (CRT, MOART System, Lafayette, IN) under rested and fatigued conditions. **METHODS:** Twenty-two (12 males, 10 females), college-aged (mean \pm SD: 21 ± 1.1 yrs; 1.73 ± 0.10 m in ht; 74.6 ± 14.18 kg in wt), volunteers participated in a double-blind, cross-over, placebo-based study. All subjects completed an IRB consent form. Subjects were asked to be available for testing on two non-consecutive days, for one hour. Prior to each testing period, subjects fasted from food for 7 hours and abstained from alcohol for 24 hours. Upon arrival the first day, subjects completed a brief health assessment survey, performed the CRT and the Wingate cycling power (WCP) test. Subjects performed the CRT (pre-gum CRT), were given two pieces of either 200 mg caffeinated MEG (cMEG) or placebo MEG (pMEG), chewed the gum for ten minutes, and again performed the CRT (post-gum CRT), completed the WCP test, and did CRT for third time (post-gum WCP). A mixed-methods ANOVA was conducted to determine if a group (MEG, placebo) by time (pre-gum, post-gum, post-WCP) interaction on choice reaction time existed. Significance was established at $p < 0.05$. **RESULTS:** There was no statistically significant interaction between group and time. However, CRT for the cMEG improved significantly from pre-gum ($0.544 \pm .09$ sec) to post-gum ($0.504 \pm .07$ sec), and pre-gum to post-Wingate ($M = .483 \pm .08$ sec). **CONCLUSION:** When compared to a placebo, caffeinated MEG did not significantly improve choice reaction time of college-aged participants under rested or fatigued conditions. Yet, choice reaction timing did show an improving trend during the sequential testing.

2565 Board #229 May 31 11:00 AM - 12:30 PM
Efficacy of Caffeine Supplementation for Supporting Exercise Performance During Delayed Onset Soreness

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Caffeine, an adenosine receptor antagonist, has documented hypo-analgesic effects during exercise. However, there is currently a lack of research focusing specifically on the potential analgesic effects of caffeine on delayed onset muscle soreness. **PURPOSE:** The purpose of this study was to determine whether 5 mg/kg of caffeine attenuates muscle pain and improves 5k running performance following exercise-induced muscle soreness. **METHODS:** The subjects ($n=11$) included nine males and two females who were apparently healthy adults (height: 175.9 ± 8.4 cm, body mass: 69.2 ± 7.5 kg, age: 24.5 ± 6.3 years, body fat: $8.5 \pm 4.7\%$, $\dot{V}O_{2max}$ 63.6 ± 6.1 ml \cdot kg⁻¹ \cdot min⁻¹). Prior to participating, the subjects were asked to discontinue supplement use for 72 hours and abstain from caffeine consumption for 48 hours. Participants first performed an introductory testing and familiarization session to gain an understanding of the procedures. The study included a 30-minute downhill run on a treadmill set at $\sim 10\%$ grade and 70% $\dot{V}O_{2max}$ to induce delayed onset of muscle soreness. Participants then returned 48 hours after to complete a 5k time trial run where they consumed either

5 mg/kg of caffeine (CAFF) or placebo (PLB). Rating of perceived exertion (RPE) and heart rate (HR) were taken every two minutes during the trial. **RESULTS:** There was no detectable statistical difference between 5k performance between trials ($p = .67$) for CAFF (1036.2 \pm 92.6 sec) vs. PLB (1043.4 \pm 91.9 sec). Algometer readings were similar between CAFF and PLB trials for rectus femoris (RF) muscle soreness ($p = .216$) and vastus medialis oblique (VMO) muscle soreness ($p = .679$). There was no difference detected between CAFF and PLB trials for muscle weakness or tenderness ($p = .824$). There were also no differences between trials for RPE ($p = .818$). **CONCLUSIONS:** The present study does not suggest that caffeine is effective at reducing muscle soreness, RPE or improving performance during exercise when DOMS is present.

2566 Board #230 May 31 11:00 AM - 12:30 PM
Effects of 8 Weeks of Caffeine Supplementation on Protein Metabolism Markers in Resistance-Trained Men
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The use of caffeinated beverages and supplements is common among collegiate and recreational athletes, with 85% of people aged 18-24y consuming caffeine. The use of caffeine may influence the adaptations to resistance training by altering pathways in protein metabolism. **PURPOSE:** The purpose of this study was to determine if caffeine intake alters markers of protein metabolism, changes in strength gains, or body composition in response to an 8-week resistance training protocol. **METHODS:** Resistance-trained men ($n=20$; 22.1 \pm 2.4 y; 178.1 \pm 7.5 cm; 82.8 \pm 15.7 kg) were randomly assigned into a caffeine (CAF; $n=10$) or placebo supplementation group (PLA; $n=10$). Participants were instructed to consume three caffeine (200 mg per capsule; 7.7 \pm 1.3 mg \cdot kg $^{-1}$) or placebo capsules per day. Both groups followed 4-day meat-free meal plans before study commencement, the 4th week of the protocol, and the 8th week of the protocol. Skinfold and 10-repetition max test (10RM) were performed to test body composition and strength, respectively, at each time point. Urine collection (24-hr) was performed to determine urinary 3-methylhistidine (3MH), urinary creatinine (Cr), and 3MH:creatinine (3MH:Cr). A 2x3 repeated measures MANOVA with a Bonferroni *post-hoc* test was used to test significance ($p<0.05$). **RESULTS:** After 8 weeks of supplementation and resistance training, urinary 3MH:Cr was significantly lower in CAF than PLA (0.137 \pm 0.49 vs 0.178 \pm 0.48 μ mol \cdot mmol $^{-1}$; $p=0.016$). There were no significant differences between groups in strength or body composition. **CONCLUSION:** The results from this study demonstrated consuming caffeine does not negatively affect common adaptations to resistance training, and may improve the metabolic environment to promote muscle protein synthesis. Young, resistance-training men who habitually consume ergogenic doses of caffeine may impart proteolytic suppression that can benefit a hypertrophic training program.

2567 Board #231 May 31 11:00 AM - 12:30 PM
The Effect of Ingestion of Caffeine, Creatine, and Amino Acids On Anaerobic Performance
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Introduction: Pre-workout supplementation has become a growing interest in the sports nutrition industry. Specifically, caffeine, creatine, and beta alanine have been combined in an effort to enhance performance. **Purpose:** The purpose of this study was to examine the effect of the consumption of the combination of caffeine (150mg), creatine (1g), and amino acids (1.6g) in habitual and non-habitual caffeine users in anaerobic performance. **Methods:** 24 recreationally active college-age students (age 21.6 \pm 2 yr, ht. 176.8 \pm 16 cm, body mass 73.8 \pm 18.3 kg, 15♂) volunteered to participate in a randomized, double-blind crossover study. Two Wingate Anaerobic Power Test (WAPT) familiarization trials were conducted prior to entry into the study. Subjects refrained from vigorous activity 24 hours before testing, maintained their normal diet, and habitual caffeine users continued their habit, while non-habitual caffeine users did not ingest caffeine for 2 weeks prior to testing. Fasted subjects ingested either the supplement (SUP) or a taste, texture and color matched placebo (P), 30 minutes prior to WAPT with a minimum of 48 hrs between trials. Finger stick blood lactate was obtained three minutes post all trials. **Results:** Means for Peak Power (PP) was 1082.1 \pm 326.1 and 1085.3 \pm 357.3 watts, Mean Power (MP) was 545.2 \pm 226.5 and 579.6 \pm 190.6 watts, Fatigue Index (FI) was 77.4 \pm 16 and 74.8 \pm 7.2% and Total Work (TW) was 17227.8 \pm 6211.3 was 17387.1 \pm 5718.5 joules for P and SUP trials, respectively. Statistical analysis by Factorial ANOVA ($p<0.05$) revealed no significant difference between habitual and non-habitual caffeine users across both conditions. **Conclusion:** SUP ingestion does not improve anaerobic performance regardless of previous caffeine ingestion history at the commercially available levels evaluated in this study.

2568 Board #232 May 31 11:00 AM - 12:30 PM
The Physiological Responses of Caffeine Supplementation During Repeated-Sprint Activity
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 (No relevant relationships reported)

Caffeine is one of the most widely used drugs in the world due to its benefits of increasing mental and physical capabilities. Caffeine also is commonly used as an ergogenic aid when performing repeated-sprint activity (RSA). **PURPOSE:** The purpose of this study is to examine the effects of 200 mg of caffeine during RSA on heart rate (HR), rating of perceived exertion (RPE), blood lactate concentration (BLA), and sprint time (ST). **METHODS:** Thirty-two students (Age: 22.19 \pm 2.29 years) participated in the study. The study followed a randomized crossover design, in which each participant ingested either 200 mg of caffeine or placebo 45 minutes prior to sprinting. The sprinting protocol consisted of three sets of six maximal-effort 30-meter sprints. Each sprint covered a 15-meter distance between the starting and the secondary marker, such that each subject sprinted down to the secondary and back to the starting. Each of the sprints in a set were separated by a total of 20 seconds of active recovery. Following each set, HR, BLA, ST, and RPE were recorded. **RESULTS:** The caffeine trials were not significantly different than the placebo for HR and RPE. However, for RPE, there was a main effect for time [$F(3,93) = 292.810$, $p < 0.001$]. The caffeine trials (Resting: 1.30 \pm 0.52 mmol/L; Set 1: 11:33 \pm 2.38 mmol/L; Set 2: 13.26 \pm 3.02 mmol/L; Set 3: 13.67 \pm 2.49 mmol/L) elicited increased BLA compared to the placebo (Resting: 1.37 \pm 0.53 mmol/L; Set 1: 9.24 \pm 2.43 mmol/L; Set 2: 11.46 \pm 2.87 mmol/L; Set 3: 11.83 \pm 2.55 mmol/L). The caffeine trials (Set 1: 6.78 \pm 0.58 secs; Set 2: 6.81 \pm 0.55 secs; Set 3: 6.85 \pm 0.57 secs) also produced a decreased average ST compared to the placebo (Set 1: 7.00 \pm 0.64 secs; Set 2: 7.02 \pm 0.62 secs; Set 3: 7.12 \pm 0.63 secs). For the average ST, there were significant main effects for condition [$F(1,31) = 36.839$, $p < 0.001$] and time [$F(2,62) = 5.806$, $p = 0.006$]. **CONCLUSION:** Caffeine supplementation of 200 mg elicits an increase in RSA in college-aged non-athletes.

2569 Board #233 May 31 11:00 AM - 12:30 PM
Effects Of Caffeine On High-intensity Functional Training Performance In High- Vs. Low-caffeine Users
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 (No relevant relationships reported)

Caffeine's ergogenic effects during endurance and high-intensity exercise are well-established. However, habitual caffeine use may diminish its ergogenic properties. Researchers have investigated high-intensity functional training (HIFT) which incorporates endurance, weightlifting, and gymnastics modalities performed at a relatively high-intensity. However, the effects on caffeine supplementation on HIFT performance remain unknown. **PURPOSE:** Our study aimed to determine the effects of caffeine on HIFT performance between low- and high-caffeine users. **METHODS:** 13 HIFT-trained men were recruited. Participants completed a 7-day caffeine recall to determine low- (<200mg/day, $n=7$, age=29.3 \pm 8.4 years, HIFT-experience=5.2 \pm 3.2 years, weight=86 \pm 11.3 kg) and high-caffeine users (>300mg/day, $n=6$, age=27.7 \pm 4.2 years, HIFT-experience=2.8 \pm 2.4 years, weight=94.5 \pm 8.5 kg). Using a double-blind, crossover design, participants were randomized to consume 5mg/kg body weight of caffeine or a placebo 60 minutes before a HIFT workout. The HIFT workout consisted of as-many-rounds-as possible in 20 minutes of 5 pull-ups, 10 push-ups, and 15 air squats (1 round = 30 repetitions). HIFT performance was determined by the absolute difference in repetitions between the caffeine and placebo conditions (HIFT performance = repetitions during caffeine – repetitions during placebo). An independent-samples t-test was used to determine the differences in HIFT performance between low- and high-caffeine users. **RESULTS:** Low- and high-caffeine users completed 451 \pm 91 vs. 395 \pm 95 and 501 \pm 95 vs 415 \pm 99 repetitions during the placebo and caffeine conditions, respectively. HIFT performance was not significantly different between low- and high-caffeine users (50 \pm 38 vs. 20 \pm 18 repetitions, $p=0.10$). **CONCLUSION:** Caffeine's ergogenic effect was not significantly different between low- and high-caffeine users' performance, suggesting a no caffeine tolerance effect. HIFT athletes may benefit from supplementing caffeine without significant impairments from high-caffeine consumption. Future investigations should determine the effects of caffeine utilizing other HIFT workouts, and consider stratifying participants by daily caffeine consumption relative to body weight.

2570 Board #234 May 31 11:00 AM - 12:30 PM
Low Dose of Caffeine Do Not Affect Torque and Rate of Torque Development

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Higher rate of torque/force development (RTD) and peak torque (PT) are associated with sports performance, lower risk of injuries and better recovery from injury. For elderly individuals, a higher RTD and PT are often associated with independence, quality of life, and reduced risk of falls. Evidences have shown that caffeine may enhance RTD in younger adults, but no information are available for elderly.

PURPOSE: This study investigated the effect of a low dose of caffeine on PT and RTD of older (OG) and younger adults (YG).

METHODS: Fifteen older (69±6 years; 70±12 kg; 169±6 cm) and 15 younger men (27±4 years; 78±9 kg; 176±7 cm) were tested for PT and RTD of the plantar flexors using a Biodex 4 dynamometer. They were familiarized with testing conditions in the first visit to the laboratory. The two experimental (3 mg/kg of caffeine or placebo) conditions were tested in two days, separated by at least 48 h. Subjects performed four maximal isometric voluntary contractions (MIVC) before and after supplementation. PT, RTD 0 to 50 ms (RTD₀₋₅₀) and RTD 100 to 200 ms (RTD₁₀₀₋₂₀₀) were analyzed. RTD and PT were normalized by body mass for comparisons. The Shapiro-Wilk test was used to check data normality and the mixed-model ANOVA was used to investigate time and group interaction.

RESULTS: No difference ($p>0.05$) for time and group x time interactions were found for PT (OG: +0.6%; YG: +1.2%), RTD₀₋₅₀ (OG: +3.5%; YG: +4.8%), and RTD₁₀₀₋₂₀₀ (OG: -3.1%; YG: -2.3%). As expected, placebo did not show any significant difference.

CONCLUSIONS: A low dose of caffeine did not affect PT and RTD in older and young adults. It could be hypothesized that a greater dose of caffeine may be required to improve muscle function in young and older subjects.

2571 Board #235 May 31 11:00 AM - 12:30 PM
The Effects of Carbohydrate and Caffeine Mouth Rinse on Upper Body Muscular Strength and Endurance

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(No relevant relationships reported)

Carbohydrate (CHO) and caffeine (CAF) are the most preferred nutritional ergogenic aids by elite athletes. CHO improves performance by sparing the muscle glycogen depots and CAF by antagonizing adenosine receptors. In recent years it has been shown that combined or separated CHO and CAF mouth rinsing can improve sprint performance. However, more research is needed to examine the effect of CHO and CAF rinsing on strength and muscular endurance performance.

Purpose : to investigate the effect of rinsing of CHO and CAF on bench press strength and endurance performance.

Metots: Twelve resistance trained men participated in this research. After the familiarization test day, participants participated in a total of 4 test days with a randomized, counterbalanced, crossover study design: 6% (1.5 gr.) weight / volume (w / v) CHO mouth rinse (CMR) with 25 ml water, mouth rinse with water (PLA), %1.2 CAF mouth rinse (CAFMR) and combined %6 CHO, %1.2 CAF mouth rinse (CCMR). After a 10-hour night fasting one repetition maximum (1RM) was determined for strength and %40 1RM strength endurance test over a 3 sets until repetition to failure with 2 seconds eccentric and 2 seconds concentric phase. Prior to strength and endurance measurements, participants rinsed the solutions in their mouths for 10 seconds. During the test protocol heart rate (hr), lactate (la), glucose (glu), felt arousal (fa) and ratings of perceived exertion (rpe) were measured. In the analysis of the data, single and two-way repeated measures analysis of variance were used.

Results: No significant differences were detected between trials as for strength, endurance, hr, glu, la, fa, rpe ($P>0.05$).

Discussion: This research has shown that orally rinsing of carbohydrate and caffeine does not have a significant effect on upper body strength and muscular endurance performance. The results of the study are in parallel with the literature. In future studies, higher doses of solutions may be rinsed in the mouth to investigate the effect on lower body strength and muscular endurance performance whose muscle activation percentage is low during maximal voluntary contraction.

Keywords: Caffeine, carbohydrate, rinsing, ergogenic,

2572 Board #236 May 31 11:00 AM - 12:30 PM
Effects of Caffeine on High-Intensity Functional Training Performance

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(No relevant relationships reported)

Caffeine demonstrates an ergogenic effect on endurance exercise performance, however, limited information exists establishing its efficacy during high-intensity functional training (HIFT). HIFT is an exercise program that incorporates a variety of multi-joint movements performed at a relatively high-intensity and designed to improve parameters of general physical fitness and performance. **PURPOSE:** Our study aimed to determine the effects of caffeine on HIFT performance. **METHODS:** 13 HIFT-trained men (age = 28.5 ± 6.6 years, HIFT experience = 4.1 ± 3.0 years, body weight = 84.3 ± 9.9 kg) were randomized in a double-blind, crossover design. After consent, participants completed two HIFT sessions separated by a 7-day washout period, 60-minutes after consuming 5mg/kg of caffeine or a placebo. During HIFT sessions, participants completed as-many-rounds-as-possible in 20 minutes of 5 pull-ups, 10 push-ups, and 15 air squats, with performance measured as the number of rounds completed (30 repetitions = 1 round). Paired-samples t-tests were used to compare HIFT performance between the caffeine and placebo conditions and to test for a potential learning effect between the first and second sessions. **RESULTS:** Participants significantly improved HIFT performance during the caffeine trial (15.3 ± 3.6 rounds) as compared to placebo (14.3 ± 3.0 rounds), $t(12) = -2.783$, $p < 0.05$. The eta squared statistic (0.39) indicated a large effect size. Moreover, no significant learning effect was identified between the first and second sessions (14.9 ± 3.2 vs. 14.7 ± 3.5 rounds, $p = 0.73$). **CONCLUSION:** Caffeine elicited an ergogenic response during HIFT in HIFT-trained men, with no identifiable learning effect, which is useful for competitive HIFT athletes aiming to optimize performance. However, future investigations should establish the efficacy of caffeine during varying-duration HIFT sessions and among female HIFT athletes.

2573 Board #237 May 31 11:00 AM - 12:30 PM
Effect Of Caffeine On Muscular Strength And Endurance In Resistance-trained College-aged Males

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(No relevant relationships reported)

PURPOSE: To determine if pre-exercise caffeine consumption would significantly enhance performance during muscular strength and endurance testing in habitual caffeine users.

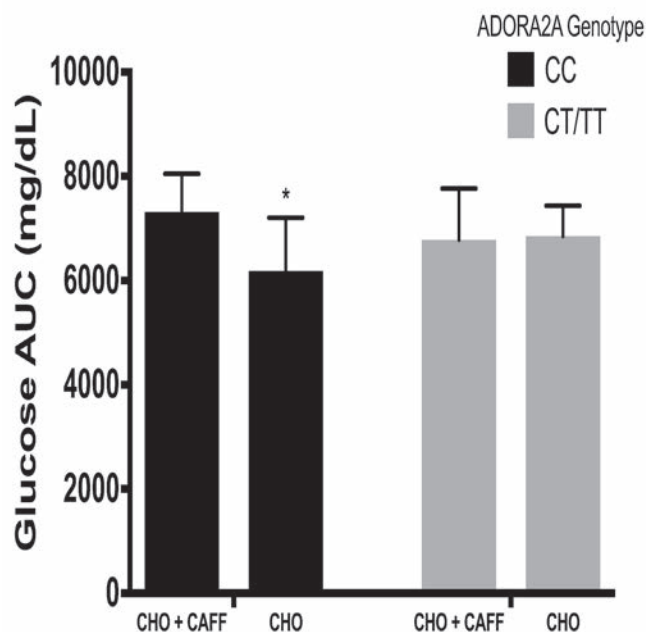
METHODS: Males ($n=8$, 22.12±8.83yrs., 85.82±12.75kg) who self-reported to be habitual caffeine users volunteered for the study. All participants reported resistance training a minimum of 3 times per week for at least 3 months prior to involvement in the study. Participants abstained from caffeine for at least 48 hours prior to testing. In this double-blind, placebo-controlled, within-subjects design, participants were randomly assigned to consume either 150mg caffeine (10 oz. standardized coffee) or decaffeinated coffee (10 oz. placebo) and performed a 5-repetition (5RM) maximal effort leg press followed by a maximal effort YMCA push-up test. Participants returned 1 week after the first trial for the second treatment. A paired samples t-test was performed to test for significant differences between treatments.

RESULTS: Analysis showed significant increases in 5RM leg press weight ($p=0.029$) and push up performance ($p=0.009$) between treatment and placebo trials. An 11% improvement was seen in 5RM leg press weight (600±161 lbs) compared to the placebo (539±135 lbs). Similarly, there was a 14% improvement in push up performance (caffeine 40±10 repetitions, placebo 35±7 repetitions) between treatment and placebo testing. The relative dose of caffeine for the participants was 1.78±0.26 ml/kg of bodyweight (1.4 - 2.2 mg/kg of bodyweight).

CONCLUSIONS: Our results indicate that 150mg caffeine may improve muscular strength and endurance in resistance-trained habitual caffeine users. Further, the relative amount of caffeine consumed was less than that believed to be required for an ergogenic effect on performance. These results suggest that for habitual caffeine users that follow a washout period, a lower caffeine dosage can still elicit an ergogenic effect on muscular strength and endurance. Future research should determine whether our results are consistent across both sexes as well as determine whether the same ergogenic effect can be seen following similar dosages to those who are not habitual users.

- 2574 Board #238 May 31 11:00 AM - 12:30 PM
ADORA2A, but Not CYP1A2, Genotype Influences Caffeine's Effect On Glucose Responses To A Carbohydrate Feeding
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(No relevant relationships reported)

Cytochrome P450 1A2 (CYP1A2) is a liver enzyme that is responsible for 95% of caffeine metabolism, while adenosine A_{2A} receptors (ADORA2A) are antagonized by caffeine. Functional single nucleotide polymorphisms (SNP) in CYP1A2 (-163 C>A; rs762551) and ADORA2A (1083 T>C; rs7571876) have been reported to influence various physiological responses to caffeine. **PURPOSE:** To examine if SNPs in CYP1A2 or ADORA2A influence the effect of caffeine on the postprandial glucose (GLU) response to a carbohydrate feeding (CHO). **METHODS:** Sixteen healthy males (mean \pm SD, 25 \pm 4 y, 94 \pm 15 kg, 178 \pm 6 cm) were genotyped for rs762551 (AA; n=9, AC/CC; n=7) and rs7571876 (CC; n=6, CT/TT; n=10). During two separate visits, blood draws were performed prior to and 30- and 60-min after the subject consumed either a liquid CHO meal (0.75g CHO/kg) or the same liquid CHO meal with 4 mg/kg of pharmaceutical grade caffeine (CHO + CAFF) in random order. Trapezoidal areas under the GLU curve (AUCs) were calculated for each participant in each condition and subsequently analyzed with separate two-way mixed factorial ANOVAs (Genotype [AA vs. AC/CC or CC vs. CT/TT] \times Condition [CHO vs. CHO + CAFF]). The type-I error rate was set a priori at 5%. **RESULTS:** For CYP1A2, there was no significant genotype \times condition interaction ($p=0.87$), nor main effects for genotype ($p=0.20$) or condition ($p=0.22$). For ADORA2A, however, there was a genotype \times condition interaction ($p=0.03$) (Fig 1). In the CC allele-carriers, the GLU AUC was greater during the CHO + CAFF than CHO condition ($p=0.026$, 95% CI of difference [137.8, 2132]), whereas there was no difference during the CHO + CAFF and CHO conditions for the CT/TT allele-carriers ($p=0.97$, 95% CI of difference [-842.9, 701.9]). **CONCLUSION:** The caffeine-induced impairment in postprandial glycaemia is influenced by ADORA2A 1083 T>C, but not CYP1A2 -163 C>A genotype.



- E-41 Free Communication/Poster - Fat Metabolism
 Friday, May 31, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

- 2575 Board #239 May 31 11:00 AM - 12:30 PM
Electromyostimulation Induced Changes In Intramyocellular Lipid Of Vastus Lateralis In Older Adults
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Intramyocellular lipid (IMCL) is an important energy substrate during physical activity for young as well as older adults. However age-related changes in lipid metabolism can cause excess IMCL accumulation that can induce insulin resistance. Our previous studies have reported that IMCL content is inversely correlated with physical activity level in young, while it is not in the older adults (Hioki et al. 2018). In contrast, electromyostimulation (EMS) has been used to improve muscle mass, strength, and metabolism after spinal cord injury or chronic heart failure.

PURPOSE: We aimed to prove the hypothesis that EMS can induce changes in the IMCL content of the vastus lateralis (VL) in older adults.

METHODS: Fourteen physically active, non-obese older men and women were randomly assigned to an EMS group (70.4 \pm 1.8 years) or a control group (without EMS) (68.0 \pm 1.4 years) (n = 7 each). We applied EMS to the VL of the right leg for 30 min at a frequency of 30 Hz, pulse duration 300 μ s, and contraction/relaxation durations of seven seconds on and seven seconds off. IMCL content in the VL was quantified by ¹H-magnetic resonance spectroscopy before and immediately after the EMS in the EMS group, as well as in the control group. ¹H-MRS spectra with and without water suppression were taken, and calculation of IMCL contents and creatine (Cr) (mM) was performed by the LCModel software. Fasting plasma glucose and insulin values were also determined from blood samples collected before and immediately after EMS.

RESULTS: In the EMS group, values for IMCL/Cr increased significantly from 4.8 \pm 2.1 to 6.9 \pm 2.5 ($p < 0.05$) and plasma glucose decreased significantly from 96.4 \pm 4.0 to 93.0 \pm 3.4 mg/dL ($p < 0.05$); whereas, insulin did not change significantly (5.6 \pm 1.1 vs. 5.2 \pm 1.2 μ U/mL; $p = 0.43$). Values for IMCL/Cr did not change significantly after resting for 30 min in the control group (4.9 \pm 2.1 vs. 5.0 \pm 1.1, $p = 0.95$). Creatine values did not change after EMS in the EMS group (63.3 \pm 3.4 vs. 62.9 \pm 8.4 mM, $p = 0.96$) or after resting in the control group (63.3 \pm 7.4 vs. 65.6 \pm 8.9 mM, $p = 0.76$).

CONCLUSION: The findings suggested that a single bout of EMS induces an increase in the IMCL content in the VL of older adults. This study was supported by a Grant in Aid (KAKENHI No. 23650432) and the Descende and Ishimoto Memorial Foundation for the Promotion of Sports Science.

- 2576 Board #240 May 31 11:00 AM - 12:30 PM
The Effect Of Eleutherococcus Senticosus On Metabolism-associated Protein Expressions In C2C12 Cells
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PURPOSE: Eleutherococcus senticosus (ES) is a kind of Araliaceae and used as a medical plant. The principal component of ES is a glycoside such as triterpenoid and more than 16 kinds of components exist (e.g. sesamin, eleutheroside B, isoflavadin, chlorogenic acid). Given the finding that an intake of ES for 8 weeks enhances fat utilization and endurance exercise capacity in human study (Kuo et al., 2010), it is hypothesized that, in addition to fat mobilization from adipocytes, skeletal muscle energy metabolism is increased. However, the effect of ES on metabolic profile in a skeletal muscle cells is unknown. The aim of this study was to investigate the effect of ES on expressions of metabolism-associated proteins in differentiating C2C12. **Methods:** **METHODS:** During and after differentiation, C2C12 cells were treated with 0.1 mg/ml, 0.2 mg/ml, 0.5 or 1.0 mg/ml ES for 72 hours. The expressions of Mitochondrial lipid related proteins and energy metabolism associated proteins were analyzed by Western blotting. **RESULTS:** The expressions of mitochondrial lipid metabolism-associated proteins such as carnitine palmitoyltransferase I (CPT I),

uncoupling protein 3 (UCP3), and cytochrome c oxidase (COX) did not change to ES treatments during and after C2C12 cell differentiation. However, the expression of phosphorylated AMP-activated protein kinase (AMPK), a metabolism-associated protein, was increased in response to 1.0 mg/ml ES ($p < 0.05$) in both during and after cell differentiation. **CONCLUSION:** The finding suggests that ES may enhance skeletal muscle energy metabolism by means of augmented AMPK activity, and may relate to elevated endurance exercise capacity. Supported by Bizen Chemical Co., LTD

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The Effect Of Eleutherococcus Senticosus On Adipocyte Differentiation And Lipid Accumulation In 3T3-L1 Cells

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PURPOSE: Eleutherococcus senticosus (ES) is a kind of Araliaceae and used as a medical plant. The principal component of ES is a glycoside such as triterpenoid and more than 16 kinds of components exist (e.g. sesamin, eleutheroside B, isoflavadin, chlorogenic acid). Given the finding that an intake of ES for 8 weeks enhances fat utilization and endurance exercise capacity in human study (Kuo et al., 2010), it is hypothesized that fat mobilization from adipocytes is increased. However, the effect of ES on fat metabolism such as lipolysis and lipogenesis in adipocytes is unknown. The aim of this study was to investigate the effect of ES on cell differentiation, lipolytic and lipogenic activities, and those related protein expressions in differentiating 3T3-L1 adipocytes. **METHODS:** 3T3-L1 adipocytes were treated with 0.2mg/ml, 0.5 or 1.0mg/ml ES for 72 hours. Triacylglycerol (TAG) content was biochemically measured. The expressions of adipocyte differentiation-, lipolysis-, and lipogenesis-associated proteins were analyzed by Western blotting. **RESULTS:** ES treatment (1.0mg/ml ES) significantly decreased intercellular lipid accumulation (TAG content) compared with control ($P < 0.01$). The expressions of lipolysis-associated proteins such as adipose triglyceride lipase (ATGL), perilipin 1 and CGI-58 were significantly lower in the ES compared with control ($p < 0.01$). On the other hand, ES significantly decreased the protein expression of peroxisome proliferator-activated receptor γ (PPAR γ) ($p < 0.01$), while enhanced AMP-activated protein kinase (AMPK), acetyl-CoA carboxylase (ACC) and Akt phosphorylation ($P < 0.05$). Furthermore, the expression of lipogenesis-associated protein (e.g., Phosphoenolpyruvate carboxykinase (PEPCK)) was lower in ES treated cells than in control ($P < 0.05$). **CONCLUSION:** These results suggest that ES suppressed intracellular lipid accumulation during adipose differentiation in 3T3-L1 adipocytes. The mechanisms underlying this effect of ES might be inhibition of adipocyte differentiation by down-regulation of PPAR γ , and suppression of fatty acid synthesis by decreased expression of PEPCK as well as augmented phosphorylation of AMPK and ACC. Funding This study was supported by grants from the Bizen Chemical Co., LTD.

2578 Board #242 May 31 11:00 AM - 12:30 PM

Effect of Aerobic and Resistance Exercise on Fatty Liver in Mice Model

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(No relevant relationships reported)

The role of exercise in treatment of fatty liver has been recognized clinically, but the underlying molecular mechanism still unclear. PPAR α is a hormone activated nuclear receptor and transcription factor, which is important for lipid metabolism, adipogenesis and insulin regulation.

PURPOSE: This research was aimed to explore the effect of aerobic exercise combined with resistance training on fatty liver induced by high fat diet in mice, and the potential mechanism related with PPAR α pathway.

Methods: Thirty male 8 weeks old C57BL/6 mice were randomly divided into sedentary control group (CON), high-fat diet intervention group (HF) and high fat diet with exercise intervention group (HFE). After 16 weeks of high fat diet, HFE mice were subjected to 1 hour treadmill running at 15 m/min and 0° incline or 1-m vertical ladder with an 85° incline climbing for 16 times. Aerobic treadmill running and resistance climbing were arranged alternately for six days per week for 8 weeks. Blood samples were collected to measure the liver function. The liver tissues were stained with oil red O. PGC-1 α and PPAR α expression in liver tissue was detected by Western-blot.

RESULTS: The study found that high fat diet significantly increased body weight, liver index (32.93 ± 0.59 g vs 46.88 ± 1.03 g, 0.046 ± 0.001 vs 0.051 ± 0.003 , $p < 0.05$), serum transaminase AST and ALT (126.33 ± 22.49 U/L vs 249.63 ± 17.59 U/L, 59.5 ± 10.50 U/L vs 297 ± 25.88 U/L, $p < 0.05$) in HF mice as compared with CON mice. While these changes were alleviated by combined exercise for eight weeks with decreasing body weight, liver index (46.88 ± 1.03 g vs 40.1 ± 1.27 g, 0.051 ± 0.003 vs

0.040 ± 0.002 , $p < 0.05$) and serum transaminase AST and ALT (249.63 ± 17.59 U/L vs 244.25 ± 59.89 U/L, 297 ± 25.88 U/L vs 169.88 ± 38.67 U/L, $p < 0.05$) in HFE mice as compared with HF mice. Expression of PPAR α in HFE was increased as compared with HF mice ($p < 0.05$), while the expression of PGC-1 α was found decrease ($p < 0.05$) at the mean time.

CONCLUSION: These results indicated that combined exercise for eight weeks might ameliorate high fat diet induced hepatic lipid metabolism disorder by regulating the expression of PGC-1 α and PPAR α .

2579 Board #243 May 31 11:00 AM - 12:30 PM

Aerobic Interval Training Improve Effect of Liraglutide on Hepatic Lipid Steatosis in Diabetic Rats with NASH

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(No relevant relationships reported)

PURPOSE: The nonalcoholic steatohepatitis (NASH) that is usually accompanied by type 2 diabetes, which characterized by hepatic steatosis, is roaring in the worldwide. It is clear that aerobic interval training (AIT) is an effective means to reduce visceral fat and protect liver. The liraglutide has also antidiabetic effect. Here, we are trying to explore whether AIT combined with liraglutide have a better effects on reducing hepatic lipid steatosis in diabetic rats.

METHODS: 60 Wistar male rats were divided into control group (CON), diabetes group (DM), DM+AIT group (DE), DM+Liraglutide group (DL) and DM+AIT+Liraglutide group (DLE). The diabetes model was induced by high fat diet and STZ. Liraglutide (subcutaneous injection, 0.2mg/kg/day) and AIT (treadmill, 7 min 85%-95% $\dot{V}O_{2\max}$ interspersed with 3 min intervals at 50-60% $\dot{V}O_{2\max}$, 4 times/d, 5d/week) were maintained for 8 weeks. The fasting blood glucose (FBG), triglyceride (TG), was measured by enzymatic method; the serum insulin, ALT, AST, FFA and DAG in liver were analyzed by ELISA. The CD36, CPT-1A, and PPAR α expression in liver were analyzed by western blotting.

RESULTS: Compared with CON, the FFA and DAG in DM increased by 89% and 67.6% ($P < 0.01$), and with increased serum ALT and AST (174% and 78.9%, $P < 0.01$). The ALT, AST, FFA and DAG decreased by 39.33%, 19.05%, 43.02%, and 33.08%, respectively, in DLE compare to DM. There is a significant interaction between liraglutide and AIT on decreased parameters. In addition, the CD36 expression were 64%, 77% and 75% lower in DE, DL and DLE than DM ($P < 0.01$), and the CPT-1A expression was higher 120%, 141% and 86% in DE, DL and DLE than DM ($P < 0.01$), the PPAR α expression were increased by 228%, 116% and 124% in DE, DL and DLE, compare to DM ($P < 0.01$).

CONCLUSIONS: Aerobic interval training combined with liraglutide have a better effect on lipid steatosis in diabetic rats with NASH than separate AIT or liraglutide intervention.

Comparison of liver function and lipid steatosis					
	CON	DM	DE	DL	DLE
ALT(U/L)	8.87 \pm 1.58	24.28 \pm 0.89#	16.22 \pm 3.00*	15.32 \pm 1.01*	14.73 \pm 2.25*
AST(U/L)	24.05 \pm 1.10	42.93 \pm 1.88#	37.72 \pm 0.55	36.08 \pm 4.10*	34.75 \pm 3.23*
FFA (umol/L)	211.44 \pm 2.33	419.53 \pm 0.65#	257.60 \pm 3.68**	269.20 \pm 4.84**	239.04 \pm 3.18**
DAG (ng/mL)	3.12 \pm 0.18	5.23 \pm 0.45#	3.70 \pm 0.16**	3.68 \pm 0.05**	3.50 \pm 0.24**

#: $P < 0.01$ compared with CON. *: $P < 0.05$, **: $P < 0.01$ compared with DM

2580 Board #244 May 31 11:00 AM - 12:30 PM

The Effect Of Exercise On Hypothalamic Kiss-1 Of Rats With Post-weaning High Fat Diet

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Kisspeptins, encoded by the Kiss1 gene, is unanimously recognised as essential regulators of regulating gonadotropin secretion. It is mainly expressed in the arcuate nucleus in the hypothalamus, and have a direct role in regulating energy balance.

PURPOSE: To explore high fat diet (HFD) and moderate-intensity treadmill training (MIT) in modulating the hypothalamic expression of kiss-1 mRNA relative expression and kisspeptin-immunoreactivity in 3 weeks post-weaning rats. **METHODS:** The 3 weeks SD rats (weight= 58.54 ± 2.69 g) after 5 weeks high fat feeding, 30 HFD 8-weeks SD rats were randomly assigned to sedentary (HS, n=15), MIT (n=15), and 15 normal diet 8-weeks SD rats were assigned as sedentary (SS, n=15) group. During the following 5 weeks, HS group rats were continued expose to HFD. MIT group did the 60%-70% $\dot{V}O_{2\max}$ treadmill training (5 days/week, 1 hour/day). RT-qPCR and

immunohistochemistry were used to test the expression of hypothalamic Kiss1mRNA and the number of kisspeptin neurons in each group. **RESULTS:** After 5-weeks high fat feeding, the HFD rats were heavier than normal diet group (308.96 ± 28.38 g vs. 324.52 ± 37.52 g, $p=0.139$), and had more expression of kiss-1 mRNA (1.55 ± 0.59 vs. 2.47 ± 0.81 , $p<0.05$) in the hypothalamic. The number of kisspeptin neurons in the ARC HFD group were also significantly higher than SS group (8.23 ± 3.17 vs. 15.46 ± 4.15 , $p<0.05$). After 5-weeks training, MIT group weighted less than HS group (300.83 ± 21.06 g vs. 324.52 ± 37.52 g, $p<0.05$). In the same conditions of HFD intervention, compared with HS group, MIT group had lower hypothalamic expression of kiss-1 mRNA (2.47 ± 0.81 vs. 1.6 ± 0.22 , $p<0.05$), and the number of kisspeptin neurons in ARC were also significantly lower than HS group (15.46 ± 4.15 vs. 12.08 ± 2.56 , $p<0.05$). **CONCLUSIONS:** High fat diet could increase the expression of kiss-1 mRNA and the number of kisspeptin neurons in ARC while increasing bodyweight; moderate-intensity treadmill training could reduce the stimulating effect of high fat diet induced weight gain and changes hypothalamic expression of kiss-1 and kisspeptin.

2581 Board #245 May 31 11:00 AM - 12:30 PM
Effects Of Dietary And Hiit On Lipid Metabolism Of The Liver Tissue In Obese Rats

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PURPOSE: This study aimed to investigate the effects of diet and High Intensity Interval Training (HIIT) on body mass gain, serum inflammatory markers and hepatic lipid metabolism of obese rats. **METHOD:** Male Sprague-Dawley rats were fed with a normal standard diet (N) or a high fat diet (H; 45% kcal as fat) for eight weeks without exercise stimuli. Obese rats were defined as increased at least 20% body weight than normal diet rats. Normal diet rats were then continue fed with a normal diet (N), and half of obese rats were fed with a normal diet (ON), while the other half were continue fed with a high-fat diet (OH). Each diet type group was then divided into two subgroups, control (NC, ONC, OHC groups) and High Intensity Interval training (NHI, ONHI, OHHI groups) ($n=10-12$). The HIIT training consisted of a swimming exercise performed over eight weeks. **RESULTS:** Obese high fat diet rats showed greater body weight, visceral adipose mass, serum lipid levels (LDL, TG, TC), and inflammatory markers (MCP-1, IL-1 β , TNF- α) in values than normal diet rats, but were significantly reduced with HIIT, but this phenomenon was not observed in obese normal diet rats, except MCP-1. In addition, compared to normal rats, OHC group rats exhibited high levels of hepatic wet weight and liver triglycerides, but not in ONC group. HIIT significantly decreased liver TG content compared with control groups, which consistent with liver oil red O stain images. Moreover, compare to the control groups, mitochondrial CS activity and the biogenesis marker PGC-1 α expression were upregulated with HIIT in obese high fat diet rats, meanwhile, the activity of mitochondrial fatty acid oxidation enzymes, include CPT-1 α , β -HAD were significantly increased in HIIT groups. However, the activity of LPL and FAT/CD36 enzymes, which are key regulators of tissue fatty acid uptake from plasma were not changed with HIIT. **CONCLUSION:** HIIT was shown to be effective in controlling body weight, adiposity levels and serum lipid contents in high-fat diet fed obese rats, HIIT displayed positive effects on mitochondrial lipid oxidation enzyme activities and significantly attenuated lipid accumulation of liver tissue in obese rats. Additionally, diet and exercise was more effective than exercise alone in reducing body weight, VAT mass, serum inflammatory and liver TG content.

2582 Board #246 May 31 11:00 AM - 12:30 PM
Bodipy Is Superior To Oil-red-O For Detecting And Quantifying Intramuscular Triglyceride In Human Skeletal Muscle

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PURPOSE: To compare the use of bodipy and oil-red-O (ORO) for quantification of intramuscular triglyceride (IMTG) content and use during exercise as well as investigation of lipid droplet (LD) morphology in human skeletal muscle. **METHODS:** Biopsies were obtained from the *m. vastus lateralis* of six fasted healthy, lean sedentary males (age: 20 ± 1 y, BMI: 24.8 ± 1.2 kg.m², VO_{2peak} : 39.8 ± 2.4 ml.min⁻¹.kg⁻¹) prior to and immediately following 60min cycle ergometer exercise at $\sim 60\%VO_{2peak}$. Cryosections were labelled using antibodies targeting MHCI and MHCIa. Anti-laminin was used to identify the cell membrane. LDs were labelled with either bodipy or ORO. Images were captured using confocal immunofluorescence microscopy and analysed using Image Pro Plus.

RESULTS: IMTG content (% area stained) was greater when using bodipy compared to ORO ($P=0.006$), and bodipy detected more LDs ($P=0.03$) with a greater mean LD size ($P=0.03$) than ORO. Regional distribution was also different for the two dyes with IMTG content with bodipy being greater in the central vs. peripheral region (5 μ m from plasma membrane) in both type I (central: $3.1 \pm 0.5\%$ vs. peripheral: $2.8 \pm 0.5\%$) and type IIa fibres (central: $1.4 \pm 0.3\%$ vs. peripheral: $1.3 \pm 0.2\%$; $P=0.036$). The opposite was true when using ORO, with a greater IMTG content observed in the peripheral vs. the central region in all fibre types ($P=0.013$). These regional differences in IMTG content for bodipy and ORO were attributed to differences in LD number ($P=0.039$). Following exercise, using bodipy, IMTG content was decreased in both the peripheral ($-58 \pm 21\%$, $P=0.014$) and central regions ($-63 \pm 21\%$, $P=0.016$) of type I fibres. However, using ORO only a significant decrease in IMTG content in the peripheral region of type I fibres was observed ($-85 \pm 19\%$, $P=0.021$).

CONCLUSION: Bodipy is preferable to investigate IMTG in skeletal muscle due to its superior LD detection capabilities and specificity for detecting IMTG avoiding labelling of membrane structures, compared to ORO. We demonstrate the importance of this in the context of regional distribution of IMTG detected using ORO and bodipy and differences in region-specific IMTG utilisation during exercise. Therefore, it is possible that the choice of lipid dye could impact the conclusions drawn in studies in which subcellular IMTG distribution is considered.

2583 Board #247 May 31 11:00 AM - 12:30 PM
Pre-Exercise Ingestion of Isomaltulose Increases Energy Expenditure with Enhancing Fat Oxidation in Healthy Young Adults

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Isomaltulose, which is a disaccharide composed of glucose and fructose, is known for suppressing rapid elevation of blood glucose level and excess secretion of insulin. However, it is unclear how pre-exercise isomaltulose ingestion alters energy metabolism during subsequent exercise in young adults. **PURPOSE:** In this study, we investigated the effects of pre-exercise isomaltulose ingestion on carbohydrate, fat and energy metabolism during subsequent exercise of young adult. **METHODS:** Twelve young healthy participants (6 females and 6 males, 23.1 ± 1.3 yrs) performed three experimental trials in a randomized counterbalanced design, which consisted of 60 min of pre-exercise resting with ingesting a isomaltulose drink (ISO), a sucrose drink (SUC), or plain water (WAT), 30-min of treadmill running at an individually predetermined speed ($50-60\%VO_{2max}$), and 60-min of post-exercise resting. During the trials, we continuously recorded heart rate (HR), blood pressure (BP), VO_2 , and VCO_2 . We also calculated energy expenditure (EE), respiratory quotient (RQ), carbohydrate oxidation (CHO) and fat oxidation (FO) during exercise. **RESULTS:** There were no significant effect of trial in HR and BP during exercise. Nevertheless, EE during exercise had a significant effect of trial (ISO: 377.3 ± 26.2 kcal, SUC: 345.6 ± 22.3 kcal, WAT: 318.7 ± 23.5 kcal). Also, RQ during exercise had a significant effect of trial (ISO: 0.85 ± 0.05 , SUC: 0.89 ± 0.06 , WAT: 0.85 ± 0.06). These results indicates that EE increases in the SUC trials might be attributed mainly to facilitation of carbohydrate oxidation and that EE increases in the ISO trials might be mainly due to facilitation of both carbohydrate and fat oxidation. **CONCLUSION:** These results suggest that pre-exercise isomaltulose ingestion facilitated fat oxidation and energy metabolism during subsequent exercise on healthy young adults.

2584 Board #248 May 31 11:00 AM - 12:30 PM
The Effects Of 8-weeks Moderate Intensity Exercise In Skeletal Muscle Autophagy Of Obese Sd Rats

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Purpose: The study aims to investigate the effect of 8 weeks of moderate intensity exercise on the level of autophagy in skeletal muscle of obese rats. Based on this, to further explore the effective exercise load for promoting the skeletal muscle autophagy, and the possible mechanism of enhanced autophagy in skeletal muscle of exercise-trained rats.

Methods: 40 11-week-old male SD rats were selected after 8 weeks adaptive feeding and divided into normal control group and high-fat group. These groups then further subdivided into exercise group (control trained group (CT), obese trained group (OT)) and sedentary groups (control sedentary group (CS), obesity sedentary group (OS)). CT

and OT did the 60%-70%•VO₂max treadmill training(5days/week,60min/day). After the 48h at the end of the last training, the LC3b,Beclin1 mRNA expression were tested in each group.

Results:After 8 weeks high fat diet intervention, the body weight of OS group was significantly higher than CS group(546.98±72.07gvs. 667.96±46.97g, p<0.01). After 8 weeks training, OS group were heavier than OT group(667.96g±46.97 vs. 586.05±32.77g,p<0.01),and OT group has more expression of LC3b mRNA(0.93±0.06 vs. 0.75±0.11, p=0.156)and Beclin1 mRNA(1.86±0.22 vs. 1.34±0.11, p=0.841).

Conclusions:8 weeks high fat diet can significantly reduce the skeletal muscle autophagy activity in obese quiet rats, whereas 8 weeks of moderate-intensity exercise intervention can improve the obese rats the skeletal muscle autophagy activity.

2585 Board #249 May 31 11:00 AM - 12:30 PM
High Intensity Interval Training Activates Specific Site HSL Phosphorylation and Reduces Visceral Fat

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Objectives:To investigate the possible underlying mechanisms of why high-intensity interval training can significantly reduce the weight of visceral fat: differences in HSL(Hormone Sensitive Lipase) phosphorylation at different Sites (subcutaneous and visceral). **Methods:** Female c57bl/6 mice were fed a high-fat diet to produce a diet-induced obesity animal model. After successful modeling, 36 obese mice were randomly divided into high-fat diet control group (HFD group), moderate-intensity continuous training group (MICT group) and high-intensity interval training group (HIIT group).The HFD group was fed a high-fat diet for 12 weeks without exercise. The MICT group continued to exercise on a treadmill of approximately 60% VO₂max with high-fat diet,while the HIIT group were given a high-intensity interval training of approximately 100% VO₂max peak intensity with high-fat diet. At the end of the 12 weeks training, mouse body weight, Lee's index, inguinal (subcutaneous) and peri-uterine (visceral) fat weights were measured. Hepatocyte fat infiltration was observed by HE staining. Serum lipids (TC, TG, HDL-C, and LDL-C) were measured by colorimetry. HSL protein expression and phosphorylation of Ser563, ser565, ser660 were measured by Westernblot. **Results:**Compared with the HFD group as the baseline, there was a significant body weight decrease in the MICT group and HIIT group (p<0.01). HIIT and MICT showed no significant difference in subcutaneous fat reduction, but compared with MICT, HIIT could significantly reduce the peri-uterine (visceral) fat (p<0.01); Liver lipid droplet infiltration of HIIT group was lower than HFD and MICT, and LDL-C of HIIT significantly decreased (P<0.05); Phosphorylation of ser563 in peri-uterine fat of HIIT was significantly higher than HFD and MICT (p<0.05). Ser660 of inguinal fat was significantly higher in MICT than in HFD HIIT groups (p<0.05). **Conclusion:** HIIT can reduce visceral fat, relieve hepatic fat lesions, and reduce LDL more than moderate-intensity continuous training. This is related to the fact that HIIT can specifically increase the phosphorylation of HSL-ser563 in visceral adipose tissue and promote fat hydrolysis.

2586 Board #250 May 31 11:00 AM - 12:30 PM
Concurrent Training Induces Remodeling Of Subcutaneous Fat In People Living With Hiv

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(No relevant relationships reported)

TEXT: The lipodystrophy syndrome affects several people living with HIV under antiretroviral therapy (ART) being characterized by visceral adipose tissue accumulation and atrophy of subcutaneous adipose tissue (SAT) associated to metabolic disturbances and extracellular matrix (ECM) protein deposition and tissue fibrosis. On the other hand, concurrent training (CT) has been adopted as an efficient therapy to reduce severities caused by ART. **PURPOSE:** Hence, we aim to determine the effects of twelve weeks of CT in remodeling of adipose tissue, ECM proteins and gene expression of SAT in people with HIV. **METHODS:** Healthy non-active (HIV-, n=6) and people living with HIV (HIV+, n=6) (Brazilian Clinical Trials Registration, n. U1111-1214-3022) were submitted to a CT program (3x a week for 12 weeks), composed of aerobic (13 BORG scale, 20 min.) and resistance training (8 ex., 10-12RM). Total load lifted, aerobic performance (Vpeak) and SAT biopsies to determine adipocyte area (*Hematoxylin and eosin*), Collagen I, collagen III and Collagen total areas (*Picro-Sirius*), elastic fibers deposition area (*Weigert/VanGieson*) (µm²) and Real Time-PCR to quantify mRNA expression of the following genes: collagen I, collagen III, VEGF and Fibronectin were performed. Data were analyzed by two-way RMANOVAs. **RESULTS:** CT improved aerobic and strength performance, reduced adipocyte area (Δmean= -1144 [IC95%: -1934; -353.8]) and elastic fiber deposition

in HIV+ group (Δmean= -204.9 [IC95%: -132.5; -227.3] in HIV- and HIV+ groups (P<0.05). CT did not change Collagen I (Δmean=-2941.7 [IC95%: 3814.3; -9697.8]; F=0.229;) and III (Δmean=-2241.7 [IC95%: 2476.0; -6959.5], F=2.97) deposition and gene expression (Δmean=-0.495 [IC95%: -2.401;1.410]; F=0.53; ES= 0.02 and Δmean=-0.558 [IC95%: -1.97; 0.86]; F=1.55. ES=0.07, respectively), as well as, VEGF (Δmean= 0.07 [IC95%: -0.79; 0.95]; F=0.03; ES=0.002) and Fibronectin (Δmean=-1.62 [IC95%: -7.94; 4.70]; F=0.04; ES=0.002) (P>0.05). **CONCLUSION:** CT was able to improve adipocyte area heterogeneity and promoted a reduction of elastic fibers deposition in SAT of people living with HIV.This study was sponsored by UEM.

2587 Board #251 May 31 11:00 AM - 12:30 PM
Differences In Energy Expenditure During Constant Speed And Interval Walking In Healthy Sedentary Adults

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(No relevant relationships reported)

Walking represents a popular, convenient and relatively safe form of activity that can easily be incorporated into weight management programs. The energy expenditure associated with walking has been reported to be either linearly or slightly exponentially related to speed. Thus, interval walking training has been developed as a novel free-living training modality that improves physical fitness and cardiovascular risk factors in humans. **PURPOSE:** To determine the effect of interval walking exercise (INT) and constant speed walking exercise (CON) on whole body energy expenditure and fat utilization in healthy sedentary adults. We hypothesized that interval walking exercise increases whole body fat utilization and energy expenditure to a greater extent, compared with the constant speed walking exercise. **METHODS:** This study was set as randomized crossover design. Nine healthy sedentary individuals (BMI ≤ 25 kg/m² and 18-50 yrs) were recruited. Initially nine subjects were randomly assigned into CON or INT group. Then, CON became INT and INT became CON. The constant speed walking consists of a single bout of 60 min walking exercise at 45% of VO₂max on a treadmill. The interval walking consists of a single bout of 60 min walking exercise with cycles of alternating 3-min slow (30% of VO₂max), 3-min moderate (45% of VO₂max), and 3-min fast (60% of VO₂max) walking. Energy expenditure and fat usage were determined via indirect calorimetry during rest and walking exercise. Two-way ANOVA was used to determine differences in energy expenditure and fat utilization between the groups. **RESULTS:** The rate of fat utilization (g/min) was higher in INT group, compared with CON (0.276±0.01 g/min vs. 0.238±0.01 g/min, respectively, P=0.046) during 60 min walking. The rate of total calorie expenditure (kcal/min) from body fat was also higher in INT group, compared with CON (2.996±0.13 kcal/min vs. 2.564±0.13 kcal/min, respectively, P=0.028) during 60 min walking. **CONCLUSION:** Our data show that an interval type of walking pattern compared to walking at a constant speed, could be better to expend more energy from body fat. Thus, these findings may provide a better exercise strategy to maintain a healthy body weight in healthy sedentary individuals and to reduce body weight/fat potentially in obese people.

2588 Board #252 May 31 11:00 AM - 12:30 PM
One-hour Of Moderate Intensity Exercise Does Not Attenuate DNA Single Strand Breaks And Base Oxidation Following High-fat Meal Consumption.

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(No relevant relationships reported)

BACKGROUND: Exercise following a high-fat meal can ameliorate lipid peroxidation but the effects on DNA single strand breaks and base oxidation currently remain unknown. **PURPOSE:** To determine the effects of moderate intensity postprandial exercise on biomarkers of DNA damage and oxidation and inflammation. **METHODS:** Twelve apparently healthy, recreationally active, male participants (21.8 ± 3.7 years; 178.6 ± 6.2 cm; 83.6 ± 14.9 kg; 51.2 ± 8.6 ml·kg⁻¹·min⁻¹) completed a randomized, crossover study consisting of two trials: (1) a high-fat meal alone (resting control) or (2) a high-fat meal 2 h before 60 mins of moderate intensity exercise (65% maximal heart rate). Venous blood was collected at baseline, prior to exercise (2 h after meal ingestion), immediately post-exercise, and at 2 and 4 h post-exercise. Biomarkers of oxidative damage (DNA single-strand breaks - comet assay); DNA base oxidation (formamidopyrimidine DNA glycosylase [FPG] - comet assay); lipid peroxidation; ascorbyl free radical metabolism and inflammation (retinol-binding protein-4 and erythrocyte sedimentation rate) were determined using conventional biochemistry techniques.

RESULTS: DNA percentage tail intensity increased following the test meal, remaining elevated at 4 h post-exercise ($p<0.05$; main effect for time). Similarly, FPG increased postprandially and remained elevated at 4 h ($p<0.05$; main effect for time). Likewise, a persistent increase in lipid hydroperoxides and in ascorbyl radical metabolism was observed ($p<0.05$; main effect for time). Erythrocyte sedimentation rate increased postprandially and remained elevated at 2 h ($p<0.05$; main effect for time) while no changes were detected in retinol-binding protein-4.

CONCLUSIONS: Ingesting a high-fat meal induced a state of postprandial oxidative stress, including DNA damage and base oxidation, that remained unaltered by one hour of postprandial exercise.

E-42 Free Communication/Poster - Behavioral Aspects of Exercise

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2589 Board #253 May 31 9:30 AM - 11:00 AM Correlates Of Workout Adherence: Golf Skill, Exercise Enjoyment, Life Satisfaction, And Mood Of Senior Golfers

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Many senior golfers (≥ 50 yrs of age) desire to improve their golf scores, however, they may, or may not participate in workout programs to achieve their golf goals.

PURPOSE: To investigate whether individualized, "take-home," golf-specific fitness and skill exercises would motivate golfers to work out, and to explore the relationships between workout adherence, golf fitness and skill, life satisfaction, exercise enjoyment, and mood before and after a pre-season, golf-specific training program. **METHODS:** Before and after eight weeks of golf-specific training programs, senior golfers (Age = 63.3 ± 6.8 yrs; $N=10$; 1 male, 9 females) completed assessments. These included the Titleist Performance Institute[®] TPI-fit (17 tests; one score) and Big12 (golf swing analyses and errors score), golf histories, Life Satisfaction Scale (LS), Physical Activity Enjoyment Scale (PACES), Profile of Mood States (POMS), and 6-min walk tests (6MWT). Pearson correlations and repeated measures ANOVAs were calculated (pilot study: $\alpha = 0.10$). **RESULTS:** Before and after training, TPI-fit scores were 18.1 ± 4.3 , 14.4 ± 6.9 ($M \pm SD$), and the Big12 scores were 12.7 ± 9.4 , 8.0 ± 3.7 . These scores changed in desirable directions (lower is better). The number of workouts completed by the golfers was 14 ± 9 ($M \pm SD$), or 43% of 32 workouts. After eight weeks, the number of workouts completed was positively correlated with PACES Trait ($r = .55$, $p = .05$) and Age of Beginning Golf ($r = .85$, $p = .001$), and negatively correlated with LS ($r = -.51$, $p = .07$). Those who enjoyed exercise and started golf later in life adhered to the workouts. In contrast, those who had high life satisfaction and started golf at younger ages did not adhere to the prescribed golf workouts. When measured after the eight-week training program, golfers who reported more exercise enjoyment had more desirable mood changes after the 6MWT ($r = .72$, $p = .01$), began golf at a later age ($r = .50$, $p = .07$), but had higher 9-hole scores ($r = .47$, $p = .09$). **CONCLUSION:** Senior golfers who wanted to improve their golf scores adhered to less than half of the prescribed golf-specific workouts when working out alone. Therefore, future studies of senior golfers should investigate group training for golf workouts, and examine the possible contributions of peer support and social interactions to enhance workout adherence.

2590 Board #254 May 31 9:30 AM - 11:00 AM Physical Activity Is Associated With Grit And Resilience In College Students: Is Intensity The Answer?

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(No relevant relationships reported)

Physical activity (PA) has been positively associated with academic performance; however, as students transition from high school to tertiary education their PA levels often decrease. The transition to tertiary education is a substantial life event, requiring a combination of academic and social determinants to succeed. Little research has investigated the associations between PA and determinants of academic success, such as grit and resilience. **PURPOSE:** To determine the associations among PA, grit and resilience in undergraduate students.

METHODS: Undergraduate students ($n=244$; 165 females, age 21.1 ± 2.9 years) participated in an online survey. Self-reported PA was collected using the International Physical Activity Questionnaire. Grit was measured using the Short Grit Scale and resilience was determined with the Connor-Davidson Resilience Scale. Linear regression analyses were used to determine associations among grit, resilience, and PA. One-way ANOVAs were used to determine differences in grit and resilience across tertiles of PA.

RESULTS: Vigorous PA was positively associated with resilience ($\beta=0.17$, $p=0.01$) and the perseverance of effort grit domain ($\beta=0.19$, $p=0.004$), while being negatively associated with the consistency of interest grit domain ($\beta=-0.22$, $p=0.001$). Moderate PA was associated with both grit domains ($p \leq 0.03$) but not resilience ($p=0.38$). Further, resilience (tertile 1: 34.1 ± 5.5 vs. tertile 2: 36.8 ± 4.9 , $p=0.005$) and the perseverance of effort grit domain (tertile 1: 4.1 ± 0.7 vs. tertile 3: 4.4 ± 0.5 , $p=0.01$) were significantly higher with increased vigorous PA. Consistency of interest grit domain scores (tertile 1: 2.9 ± 0.9 vs. tertile 3: 2.6 ± 0.8 , $p=0.04$) were lower with higher levels of vigorous PA. There were no differences in grit and resilience across tertiles of moderate PA ($p>0.05$).

CONCLUSIONS: Vigorous PA was positively associated with the perseverance of effort grit domain and resilience but negatively associated with the consistency of interest grit domain. Moderate PA was also associated with grit but not resilience in this cohort. The findings suggest that intensity of PA may play a role in grit and resilience levels in students. Future research may be beneficial to determine if participation in vigorous PA can increase grit or resilience in college students.

2591 Board #255 May 31 9:30 AM - 11:00 AM Examining Intra-Individual Variability of Perceived Physical Discomfort In Young Adults: A Potential Exercise Antecedent

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Ecological Momentary Assessment (EMA) allows the observation of intra-individual variance in cognitive, perceptual, psychological, and contextual variables that may impact recurrent health behaviors such as exercise. Perceptions of physiological states (e.g. pain, illness) likely influence behaviors, but most assessments are cross-sectional. **PURPOSE:** To determine preliminary estimates of intra-individual variability in perceived physiological states. **METHODS:** A secondary analysis was conducted using data from young, healthy adults ($N=29$) undergoing EMA of exercise antecedents. Participants were sent four surveys per day across 14 days (56 total surveys). The extracted variables pain, stiff, and achy were scored on a seven-point Likert scale; 0= not at all, 3= moderately, 6= extremely. Individual item scores were summed to create a "physical discomfort" score (Cronbach's $\alpha=0.847$). Data were retained from compliers who completed $\geq 75\%$ of EMA surveys. Compliers ($n=20$, 23 ± 4 years, BMI= 25.6 ± 3.1 kg/m², 60% female) completed $89 \pm 5\%$ of surveys. Missing data were imputed with the participant's daily means for that respective variable. Two-way mixed intra-class correlation coefficients (ICC) were calculated with 95% confidence intervals (CI) for pain, stiffness, achiness, and physical discomfort across all 56 time blocks and across 14 daily means. ICC ≤ 0.5 , between 0.5-0.75, between 0.75-0.9, and ≥ 0.9 indicate poor, moderate, good, or excellent consistency. **RESULTS:** Indices of physical discomfort were generally low ($M \pm SD$): pain= 0.9 ± 1.2 ; achy= 1.3 ± 1.4 ; stiff= 1.5 ± 1.5 . Poor consistency was observed across time points for pain (ICC=0.32; CI=0.21-0.51), achy (0.44; 0.31-0.63); stiff (0.48; 0.34-0.67), and physical discomfort (0.49; 0.35-0.67). Poor-to-moderate consistency was observed across daily means for pain (0.46; 0.31-0.66), achy (0.57; 0.41-0.75), stiff (0.60; 0.45-0.77), and physical discomfort (0.59; 0.43-0.76). **CONCLUSION:** Due to the inconsistent nature of perceived pain, achiness, stiffness, and physical discomfort, more frequent assessment of physical discomfort may be necessary within EMA to capture important fluctuations. Understanding the timing, magnitude, and direction of fluctuations could expose points of vulnerability relating to exercise behavior.

2592 Board #256 May 31 9:30 AM - 11:00 AM Association Of Asian/Asian-American Immigrants' Physical Activity Behavior And Time Spent Living In The U.S.

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The Asian/Asian-American population comprises one of the largest ethnic/racial cohorts in the U.S. They also are reported to be among the most inactive.

PURPOSE: To examine the potential relationship between Asian/Asian-American immigrants' leisure-time physical activity behavior and their length of time spent living in the U.S. (i.e., temporality).

METHODS: Data were obtained from the 2013-2014 National Health and Nutrition Examination Survey. Among 1,074 Non-Hispanic Asian/Asian-American participants, 541 (Female = 287, Male = 254) were age ≥ 20 yr. ($M = 48.5$, $SD = 15.2$), not born in the U.S., and they reported their physical activity data. Those responding "yes" to either of the following two questions were classified into the moderate-to-vigorous physical activity (MVPA) group: (1) "In a typical week, do you do any vigorous-intensity sports, fitness, or recreational activities that cause large increases in breathing or heart rate like running or basketball for at least 10 minutes continuously?" and (2) "In a typical week do you do any vigorous-intensity sports, fitness, or recreational activities that cause large increases in breathing or heart rate like running or basketball for at least 10 minutes continuously?" Temporality groupings were as follows: <1, 1<5 years, 5-9, 10-20, and ≥ 20 years.

RESULTS: All total, 306 study participants (56.56%) reported engaging in MVPA. Binary logistic regression was used to estimate the odds ratios and 95% confidence intervals of reporting participation in MVPA. After adjusting for age, gender, income, and education level, those living in the U.S. increased their odds of participating in MVPA. Specifically, compared to those who had been in the U.S. for <1 year, those who had been in the U.S. for 1<5 years, 5-9 years, 10-20 years, and ≥ 20 increased their odds of MVPA participation by 145%, 139%, 189% ($p = 0.06$) and 293% ($p = 0.02$), respectively.

CONCLUSIONS: Notwithstanding the evidence of a generally inactive nation, the findings of the current study suggest that there are some positive features in American culture that facilitate and support MVPA among Asian/Asian-American adults who have immigrated and resided in the U.S. for one or especially two or more decades. Gaining deeper insight into precisely what those features are should be the focus of future research.

2593 Board #257 May 31 9:30 AM - 11:00 AM
Mental Toughness As A Moderator Of The Physical Exercise - Esports Performance Relationship: A Pilot Study.

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eSports popularity has been growing faster than any sport in history (global audience, money prizes, NCAA scholarships, part of 2022 Asian Games). Preliminary data show a positive relationship between physical exercise (PEX) and eSports performance (eSP). To date, there has been no effort to explore the effect of the player's level of mental toughness (MT) on eSports key performance indicators (KPI), such as placement in a contest.

PURPOSE: (a) To explore the perceptions of players concerning the relationship between PEX and eSP; (b) To confirm the positive aforementioned relationship; (c) to investigate the moderation effect of MT in that relationship; and (d) provide evidence for larger-scale efforts.

METHODS: Data were collected on 23 male recreational eSport competitors (>6hours per week) ($M_{age} = 20.7$, $SD = 2.1$). The eight-item Mental Toughness Index (MTI) was used to measure MT, one question with five scales (0=significantly negatively, 5=significantly positively) was used to collect information on their perceptions, number of days of exercise per week was used as an indicator of PEX, and average place on *Fortnite: Solo* matches over 3 hours was used as KPI. We investigated the moderating role of MT using regression analysis in R. Predictors were mean-centered. The interaction was probed looking at simple slopes.

RESULTS: The majority of players tended to perceive PEX as having no significant or negative effect on eSP (65%). The estimated regression model without an interaction is $KPI = 27.6 + 3.13(PEX) + 1.07(MT)$, where $R^2 = .296$. The estimated regression model with an interaction is $KPI = 26.7 + 3.36(PEX) + 0.85(MT) + 0.4(PEX \times MT)$, where $R^2 = .310$. Simple slopes of PEX conditional on MT scores +1SD, Mean, and -1SD are: 4.72, 3.29, and 1.86, respectively.

CONCLUSIONS: Contrary to the players' belief, PEX was found to be positively correlated with eSP. Furthermore, we identified a potentially enhancing moderating effect of MT on the relationship between frequency of exercise and eSP. Therefore, not only PEX but also psychological skill training (PST), such as MT training, may be beneficial for the players on their effort to place higher and win larger prizes. This pilot study offers preliminary evidence for the need for larger-scale similar projects. Future studies should recruit professional eSports players, as well.

2594 Board #258 May 31 9:30 AM - 11:00 AM
The Effects Of Aerobic, Resistance, And Combination Training On Satisfaction With Physical Function And Appearance

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(No relevant relationships reported)

Purpose To determine the effects of aerobic training (AT), resistance training (RT), and combination training (AT/RT) on personal satisfaction with physical function (SPF) and appearance (SPA). We also examined the sex-specific relationships between objective measures of body habitus and cardiorespiratory fitness with changes in these satisfaction scores.

Methods Participants ($n=130$ from the STRRIDE AT/RT randomized trial) completed one of four 8-month exercise programs: 1) AT: 14 kcal exercise expenditure per kg per week (KKW) at 75% VO_{2peak} ; 2) RT: 3 days per week, 8 exercises, 3 sets per exercise, 8-12 repetitions per set; 3) AT/RT: full combination of the AT and RT programs; 4) AT-High Amount (AT-H): 21 KKW at 75% VO_{2peak} . The Satisfaction with Physical Function and Appearance Questionnaire [7-point integer scale ranging from -3 (very dissatisfied) to +3 (very satisfied)] was administered at baseline and post-intervention. We also assessed measures of body habitus (weight, lean and fat mass, and minimal waist and hip circumferences) and cardiorespiratory fitness (VO_{2peak}). Paired t-tests determined post- minus pre-intervention change score significance within training groups ($p<0.05$). Sex-specific correlations examined the relationship between changes in SPF and SPA with changes in body habitus and fitness.

Results After 8 months of training, all groups significantly improved their SPF scores, ranging from 1.8 (AT) to 2.8 points (AT-H), and their SPA scores, ranging from 0.8 (RT) to 2.4 points (AT-H). Change in SPF was significantly correlated with change in fat mass ($r = -0.34$) in women and change in VO_{2peak} ($r = 0.29$) in men. Change in SPA was significantly correlated with change in fat mass ($r = -0.39$), waist circumference ($r = -0.25$), and weight ($r = -0.30$) in women and change in hip circumference ($r = -0.28$), weight ($r = -0.32$), and lean mass ($r = -0.45$) in men.

Conclusions On average, all of the STRRIDE AT/RT training groups improved their self-reported satisfaction with physical function and appearance. We observed sex-specific differences in the relationships between changes in SPF and SPA with changes in body habitus and fitness. These correlative results can help inform future research targeting the mediating effects of exercise on self-perception of body image and function.

2595 Board #259 May 31 9:30 AM - 11:00 AM
Exercise-Induced Upregulation of M1 Excitability Following Motor Practice Does Not Predict Procedural Consolidation

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A brief bout of moderate intensity cardiovascular exercise immediately after procedural learning can protect a newly acquired motor memory from interference. The present experiment examined the possibility that exercise after practice increases motor cortex (MCE) which has been argued to be a biomarker for procedural skill consolidation. **PURPOSE:** Examine if (a) offline gain in procedural skill is associated with elevated MCE following practice and (b) the MCE following practice can be modified via exercise. **METHODS:** 35 right handed young adults were assigned to an Interference (INT), Interference + Exercise (INT+EX), or a no interference, no exercise (NO) condition. All individuals practiced a target motor sequence and some (INT, INT+EX) performed additional training with an alternative motor sequence 2-hr after practice with the target. The INT+EXE also included cardiovascular exercise the target sequence practice. Test performance of the target sequence occurred 6-hr after practice. MCE was assessed using transcranial magnetic stimulation prior to training and after training (every 3 min for a total of 11 post training assessments of MCE). **RESULTS:** One way ANOVA (Condition: INT, INT+EXE, NO) was used to analyze the mean response time for the target sequence offline learning effect and revealed a main effect of Condition $F(1,32)=17.01$, $p<0.01$. The extra practice in INT led to significant forgetting ($-3\pm 7ms$) compared to the NO condition (NO, $+21\pm 7ms$). Introducing exercise, despite the presence of interference, eliminated the forgetting observed for the INT condition (INT+EXE, $30\pm 7ms$). A 3 (Condition: INT, INT+EXE, NO) x 11(Time: 1-11) ANOVA with repeated measures on the last factor conducted on the % change in the normalized CE failed to reveal any significant main or interaction effects ($F's < 1.0$). **CONCLUSION:** The INT+EXE condition resulted in relatively greater increase in M1 excitability after practice compared to INT and NO conditions

but this increase was not significant. Moreover, relative increase in M1 excitability did not predict the extent of procedural learning at the time of test. These data question the claim that an upregulation of excitability at M1 is a biomarker for procedural skill consolidation.

2596 Board #260 May 31 9:30 AM - 11:00 AM
Effects Of Regular Sport Activities On Stress Level In Athletic And Non-athletic University Students

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Regular sport activity has favourable influence on the physical and mental state.
PURPOSE: To analyse the effects of regular sport activities on body structural parameters, cortisol level, perceived stress and psychosomatic symptoms in university students. **METHODS:** The subjects (N=200) were athletic (athletic males: n_{am}=56, athletic females: n_{af}=50; more than 7 hours sport activity per week) and non-athletic university students (non-athletic males: n_{nam}=44, non-athletic females: n_{naf}=50; less than 3 hours sport activity per week). Body composition was estimated by Inbody720 analyser. Free cortisol level in saliva was quantified by using IBL ELISA kits. Subjects were divided into subgroups having low, average and high basic cortisol levels by considering the normal range of cortisol level by the time of awakening. Perceived stress levels were measured by the Perceived Stress Scale with 14 items (PSS-14). Psychosomatic symptoms were assessed by questionnaire. Differences of the subgroups were tested by Tukey's post-hoc test and Chi-square test. **RESULTS:** There were significant differences (mean±SD, p<0.01) between subgroups in body composition (fat% - am: 12.1±6.0 vs. nam: 17.9±6.8; af: 20.8±5.5 vs. naf: 25.4±5.7; muscle% - am: 50.3±3.6 vs. nam: 47.6±3.9; af: 43.8±3.2 vs. naf: 41.7±3.3), in stress level (total scores - am: 21.0±5.7 vs. nam: 23.3±7.2; af: 25.5±7.0 vs. naf: 28.0±9.7), and there were gender differences in psychosomatic symptoms (total scores - am: 14.6±6.3 vs. af: 20.4±7.4; nam: 14.9±6.1 vs. naf: 19.6±8.2), i.e. athletic students had larger muscle and smaller fat components, lower level of stress. Basic level of salivary cortisol revealed significant relation with the level of physical activity: athletic students had lower level of cortisol both in the males and females. This relation is reflected in the higher frequency of students with low level of cortisol in the physically more active subgroups in both sexes (am: 29% vs. nam: 15%; af: 18% vs. naf: 5%; p<0.01) as well as in the higher frequency of female students with high level of cortisol in the non-athletic subgroup (27% vs. 11%). **CONCLUSIONS:** The regular physical activity helps to achieve physical and mental well-being. It seems that non-active females are the most vulnerable to physical-psychic exhaustion. Granted: 20769/3/2018/FEKUTSTRAT

2597 Board #261 May 31 9:30 AM - 11:00 AM
The Importance Of 'Time' Prescription To Exercise Adherence: A Meta-analysis

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 (No relevant relationships reported)

Purpose: Time is perceived to be a major barrier to exercise adherence. This meta-analysis determined the effect of manipulating the time component of FITT (frequency, intensity, time, type) on exercise adherence.

Methods: Electronic databases were searched from inception to September 2018. Inclusion criteria were (1) adults ≥ 18 y; (2) randomized controlled trial; (3) adherence (percentage) was the dependent variable. Meta-regression quantified the association between exercise intervention duration and adherence. Random effects meta-analyses were utilized where effect sizes were reported as mean differences (MD). Standardized mean differences were also calculated to characterize the effect size: trivial (<0.2), small (0.2-0.3), medium (0.4-0.8), and large (>0.8).

Results: Initially, 2,885 articles were identified. After evaluation of study characteristics, quality and validity, data from 9 articles (16 trials) involving 513 participants (122 male, 391 female) were extracted. There was a non-significant effect for time (MD= 1.4, 95% CI: -1.6, 4.2) on adherence across all studies. Subgroup analyses were performed to determine the importance of population type: healthy and chronic diseases. Time manipulation had a positive medium effect in the healthy sub group (MD= 7.0, 95% CI 0.4, 13.6), and a negative, but a small non-significant effect in the chronic diseased subgroup (MD= -2.3 95% CI -5.5, 0.8). Meta-regression analysis revealed a positive association between intervention duration (month) and adherence for the healthy group (β= 3.4, 95% CI: 2.5, 4.2), but not for the chronic diseases group (β= -0.2, 95% CI: -0.7, 0.2).

Conclusions: Manipulation of time is effective for promoting exercise adherence in healthy populations, but not in those with chronic diseases. Further, exercise intervention duration is positively associated with adherence in healthy populations, but not in those with chronic diseases.

2598 Board #262 May 31 9:30 AM - 11:00 AM
Association Between Parenting Style And Adherence To The 24-hour Movement Guidelines In Adolescents

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Previous studies have examined the influence of parental style on children's physical activity (PA), sedentary behavior, and sleep in isolation. It is largely unknown how parenting style affect these movement behaviors as a whole within a 24-hour period. **PURPOSE:** To examine the association between parenting style and adherence to the 24-hour movement guidelines among adolescents in Hong Kong.

METHODS: 1,039 adolescents aged 11-18 years and their parents participated in this study. The adolescents wore an activPAL™ for 7 consecutive days to measure moderate-to-vigorous PA (MVPA), SB and sleep duration. Meeting the overall 24-hour movement guidelines was defined as: ≥ 60 minutes of MVPA, ≤ 2 hours of screen time (ST), and 8-10 hours of sleep a day. Parenting style was reported by the adolescents using the Parenting Styles and Dimensions Questionnaire (PSDQ) which assessed three domains (authoritarian, authoritative, and permissive). Linear mixed models were performed to assess the association between parenting styles from both parents and the numbers of recommendations met by the adolescents, adjusting for educational attainment of parents, number of siblings, and school clustering effects. The models were performed for boys and girls separately.

RESULTS: 278 adolescents (14.6 ± 1.6 years, 48% girls) provided valid activPAL™ data and reported the perceived parental style pertaining to their mothers and fathers. Only 1.1 % of the adolescents met the overall 24-hour guidelines. The percentage of meeting the PA, ST and sleep duration recommendations was 9.4%, 27.3%, and 37.8%, respectively. Permissive parenting style of the mothers was associated with a higher number of recommendations met by their sons (b = 0.07, 95% CI = 0.01 to 0.14, p < 0.05). There was no relationship between fathers' parental style and adherence to the guidelines for adolescents.

CONCLUSIONS: Adolescent boys were more likely to adhere to the 24-hour movement guidelines when their mothers had a more permissive parenting style. This study was supported by the General Research Fund (GRF) of the Research Grants Council (RGC) of the Government of the Hong Kong Special Administrative Region, China (#14501415).

2599 Board #263 May 31 9:30 AM - 11:00 AM
Comparison Of Affective, Perceptual, And Heart Rate Responses To Self-paced Treadmill Versus Trail Running

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The biophilia hypothesis describes the innate tendency of humans to seek connections with nature and living systems. Therefore, exercise in nature may allow more positive affective responses (AR) compared to exercise indoors, which may affect preferred intensity and ratings of perceived exertion (RPE) during exercise. **PURPOSE:** To compare AR, RPE, heart rate (HR), and exercise time between self-paced indoor treadmill running and outdoor trail running conditions.

METHODS: Ten college-aged men and women were recruited for two self-paced exercise sessions performed in a random, counterbalanced order. The indoor exercise was performed on a treadmill in the laboratory without view of nature. The outdoor exercise was performed on a wooded trail, immersed in nature. For both sessions, the first 0.25 mi was a self-paced walking warm-up, the next 1.5 mi was self-paced running, and the last 0.25 mi was a self-paced walking cool-down. AR (Feeling Scale), RPE (Adult OMNI Walk/Run Scale), and HR (Mio Alpha) were measured at the middle and end of the 1.5 mi of running. AR, RPE, and HR were compared between sessions using mixed-model ANOVA. Total exercise time was compared between sessions using a paired-samples t-test.

RESULTS: A significant main effect indicated higher average AR during trail running compared to the treadmill (2.4 ± 0.6 v 0.6 ± 0.6, p < 0.05). A significant interaction effect (p < 0.05) indicated AR increased during trail running (2.2 ± 0.5 to 2.6 ± 0.6) yet decreased during treadmill running (1.0 ± 0.5 to 0.3 ± 0.5). Although average RPE values were similar between conditions, a significant interaction effect (p < 0.05) indicated that RPE was stable during trail running (5.4 ± 1.2 to 5.3 ± 1.6) yet

increased significantly during treadmill running (4.7 ± 1.3 to 6.2 ± 1.0). HR increased similarly during both exercise sessions, yet exercise time was significantly less for trail compared to treadmill running (17.8 ± 3.5 min v 22.1 ± 4.5 min).

CONCLUSIONS: For indoor treadmill running, RPE increased with HR as expected, yet AR declined. Outdoor trail running, although with similar increasing HR, produced stable RPE and increased AR. These results indicate that self-paced running immersed in nature can have more positive effects on mood while providing the same physiological benefit as indoor treadmill running.

2600 Board #264 May 31 9:30 AM - 11:00 AM

Aerobic Fitness and Cardiac Autonomic Control Related to Better Cognitive Performance in Young Adults

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Aerobic fitness has a positively relation to cognitive function, including attention. In addition, an increased aerobic fitness has been related to better cardiac autonomic control, verified by heart rate variability (HRV), a simple and non-invasive tool for verification of autonomic nervous system activity. Previous studies have shown that higher levels of HRV is related to better attention. **PURPOSE:** To compare the cognitive performance and cardiac autonomic control of young adults with different levels of aerobic fitness (high vs low). **METHODS:** 20 males young adults (aged 21.2 ± 2.1 years) participated. The criteria for participation were: not consuming tobacco, supplements, or any drug that could interfere the evaluations; being free of cardiovascular diseases and attention disorders and do not consumed alcohol or coffee several hours before the tests. The attention components were evaluated through the Attention Network Test (ANT). The aerobic capacity (VO_{2max}) was estimated according to the Astrand nomogram. Body mass and stature was used to calculate body mass index (BMI) and skin folds were performed. Cardiac autonomic control was assessed by means of the HRV time domains (RMSSD and SDNN) at rest in the sitting position for 10 minutes prior to the ANT. Participants were divided into high and low fitness groups according to VO_{2max} (46 ± 6 vs. 31 ± 2). Results of HRV and the components of ANT: alertness, orientation and conflict were verified and compared between groups. **RESULTS:** The high fitness group compared to low fitness group demonstrated greater cardiac autonomic control [SDNN (74.1 ± 36.3 vs. 47.9 ± 12.4); RMSSD (55.4 ± 32.4 vs. 33.9 ± 13)] and better executive control of attention, verified by the Conflict component of the ANT [101.3 ± 30.1 vs. 141.2 ± 46.2], respectively. VO_{2max} had a moderate and negative correlation with the Conflict ($r = -0.50$, $p = 0.04$). Correlation between Conflict and SDNN and RMSSD appear ($r = -0.56$, $p = 0.01$), and $r = -0.46$, $p = 0.05$), respectively. In addition, there was no difference in the sum of skinfolds and BMI between groups. **CONCLUSIONS:** Participants of high fitness group demonstrated greater cardiac autonomic control and executive control of attention compared to the low fitness group. Still, the greater autonomic control seems to favor the greater executive control of attention.

2601 Board #265 May 31 9:30 AM - 11:00 AM

Principles Of Fractal Geometry As Method Of Research Of The Self-organization Of The Human Movement

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PURPOSE: The research method applied in the studies in the practice of physical exercise has predominantly used direct and/or invasive techniques, and may cause discomfort in the participants. However, it seems appropriate to apply non-invasive methods evaluating synergies during the execution of exercises. To apply the principles of fractal geometry in the kinematic analysis of the vertical jump in the mini trampoline to demonstrate the complex process of self-organization of the jump identifying individual "pattern" of synergies in the lower limbs of female undergraduate students. **METHODS:** Five Physical Education students were submitted to consecutive vertical jump with against motion and without the aid of their arms on the mini trampoline for 120 seconds. The joints angles of the lower limbs were recorded using a Vicon Bonita camera to capture the sign of the markers. Twelve markers were placed on the right and left sides of the body (anterior iliac crest, major femur trochanter, lateral femoral epicondyle, lateral malleolus, calcaneus, and the fifth metatarsal head). The position of the markers was recorded by a motion capture system (Proreflex240, Qualisys) with an individual 100 Hz sampling rate (12000 frames). For the kinematic analysis of the articular angles (Ankle, knee, hip) the Cantor Ternary Set was applied, considering two stages of iteration ($I_0 = [0,1]$; $I_1 = [0, 1/3] \cup [2/3, 1]$; $I_2 = [0,9] \cup [2/9, 3/9] \cup [6/9, 7/9] \cup [8/9, 1]$), which were demonstrated by Radar geometric method

RESULTS: The first iteration demonstrated consistency in the "standard" for ankle, knee and hip, right and left side. In the second, a recursion process was verified, since the graphs showed self-similarity.

CONCLUSIONS: The application of fractal geometry principles proved to be an adequate method to verify the individual "pattern" of jump behavior in the mini trampoline, through iterativity and recursivity, indicating a synergetic behavior in the system and characterizing itself as a process of self-organization.

2602 Board #266 May 31 9:30 AM - 11:00 AM

Association Between Binge Watching TV and Physical Activity in College Students

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Binge television (TV) watching is a relatively new phenomenon that involves watching more than two TV episodes or multiple movies in one sitting. TV watching is a form of sedentary activity. Prolonged sedentary time has been shown to be independently associated with deleterious health outcomes regardless of physical activity (PA). The influence of binge TV watching on PA has not been studied in college students.

PURPOSE: The purpose of this study was to examine the associations between PA with binge TV watching in male and female college students. **METHODS:** A total of 46 Albion College students (25 males age = 20.0 (1.0) years; 21 females age = 20.5 (1.0) years) participated in this study. Height (females = 167.9 (6.1) cm; males = 182.4 (6.9) cm) and weight (females = 65.5 (15.7) kg; males = 86.9 (17.6) kg) were measured. The International Physical Activity Questionnaire was used to assess PA. Binge TV watching was assessed by self-report. Statistical analysis was performed using t-test and Pearson product-moment correlations. Significance was set to $p < 0.05$.

RESULTS: 47.6% of female and 48.0% of male college students met the ACSM minimum recommendations for 30 min of moderate intensity PA 5 days per week or 20 min 3 days per week of vigorous intensity PA. 76.2% of females and 56.0% of males reported binge watching TV at least 1 time per week. 100% of females and males reported binge watching TV in the past year. Students that met the PA requirements binge TV watched on average 2.5 (2.7) times per week, while students that did not meet the PA requirements binge TV watched on average 3.2 (2.3) times per week ($p=0.20$). A significant difference ($p=0.026$) was found in the number of times males reported binge watching TV (2.1(2.3) times per week) compared to the number of times females reported binge watching TV (3.7(2.5) times per week). Physical activity was not found to be significantly correlated with binge TV watching in college students ($p=0.10$). **CONCLUSIONS:** Binge TV watching and PA were not found to be significantly associated in college students. Females binge watched TV significantly more than males. Since binge TV watching does not appear to be stopping the students from doing PA, future research should be done to determine what binge TV watching may be stopping them from doing, possibly sleeping.

2603 Board #267 May 31 9:30 AM - 11:00 AM

Exploring the Relationship Between Planned and Performed Physical Activity: the Utility of a Smartphone App

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PURPOSE: Few studies have examined day-level plans to be physically active and subsequent physical activity behavior, likely due to the feasibility of collecting this data. The purpose of this study was to test the feasibility and acceptability of a new mobile phone application (Life in a Day App: LIAD) for collecting real-time time-use data among college-aged students and to examine whether plans to be physically active (recorded in advance on an electronic calendar for the protocol period) were associated with physical activity during the study protocol (measured through the LIAD app).

METHODS: Forty-eight participants were randomly assigned to one of three protocols defined by the number of days of data collection (1, 3 or 5 days). Participants were asked to record their planned activities for the protocol period in a Gmail calendar and provided smartphones (Samsung Galaxy S5) to complete time-use entries in real time (e.g., exercise/sports, eating/cooking, school, personal care). Participants were instructed to wear an accelerometer (ActiGraph wGT3X+) on their wrist during the protocol period (i.e., 24 hours a day) in order to objectively measure physical activity. **RESULTS:** Overall compliance with the protocol was very high with all participants utilizing the LIAD app. However, not all completed the data entry in real time, which was desired. Three of the 48 participants did not complete the calendar component. Six of the 48 participants did not have sufficient accelerometry data, defined as at least 10 hours of data on each day of the protocol. The most common participant-reported feasibility issue was the difficulty in carrying two smartphones. Within the full sample, the number of days when exercise was planned in the Gmail

calendar but not executed was 18. The number days of when exercise was executed but not planned was 15, while the number of days when exercise was executed and planned was also 15. **CONCLUSION:** Overall, there was moderate congruence between plans to be physically active and executed physical activity. Despite a few challenges, the mobile app is a reasonable and practical method of collecting real-time time use data and offers insight into the relationship between planned vs. executed exercise at the day-level.

2604 Board #268 May 31 9:30 AM - 11:00 AM

The Effects Of A Six-week Boot Camp Program On Exercise-related Affects And Perceptions

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Physical inactivity is the greatest public health concern of the 21st century (Blair 2009; Kohl et al., 2012). Lack of motivation for behavior change as well as a low sense of self-efficacy for exercise are amongst the greatest contributors of the problem (Lox, 2017). While evidence suggests the effectiveness of select physical activity (PA) interventions for improving PA levels, whether these interventions can also help long term PA behavior change is unknown (Prince et al., 2014). **PURPOSE:** The purpose of this study was two-fold 1) to investigate the effectiveness of a six-week boot camp program for increasing motivations for long-term PA behavior change, self-efficacy for exercise, and improving participants' perceptions of their general health as well as 2) to gauge participants' motives for adhering to the program. **METHODS:** Twenty-seven sedentary adults ($M_{age}=30.04$, $SD=10.33$) participated in a vigorous boot camp program for a minimum of five days per week for fifty minutes a day throughout a six-week period responded to questionnaires measuring their motivation for behavior change, self-efficacy for exercise and, perceptions of general health at the onset and the completion of the program. At the completion of the program, participants also responded to a single qualitative prompt for identifying motives for continued adherence to the program. **RESULTS:** Paired sample t tests indicated a significant improvement in participants' mean scores for self-efficacy for exercise ($M=7.21 \pm 2.2$ pre vs. 8 ± 1.65 post; $t=-2.38$, $p<0.05$) and the perception of their general health ($M=3.17 \pm 1.01$ pre vs. 3.92 ± 0.7 post; $t=-4.21$, $p<0.05$). Results from the qualitative prompt revealed three main themes for continued adherence: (1) structured aspect of the program, (2) accountability between the participants and exercise leaders, and (3) the sense of community within the program. **CONCLUSIONS:** These findings suggest that alternative boot camp interventions can prove effective means for improving important precursors of PA behaviors. From a practical standpoint, structured approaches that can provide a supportive community as well as a sense of accountability may present critical initiatives in promoting long term PA and solving the problem of inactivity.

2605 Board #269 May 31 9:30 AM - 11:00 AM
Sedentary Adult Characteristics and Exercise Benefits and Barriers: Associations in an Interactive Voice Response Study

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Adults living in the Deep South suffer higher rates of cancer incidence and mortality possibly related to higher rates of physical inactivity. Hence, additional information regarding physical activity (PA) barriers and benefits is needed for targeting interventions for this at-risk population. **PURPOSE:** To examine baseline associations between participant characteristics and PA benefits and barriers in sedentary adults enrolled in an Interactive Voice Response (IVR)-supported study in the Deep South. **METHODS:** Participants ($N=63$) completed the 43-item Exercise Benefits and Barriers Scale (EBBS) and 7-day Physical Activity Recall (moderate-to-vigorous physical activity [MVPA]) prior to randomized allocation. **RESULTS:** The mean age of the sample was 43 ± 11.8 years with slightly more male (55.6%) and black or African American (58.7%) participants. On average, participants were obese (31.1 ± 6.9 kg/m²), and self-reported 40 ± 56 minutes per week of MVPA. Using Mann-Whitney test, overall barriers were significantly greater for those with annual incomes less than \$50k vs. \$50k or more (Median [Mdn] = 30.0 vs. 25.5, $p=.025$) and for those employed less than full-time vs. full-time ($Mdn = 32.0$ vs. 28.0, $p=.034$). No significant associations were indicated for benefits. For PA barrier subscales, Time Expenditure time was a less frequent barrier for African-American vs. other (Mdn

= 2.0 vs. Mdn 2.3, $p=.002$) and obese vs. non-obese ($Mdn = 1.8$ vs. 2.3, $p=.005$). Physical Exertion was a greater barrier if not employed full-time vs. employed full-time ($Mdn = 2.7$ vs. 2.3, $p=.001$). Family Discouragement barriers were greater for unmarried vs. married ($Mdn = 2.0$ vs. 1.5, $p=.014$). Exercise Milieu barriers were more frequent for those with incomes less than \$50k per year vs. \$50k or more ($Mdn = 2.0$ vs. 1.4, $p=.005$). There were no significant associations between minutes of MVPA and EBBS or subscale scores. **CONCLUSIONS:** Our results highlight demographic differences in scores of barrier items related to time expenditure, family discouragement, physical exertion, and other exercise barriers. Further study is needed to examine how barriers in this population change over the course of an IVR-supported physical activity intervention.

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2606 Board #270 May 31 9:30 AM - 11:00 AM

Mirror Mirror On The Wall: Who Prefers You Most Of All? Individual Preferences In The Context Of Mirrored-exercise Environment

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Although most fitness facilities have a mirror on at least one of four walls, not all exercisers may benefit from exercising in a mirrored-environment. While studies suggest that certain antecedents, such as body image concerns, may underline people's avoidance from mirrored-exercise settings, the reasons that motivate people to exercise in a mirrored-setting, remained unclear. **PURPOSE:** Through a qualitative investigation, we explored in-depth the reasons that drive people to, or prevent people from, exercising in a mirrored-setting, and the consequence of exercising with versus without a mirror, among exercisers with distinct exercise-settings preferences. **METHODS:** Semi-structured interviews were conducted with 8 mirror-preferring exercisers (MPEs; 22.75 ± 2 yrs) and 8 mirror-avoiding exercisers (MAEs; 21.9 ± 2.2 yrs) and analyzed through a thematic analysis. **RESULTS:** Themes of enjoyment and gratification from the "exerciser-look," a desire to track fitness progress, and a high reliance on mirrors' feedback to monitor "form" emerged as reasons to prefer a mirrored-exercise environment. Themes of body shame and a desire to avoid self-disgust emerged as reasons to avoid mirrored-exercise settings among female MAEs. Mastery and contents of self-confidence underlined male MAEs' preference to avoid the mirror during exercise. Among both MPEs and MAEs, themes of decline in enjoyment, motivation and performance level emerged in relation to exercising in a non-preferred mode. **CONCLUSION:** Adhering to one's preferred mode of exercise is crucial for positive exercise-related outcomes. While a mirrored-exercise environment can serve as a confidence-booster for people who derive their exercise-motivation from the visual feedback of their appearance, it may lead to mood, motivation, and performance decrements among people, specifically females, who are less satisfied with their physical appearance. Understanding people's exercise-environment preferences in initial stages of the fitness progress may aid professionals in tailoring personalized exercise programs, which in turn, may increase exercise motivation. A further empirical investigation must target the consequences of mirrors for exercisers with different needs is necessary.

2607 Board #271 May 31 9:30 AM - 11:00 AM

Sedentary Behavior in 6-10 Year Old Children and Associations to Portable Device Use and Parental Influence

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In recent years, portable screen-based devices such as internet-connected cellular telephones (i.e., smartphones) and portable tablet computers (i.e., tablets) have increased in availability. Prior research has indicated that the use of such devices may be associated with sedentary behavior and physical activity. While such relationships have been assessed in adults and/or evaluated other types of screen-time, the relationship between portable device use and physical activity and sedentary behavior remains untested in young children.

PURPOSE: To examine screen-based media device (smartphone, tablet, television, video games, computer) use in children and their parents in relation to sedentary behavior and physical activity.

METHODS: Parents ($N = 40$) completed validated questionnaires assessing average daily total screen use (smartphone, tablet, television, video games, computer), portable screen-based device use (smartphone, tablet), sedentary behavior, and physical activity for themselves and their children ($N = 40$, 8.7 ± 1.3 years old). Four standard regression models were used to assess the relationship between criterion variables and

the following predictor variables: child age, child sex, child average daily sedentary time, and child physical activity. Criterion variables included (a) child portable device use (Model 1), (b) child total screen use (Model 2), (c) parent portable device use (Model 3), and (d) parent total screen use (Model 4).

RESULTS: Child sedentary time was significantly ($\beta = 0.47$, $t = 3.30$, $p = 0.002$) and positively associated with child portable device use. Child sedentary time was also significantly ($\beta = 0.45$, $t = 2.91$, $p = 0.006$) and positively associated with parent total screen use. Child age and physical activity were not significantly ($p > 0.05$) related to either parent or child portable or total device use.

CONCLUSION: As found in similar studies examining young adults, child sedentary behavior was related to portable device use while physical activity was not. This suggests that children who are heavy users of portable screen-based devices allocate more time to sitting than their peers who are lower portable screen users. Furthermore, results also suggest that total screen use in parents was predictive of sitting in their children.

2608 Board #272 May 31 9:30 AM - 11:00 AM
Exercise Intensity as a Predictor of Mood States During a Group Cycling Class

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Increases in positive mood states after exercise has been well documented. Group cycling classes are a popular mode of exercise in the fitness industry. There is limited research on the effect of group fitness classes on mood states and whether intensity level will have an impact on the mood enhancing benefits. **PURPOSE:** The purpose of this study was to determine if exercise intensity predicts changes in mood states during a group cycling class. **METHODS:** A total of 99 subjects, ages 18 to 25 years old, volunteered for the study. No previous experience with group cycling classes was required. The subjects participated in one group cycling class instructed by a certified cycling instructor. Prior to the cycling session the subjects filled out an informed consent, medical history, and Subjective Exercise Experience Scale (SEES). Subjects were then given a heart rate monitor, instructed on proper bike set up and how to operate the bike during class. The cycling class consisted of a 5 min warm up, a 30 min conditioning phase with a mix of sprints, hills and jumps typically performed in a cycling class. The class ended with a 5 minute cool down and 5 minute stretch off the bike. Heart rate and percent heart rate reserve (%HRR) was continuously tracked during class. After the class, subjects filled out a second (post) SEES. A hierarchical regression analysis was used to examine whether intensity measured by %HRR predicted changes in each of the 3 mood state categories on the SEES (positive well-being, psychological distress, fatigue). Three related sample t-tests were run examining changes in mood following the cycling class. **RESULTS:** % HRR was negatively related to positive well-being ($\beta = -.178$, $p = .046$) and positively related to fatigue ($\beta = .30$, $p = .003$). There were no significant differences in fatigue after the cycling class ($p > .05$), however positive well-being increased ($p = .001$) and psychological distress decreased ($p = .021$) after the class. **CONCLUSION:** The intensity level of an acute exercise session may affect the mood enhancing benefits of exercise. The group cycling class did increase positive well-being and decrease psychological distress. However, individuals who exercised at higher intensity levels had increased levels of perceived fatigue and decreased feelings of positive well-being.

2609 Board #273 May 31 9:30 AM - 11:00 AM
What Parental Correlates Predict Children's Active Transportation to School in the Southeast USA?

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School-aged children in the Southeast USA have been found to have significantly lower levels of active transportation to school (ATS) via walking or biking. Parents, the main gatekeeper of children's ATS behaviors, usually weigh their perceptions of the sociocultural and the neighborhood-built environments when making their ATS decision. **PURPOSE:** To contrast the correlates of ATS decision-making behavior between parents living in the Southeast with other parents across the USA. **METHODS:** This study utilized data from 2,952 households from across the USA (50.6% from the Southeast USA) that had school-aged children (K-8th grade) who were located within a 20-minute walk to a school. Parents were surveyed during 2012-13 using a mixed-mode approach that involved telephone and web surveys. Parents self-reported their child's ATS behavior and their own attitudes, beliefs, and perceptions in five areas related to ATS - safety and convenience concerns, perceived ATS benefits, desired neighborhood active transportation characteristics, and perceived ATS social norms. In addition, parents reported the demographics and the geographical

characteristics of their home. PROC LOGISTIC in SAS was utilized to contrast correlates between the Southeast and the USA. **RESULTS:** Parents in the Southeast, compared to parents across the USA, were significantly less likely to allow their child to take ATS (12.9% vs. 33.3%, respectively) (OR=0.46; 95% CI=0.36-0.59). ATS correlates, regardless of USA region, included decreases in ATS with increasing age (OR=0.97; 95% CI=0.96-0.99), and increases in ATS if parents perceived ATS to be the norm (OR=2.57; 95% CI=2.23-2.96). Correlates linked to increases in ATS, which were limited to only parents living in the Southeast, were being black (OR=1.68; 95% CI=1.31-2.60) and being single, (OR=1.71; 95% CI=1.15-2.54). The only correlate association related to a decrease in ATS specific to the Southeast was heightened safety concerns (OR=0.44; 95% CI=0.23-0.84). **CONCLUSIONS:** Among households located near schools in the Southeast, interventions that allay parental ATS safety concerns might lead to increased ATS. In addition, programs that promote physical activity among adults in the Southeast might indirectly lead to increases in ATS among households with children.

2610 Board #274 May 31 9:30 AM - 11:00 AM
Determinants of Change in Sedentary Behaviour In Young Children: a Systematic Review

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High levels of sedentary behaviour have been suggested to be harmful in young children and appear to track from early to middle childhood years, suggesting the need to intervene before the behaviour becomes embedded. **PURPOSE:** To identify determinants of change in sedentary behaviour in young children (≤ 6 years old). **METHODS:** Eleven databases were searched up to March 2018. Duplicate paper selection focussed on the inclusion of longitudinal and intervention studies which: a) targeted sedentary behaviour in young children (≤ 6 years old); b) assessed a within-child change in objectively-measured sedentary behaviour; and c) reported on at least one determinant of sedentary behaviour. Intervention components were coded according to the cluster of behaviour change technique (BCT). Data synthesis was guided by the socio-ecological model and Harvest plots and included duplicate quality assessment. **RESULTS:** Sixteen studies (4 longitudinal and 12 intervention studies) met the inclusion criteria out of 14,966 papers identified in searches. Five determinants were identified from four longitudinal studies and 21 determinants (i.e. BCT components) were identified from 12 intervention studies. Studies were considered to be of high ($n=9$) or intermediate ($n=7$) quality. Interventions targeted a mean of 3.6 (SD 2.4) BCT clusters. The BCT cluster "shaping knowledge" and "antecedents" were targeted in 11 and 8 out of the 12 studies respectively. The following determinants at the interpersonal level were associated with a decrease in sedentary behaviour: goals and planning (i.e. behavioural contract), repetition and substitution (i.e. graded tasks) and reward and treat (i.e. incentives). In single studies, two environmental-level determinants were associated with an increase in sedentary behaviour: afterschool period and transition from childcare to school. **CONCLUSION:** A limited range of determinants of change in young children's sedentary behaviour have been studied. Of these, only a few were associated with objectively measured change in sedentary behaviour. There is a need for more evidence, particularly from interventions targeting sedentary behaviour only to provide more robust evidence and to support the development of future interventions.

2611 Board #275 May 31 9:30 AM - 11:00 AM
Exercise Dependence, Eating Disorder Symptoms and Biomarkers of Relative Energy Deficiency among Male Endurance Athletes

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Exercise dependence (ED) is characterized by a craving for physical training, uncontrollable excessive exercise behavior with inability to reduce exercise amounts, and potential harmful consequences, such as injuries, impaired social relations and depression. The condition is often associated with eating disorder pathology and perfectionism among women. Whether an association between ED and eating disorder symptoms among male endurance athletes exists, is less known. **PURPOSE:** The aim of this study was to explore possible associations between ED, eating disorder symptoms, and biomarkers of Relative Energy Deficiency in Sports (RED-S) among male athletes. **METHODS:** Fifty-three healthy well-trained male cyclists,

triathletes, and long-distance runners recruited from regional competitive sports clubs were included in this cross-sectional study. The protocol comprised the Exercise Dependence Scale (EDS) consisting of 7 sub-scales, the Eating Disorder Examination Questionnaire (EDE-Q), measurements of body-composition, resting metabolic rate, energy intake and -expenditure, and blood analysis of hormones and glucose.

RESULTS: Subjects with higher EDS score displayed a more negative energy balance compared to subjects with lower EDS score ($p < 0.01$). EDS total score was positively correlated with EDE-Q global score ($r = 0.41$, $p < 0.05$) and the subscale score for *Restraint eating* ($r = 0.34$, $p < 0.05$) and *Weight concern* ($r = 0.35$, $p < 0.05$). EDS total score and the subscales *Lack of control* and *Tolerance* were positively correlated with cortisol ($r = 0.38$, $p < 0.01$, $r = 0.39$, $p < 0.01$, and $r = 0.29$, $p < 0.05$, respectively). The EDS subscales *Withdrawal* and *Tolerance* were negatively correlated with fasting blood glucose ($r = -0.31$ and $r = -0.32$, $p < 0.05$, respectively), while *Intention effect* was negatively correlated with testosterone:cortisol ratio ($r = -0.29$, $p < 0.05$) and positively correlated with cortisol:insulin ratio ($r = 0.33$, $p < 0.05$). **CONCLUSION:** In this sample of healthy male athletes we found positive associations between higher EDS scores, eating disorder symptoms and biomarkers of RED-S, such as a more pronounced negative energy balance and higher cortisol levels. More studies are needed to elucidate ED as a possible contributor to the syndrome of RED-S.

2612 Board #276 May 31 9:30 AM - 11:00 AM
Parental Rewards for Children's Physical Activity: A Quantitative and Qualitative Analysis

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(No relevant relationships reported)

School-based intervention studies have used rewards to promote physical activity (PA) in children. However, little research has examined parental incentivization of children's PA including reasons and types of rewards. **PURPOSE:** To investigate parent-selected rewards for children's PA in terms of prevalence, type, and motivation to incentivize or not. **METHODS:** Parents ($N=90$, mean \pm SD; 39.3 ± 6.0 y) of children (8.7 ± 2.1 y) completed a web-based survey that included items regarding moderate-to-vigorous PA (MVPA, min \cdot week $^{-1}$), use of PA rewards, and demographic characteristics. Open-ended questions were used to determine the type of activity rewarded, type of reward given, and parents' reasoning for not using PA rewards. Independent sample t-tests were used to determine differences between reward groups (reward, no reward) and parent-reported children's MVPA. Qualitative data underwent content and thematic analysis. **RESULTS:** Over half (55%) of the respondents provided PA rewards. There was no significant difference between reward groups for MVPA (reward: 321 ± 195 min \cdot week $^{-1}$; no reward: 344 ± 180 min \cdot week $^{-1}$; $t(88)=0.862$, $p>0.05$). Two underlying themes as to why parents did not give rewards were deemed "Expectation" (e.g. being active is expected, should be part of everyday life) and "Intrinsic Motivation" (e.g. already active, already enjoy PA). Rewarded PA's were thematized as "Non-Exercise" (e.g. chores, good behavior, homework), "Sport" (e.g. performance, participation/effort), and "Non-Sport Activity" (outdoor play, structured PA, bike riding, miscellaneous PA). There were two themes for types of rewards including "Tangible" (e.g. money, food, other) and "Non-Tangible" (e.g. verbal praise, electronic time, family activities). **CONCLUSION:** Rewarding children's PA is prevalent within this sample of parents. Substantial variety exists regarding the type of PA incentivized and the type of reward provided. Motivations should be further explored to inform intervention design.

2613 Board #277 May 31 9:30 AM - 11:00 AM
Social Network of Friends and Physical Activity in University Students

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PURPOSE: To identify associations between different parameters of social networks with sedentary behavior and physical activity in university students **METHODS:** A social network analysis was carried out in a cross-sectional study in 475 university students. Sedentary behavior and physical activity were measured using self-report questionnaires, and participants were asked to nominate their best friends within the university. A multivariate analysis was performed using logistic regression models, separately for sedentary behavior and physical activity. In all the models, predictive variables included network density, cluster of friends, centrality, popularity, and friend behaviors. These models were adjusted including sociodemographic variables. Analysis of the information was carried out taking a significance level of less than 5% ($p < 0.05$) and a reliability of 95% with the SPSS V24 program and the Ucinet software for social network data

RESULTS: It was found that 17.6% of participants reported high TV viewing (2 or more hours per day of TV viewing) and 76% were physically active (150 minutes-

week of moderate physical activity or 75 minutes-week of vigorous physical activity). High TV viewing was negatively associated with popularity, and physically active participants received a greater number of friendship nominations compared with inactive students. Likewise, in women, the increase of 10 percentage points in active friends was positively associated with being physically active (OR: 2.3, CI 96% 1.1 - 5.0). By the contrary, an increase of 10 percentage points of friends with high TV viewing was associated with less probability of being physically active (OR: 0.4, CI 96% 0.1 - 0.9). For men, any of the associations were statistically significant

CONCLUSIONS: Social network of friends affects sedentary behavior and physical activity levels of women university students. Social dynamics are important correlates for sedentary behavior and physical activity in university students

2614 Board #278 May 31 9:30 AM - 11:00 AM
Mood Response To Aerobic Exercise In The Tiger Study

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The mood response to exercise may play a major role in exercise adherence and has a high degree of inter-individual variability. The difference between a positive and a negative affective mood response to exercise may influence the likelihood of regular participation in exercise.

Purpose: To determine how mood states change from pre- to post-exercise in sedentary individuals. **Methods:** The Training Interventions and Genetics of Exercise Response (TIGER) Study is a prospective cohort study, in which sedentary subjects (18-35 y, <30 min/wk for 30 days prior to enrollment) participated in a 15-week program, exercising within a prescribed (65-85% maximum heart rate reserve) target heart rate zone for 3 d/wk. Before and after each exercise session, a subset of subjects ($n=312$) completed a 10 cm visual analog scale (VAS: 0-100) for four mood states: fatigue, tension, depression, and hunger. Mean change in response to exercise for each mood state was analyzed using a paired t-test. Linear and logistic regression were used to examine associations between mood and exercise. Change was also examined by obesity status (BMI > 30 kg/m 2). **Results:** Exercise was associated with reductions in feelings of fatigue (mean pre: 53.41, post: 50.62); tension (mean pre: 43.56, post: 39.93); depression (mean pre: 38.79, post: 34.02); and increased hunger (mean pre: 51.81, post: 57.47). Mean change values from pre- to post-exercise: fatigue: -2.78, tension: -3.65, hunger: 5.67, & depression: -4.82. Non-obese subjects displayed a significantly greater hunger response to exercise (7.41 vs 4.89 respectively, $p<0.05$) and greater (but non-significant) reductions in depression following exercise (-5.91 vs -4.33 respectively, $p=0.07$) compared to obese subjects. Change in fatigue score was significantly and negatively associated with exercise intensity ($p<0.001$). An increased hunger score was significantly associated with increased risk of exercise dropout ($p<0.04$), even after controlling for obesity status. **Conclusions:** Exercise elicits reductions in feelings of fatigue, tension, and depression, while increasing hunger. Non-obese versus obese subjects display a significantly greater hunger response to exercise and a trend of reduced depression. Mood states following exercise may influence both exercise intensity and adherence.

2615 Board #279 May 31 9:30 AM - 11:00 AM
Sedentary Behavior & Health Variables in People with Type 2 Diabetes

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(No relevant relationships reported)

Sedentary Behavior and Health Variables in People with Type 2 Diabetes

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PURPOSE: The purpose of this study is to examine the relationships between sedentary behavior (SB), glycemic control, well-being, fatigue, and physical function in people with type 2 diabetes (T2D). These modifiable health variables have been shown to be 1) affected in people with T2D, and 2) associated with SB in older adults. However, the relationships between these variables and SB in people with T2D are uncertain. **METHODS:** A cross-sectional study design was used to assess the relationship between SB (total sitting time) with glycemic control (HbA1c), well-being (WBQ-22), fatigue (Fatigue Severity Scale), and physical function (Senior Fitness Test). An activPAL3™ activity monitor was used to assess SB in people with T2D aged from 50 to 75 years. **RESULTS:** Data from 59 participants were included in the final analysis. Study participants were obese (33.4 ± 5.5 kg/m 2) and sedentary (11.08 ± 2.31 Hours/day). Multiple linear regression examining the effect of the assessed variables on SB showed that poorer glycemic control ($\beta = 0.40$; 95% CI: 14.43, 58.13) was associated with higher level of SB, independent of moderate to vigorous physical

activity. No other significant relationships were observed. **CONCLUSION:** Glycemic control was a significant predictor of SB level. Understanding these relationships are important in designing and implementing interventional programs. Future studies are needed to explore this relationship further, as both glycemic control and SB are modifiable factors and could be used as main target for interventions aimed to improve health outcomes in people with T2D.

2616 Board #280 May 31 9:30 AM - 11:00 AM

Psychometric Evaluation of the Physical Activity Appraisal Inventory: Adolescence and Young Adult Version

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PURPOSE: To develop and perform initial psychometric testing of a specially designed scale: Physical Activity Appraisal Inventory--Adolescence and Young Adult Version (PAAI-AYA).

METHODS: The PAAI was validated in two separate studies: study one, elderly female patients with cancer (n=219); study two, elderly female with cancer (n=73) or without cancer (n=55). The PAAI-AYA was developed using the PAAI with the addition of nine-items pertaining specifically to young adults via content-expert validation. Following survey instrument finalization, it was distributed to students at three universities in the United States. Two hundred and sixty-eight students completed the survey. Survey data from 226 students (55 male and 165 female) who met age qualifications (16-25 yrs; x age = 23.5 years) were used for data analysis. Exploratory factor analysis was conducted with principal-axis factoring, parallel analysis, and promax rotation.

RESULTS: A one-factor, 21-item solution, physical activity self-efficacy, was decided on for the scale (loadings range = .63-.81, 55.4% of total variance). The scale had high reliability (Cronbach alpha = .96), acceptable item-total and inter-item correlations (.62-.79, .3-.78, respectively), and high concurrent validity with the Exercise Self-Efficacy Scale (rs = .80, p < .001), and with self-reported physical-activity levels (rs = .40, p < .001).

CONCLUSIONS: Although the scale developed in this study needs future confirmatory factor analysis, it is a reliable and promising tool. As such, it can be effectively utilized by clinicians to better understand and promote physical activity self-efficacy in late-adolescent and young-adult college populations.

2617 Board #281 May 31 9:30 AM - 11:00 AM

The Effects Of A Low-dose Mindfulness-based Intervention On Psychological/physiological Health And Acute Food Choices.

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(No relevant relationships reported)

Mindfulness-based interventions (MBI) are becoming increasingly popular as a low-risk tool that engage participants in the practice of positive psychological skill training. Long-term studies demonstrate that MBIs may improve physiological/psychological well-being, and specific health behaviours, but require significant time commitment, therefore prompting development of 'low-dose' MBIs. However, the efficacy of these MBIs, particularly with modification of nutritional choices has yet to be established. **PURPOSE:** This study investigated the efficacy of a short-term MBI and its effects on psychological and physiological markers of health, in conjunction with the assessment of acute food choice. **METHODS:** Following University ethical approval, 27 healthy participants were randomly assigned to 6-weeks of either: MBI; progressive muscle relaxation [PMR] or a wait-list control [C]. Within experimental groups participants undertook a 10-minute audio-guided script for six-days per week. At baseline (T1), week 3 (T2) and 6 (T3), participants completed three psychological questionnaires assessing mindfulness state (MAAS), perceived stress (PSS) and mindful eating (MEQ), in addition to physiological measures (blood pressure (BP), heart rate variability (HRV)) and a food choice task. **RESULTS:** MBI resulted in a significant increase in MAAS (0.76 ± 0.15au; p < 0.01, $\eta^2 = 0.44$) and reduced PSS (-4.89 ± 1.22au; p = 0.05, $\eta^2 = 0.17$) by T3 compared to PMR and C. Alternatively, no differences were observed between groups at any stage for MEQ scores (p ≥ 0.05). Within-MBI only, time and frequency HRV improved T1-T3 by 8.22 ± 5.52 ms⁻¹ (p = 0.02, $\eta^2 = 0.16$) and 12.29 ± 6.16nu (p = 0.05, $\eta^2 = 0.12$) respectively. These changes were not emulated for BP variables at any stage (p ≥ 0.05). Finally, no significant effects for acute food choices were observed (positive choices p = 0.90; negative choices p = 0.30). **CONCLUSIONS:** A low-dose MBI induced improvements between-groups for MAAS and PSS, and within-condition for time and frequency HRV. Whilst this supports the efficacy of an acute MBI in self-reported measures, HRV results should

be interpreted cautiously due to the lack of between-group significance. As food choice and MEQ responses were not influenced, further research targeting nutrition-specific MBIs are warranted.

2618 Board #282 May 31 9:30 AM - 11:00 AM

SPLASH (Swimming. Positive Perceptions. Lifestyle. Activity. Strength. Healthy Habits.) Into Fitness: An Intervention for Girls

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Pre-teen girls are disproportionately affected by obesity, and experience reductions in positive self-regard, physical activity (PA) participation, and healthy eating habits as they age. Previous literature demonstrates that health identity developed in youth drives adult behavior. Engagement in brief interventions has enhanced psychological underpinnings (i.e., exercise identity: EI; healthy eater identity: HEI) of healthy behavior in samples of obese and normal-weight girls. However, previous studies have not examined results from a mixed BMI weight-status sample, following participation in an innovative intervention designed to develop salient health identity in the critical pre-teen years. **PURPOSE:** To determine if participation in a multicomponent intervention (1-week health camp plus randomly assigned 10-week eHealth program) will increase EI, HEI, and health behavior in pre-teen girls. Preliminary post-camp results are presented. **METHODS:** Thirty-two participants (age=10.6±0.80 years, BMI percentile=76.7±25.83, overweight/obese=53.1%) attended a camp designed to enhance health identity. Programming focused upon improving the girls' EI by teaching three modalities of PA: swimming (aerobic), strength exercises (resistance-training), and yoga (flexibility). Nutrition/culinary lessons were included to enhance HEI. The curriculum promoted positive perceptions of self, regardless of BMI classification. Data were collected at baseline and post-camp. Measures will be repeated at three-month follow-up, following randomly assigned eHealth intervention. **RESULTS:** Participants experienced a significant increase in EI role-identity (p<0.001), and moderately increased enjoyment of PA (p=0.061) at post-camp. Additionally, participation in mild PA significantly improved (p=0.020). Small increases in HEI, moderate-vigorous PA, and fruit/vegetable intake were reported post-camp; results were not statistically significant. **CONCLUSION:** Preliminary findings indicate that psychological underpinnings of healthy behavior (such as identity or enjoyment) are positively impacted in pre-teen girls following participation in a 1-week health camp. Follow-up data will elucidate upon long-term effects, dependent upon assignment to eHealth intervention or usual care control.

2619 Board #283 May 31 9:30 AM - 11:00 AM

Investigating the Role of Perceived Willpower in Predicting Exercise Behavior- A Longitudinal Analysis on Gym Members

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PURPOSE: Implicit Theories about Willpower (ITW) propose that the beliefs of an individual's willpower as either abundant/rejuvenating or a limited resource predicts repetition of self-regulated behaviors, such as exercise. It is also theorized that willpower could be a determining factor for long-term behavioral adherence. While the ITW has demonstrated predictive validity for various health behaviors, its role in the context of exercise is limited. The purpose of the study was to test how the ITW predicts behavior among regular exercisers using an extended dual-process model. **METHODS:** Participants (n= 161) were a sample of adults (18-65) recruited across nine gym and recreation centers in a large metropolitan city and were averaging 257 min/week (SD = 171) of moderate-to-vigorous physical activity. Participants completed online surveys that were assessed monthly for six months. Multi-level structural equation modeling was used to analyze the results.

RESULTS: The model found Intention X planning interaction to predict behavior ($\beta = .29, p < .001$), while controlling for intention ($\beta = -.08, p = .14$) and planning ($\beta = -.01, p = .85$). Specifically, high intenders with specific plans predicted behavior. Habit was also found to predict behavior ($\beta = .11, p = .005$). Intrinsic motivation predicted both habit ($\beta = .25, p < .001$), and the interaction construct ($\beta = .18, p < .001$) directly and behavior ($\beta = .17, 95\% \text{ CI } [.070, .278]$) from total direct and indirect pathways. Rejuvenating willpower predicted habit ($\beta = .11, p = .020$) and intrinsic motivation ($\beta = .11, p = .008$) directly in addition to the interaction construct ($\beta = .10, 95\% \text{ CI } [.019, .184]$) and behavior ($\beta = .09, 95\% \text{ CI } [.001, .193]$) via total pathways. The model did not find limiting willpower predict any paths. Time did not predict changes in the observed model.

CONCLUSION: Findings add support to previous work on proposed maintenance constructs by testing them longitudinally in post-intenders. The model further advances

these findings by identifying how willpower, particularly, perceived rejuvenating willpower played a pivotal role as a proximal predictor of habit and intrinsic motivation and a distal predictor to behavior. Exercise-focused interventions that help participants cultivate rejuvenating willpower could be beneficial for behavioral maintenance.

2620 Board #284 May 31 9:30 AM - 11:00 AM
Correlates of Light Physical Activity Among Cancer Survivors

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Emerging evidence demonstrates positive health benefits of light physical activity (LPA) for cancer survivors. Yet, little research has explored modifiable factors that facilitate or hinder LPA behavior in this population. Furthermore, studies are often underpowered for conducting sub-group analyses. **PURPOSE:** To explore modifiable correlates of LPA among cancer survivors using a social cognitive framework, and how these correlates may differ among those engaging/not engaging in moderate-to-vigorous physical activity (MVPA). **METHODS:** Self-report data from the third survey of the American Cancer Society's Studies of Cancer Survivors I (N = 1720) were analyzed. Social cognitive variables of interest reflect cognitive determinants (i.e. perceived health competence and perceived susceptibility to cancer recurrence) and environmental determinants (i.e. healthcare provider support, perceived social support, and unsupportive partner behaviors). The Leisure Time Exercise Questionnaire was used to create four LPA categories (0, 1-59, 60-119, and 120+ minutes/week). Ordinal regressions using forced entry were conducted, stratified by MVPA status (0 minutes of MVPA, ≥ 1 min MVPA). Models were adjusted for relevant covariates (i.e., demographic, cancer-related, health-related variables), missing data bias was examined, and sensitivity analyses were conducted to examine the robustness of the results.

RESULTS: Among cancer survivors reporting no MVPA (n = 747), greater provider support for PA (adjusted OR [aOR] = 1.49, p = .03), greater perceived health competence (aOR = 1.44, p = .01), and greater unsupportive partner behaviors (aOR = 1.06, p = .03) were significantly correlated with higher LPA. No constructs were correlated with LPA among cancer survivors already engaging in MVPA (n = 973). Missing data bias was small (Cramer's V/Phi < 0.1). Results were similar in unadjusted analyses, and when stratifying by insufficient and meeting MVPA recommendations. **CONCLUSIONS:** The utility of a social cognitive framework in explaining LPA among cancer survivors who do not engage in any MVPA was supported. Interventions may be more efficacious by incorporating healthcare provider support, improving health competence, and improving interpersonal skills that address unsupportive partners.

E-43 Free Communication/Poster - Correlates and Behavioral Aspects of Sport

Friday, May 31, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

2621 Board #285 May 31 9:30 AM - 11:00 AM
Investigating the Effect of Competition Level on Penalties and Injuries in Youth Soccer

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There is an estimated 2.3 million youth soccer participants in the United States. As concern rises for the safety of youth athletes, organizations are changing the rules to make the game safer, potentially resulting in more penalized behaviors. Differences in competition levels may contribute to varying behavioral outcomes, such as foul and injury rates.

PURPOSE: Examine the relationship between competition level and behavioral outcomes, such as number of fouls and injuries, in youth soccer.

METHODS: During the competitive season, two soccer organizations were observed to examine behaviors associated with sportsmanship, behavior, fouls, and injuries during a game situation. The organizations consisted of teams from a recreation department and a travel academy soccer club located in South Georgia. Teams consisted of male and female athletes ranging from 6-16 years old, whom were divided by pre-determined age groups within the leagues. Observational data was collected on

game statistics which included spectator, coach and athlete behavior, as well as fouls and injuries, within the soccer organizations. A total of 86 recreational (n=52) and club (n=34) games were observed.

RESULTS: Club soccer teams had a greater number of fouls (F=247; 7.26 + 5.47, ranging from 0-23 per game) compared to recreational teams (F=75, 1.44 + 1.69, ranging from 0-7 per game). The number of injuries (I) were not affected by level of competition, age or number of fouls in club (I = 26; 0.76 + 0.99, ranging from 0-3 per game) and recreation (I=31; 0.60 + 0.96, ranging from 0-4 per game) youth soccer teams.

CONCLUSIONS: This pilot study provides preliminary evidence that competition level and age may be the driving force of behaviors that lead to penalties. Regardless of the number of penalties for both organizations, the number of injuries were minuscule; thus dispelling anecdotal links between aggressive behaviors and injury in youth soccer. Ultimately, greater level of competition in youth soccer, resulted in a higher competitive nature leading to more fouls, but not more injuries. Future research should consider situational factors that may impact these findings such as coaches and parents behaviors during the game, as well as referee standards for calling fouls. Supported by Centers for Disease Control Grant CE17-002

2622 Board #286 May 31 9:30 AM - 11:00 AM
An Exploratory Study of Mood States and Transient Emotions in Amateur Dressage Riders

Collin Pursley, Texas Christian University, Fort Worth, TX.
 (No relevant relationships reported)

PURPOSE: The purpose of this study was to explore the horse rider relationship through the effect of a rider's mood on the horse's behavior in practice and competition. **METHODS:** A total of 18 Female amateur dressage riders participated in this study. The participants completed five surveys and two observations. Surveys included a demographic survey, Rotter's I-E Scale, Orientation to Life Questionnaire, and the Profile of Mood States (POMS). Observations took place at a scheduled practice and during one competition per participant. **RESULTS:** The POMS results showed increased mood disturbance from the riders (N=16, M= 9.94), p= 0.03 between practice and competition. Observation data revealed no significance in horse conflict behavior between practice and competition (M= 1.18) p= 0.95. The differences between rider TMD and horse conflict behavior pre and post competition, the results demonstrated a strong, positive, and significant correlation (r=0.868), p=0.000.

CONCLUSIONS: The results of this study can be considered at best preliminary, but highlight a potential moderator of the horse rider relationship.

2623 Board #287 May 31 9:30 AM - 11:00 AM
Differences Between NCAA Division II Coactive And Interactive Ncaa Division II Athletes Motivation Types Over Time

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Few studies have examined motivation types in collegiate athletes over time using the Self-Determination Theory. **PURPOSE:** To investigate differences in motivation types between coactive (CAs) and interactive (IAs) athletes over three time points. **METHODS:** Overall, 530 participants from 21 teams composed of both IAs (n = 283) and a CAs (n = 247) voluntarily completed the 18-item Sport Motivation Scale II used to measure: intrinsic (IR), integrated (INTR), identified (IDR), introjected (INT), external (EXT), and amotivation (AMR) regulation. A 2x3 Mixed Analysis of Variance with Bonferroni post hoc tests were used to analyze the differences in motivation types over the pre-season (PS), in-season (IS), and off-season (OS). **RESULTS:** Main effects and post hoc results showed that, for IR, significant differences were seen in both the IS, F(1, 352) = 8.96, p = .003, and OS, F(1, 352) = 4.87, p = .028, with CAs scoring higher (M = 16.67, SD = 4.11; M = 16.81, SD = 3.84) versus IAs (M = 15.65, SD = 4.33; M = 16.17, SD = 4.25). For INTR, differences were seen in the OS, F(1, 352) = 7.44, p = .007, where CAs scored higher (M = 17.10, SD = 3.49) than IAs (M = 16.30, SD = 4.25). For IDR, differences were seen in both the IS, F(1, 352) = 7.10, p = .008, and the OS, F(1, 352) = 5.06, p = .025, with CAs scoring higher (M = 17.31, SD = 4.57; M = 16.82, SD = 4.01) versus IAs (M = 16.60, SD = 3.88; M = 16.16, SD = 4.15). For ITR, differences were seen in the PS, F(1, 352) = 12.98, p = .001, the IS, F(1, 352) = 12.98, p = .002, and the OS, F(1, 352) = 12.98, p = .018, where CAs scored higher (M = 14.25, SD = 4.21; M = 13.85, SD = 4.47; M = 13.94, SD = 4.40) than IAs (M = 13.02, SD = 4.81; M = 13.04, SD = 4.65; M = 13.06, SD = 4.91). For AMR, differences were seen in both the IS, F(1, 352) = 7.63, p = .006, and OS, F(1, 352) = 10.97, p = .001, with IAs scoring higher (M = 8.51, SD = 4.47; M = 8.38, SD = 4.93) versus CAs (M = 7.32, SD = 4.14; M = 7.32, SD = 4.14). No significant differences were seen for EXTR (p > .05). **CONCLUSIONS:** Results demonstrated that CAs exhibited higher IR, INTR, IDR and ITR scores than IAs support the hypothesis of Hollebek and

Amorose (2005) suggesting that CAs feel that they receive more autonomy support and individualized feedback from their coaches. Higher AMR scores were seen in IAs versus CAs and may be indicative of low self-determination and have been positively associated with burnout (Cresswell, 2009).

2624 Board #288 May 31 9:30 AM - 11:00 AM
A Comparison of Motivation and Grit in NCAA Collegiate Athletes

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Assessing self-determination to play a sport (motivation) and the strength of character or resolve (grit) in athletes is a useful tool for coaches and sports psychologists; however, gender, individual vs. team sports, and time of season differences in motivation and grit are not well documented. Whether an athlete is motivated intrinsically (more self-determined) or has sufficient grit may be the difference between athletic success or failure. Recognizing variations in motivational and grit characteristics in athletes can provide guidance towards improving individual performance and team dynamics. **PURPOSE:** To compare motivation and grit in NCAA collegiate athletes. **METHODS:** The Sports Motivation Scale II (SMS-II) and 12-Item Grit Scale were administered to 151 (87 females; 64 males; 19.2 ± 2.1 yrs) athletes spread among seven NCAA division III individual and team sports. Surveys also determined each participant's gender, class matriculation status (freshman through senior), and time of sport season (pre-, during-, off-season). Between group differences for SMS-II relative autonomy index (RAI; degree of self-determination score) and grit were made using independent T-Test and one-way ANOVA with post hoc analyses. **RESULTS:** SMS-II RAI scores (mean \pm SD) in both males and females were significantly higher/more self-determined ($p < 0.05$) in athletes on team (65.8 ± 20.0) vs. individual (53.3 ± 26.9) sports yet were significantly lower/less self-determined ($p < 0.05$) when in-season (58.5 ± 25.9) vs. pre- (65.1 ± 15.0) and post- (68.5 ± 19.8) seasons. Freshmen athletes had significantly lower/less self-determined ($p < 0.05$) RAI scores (56.3 ± 22.4) vs. sophomores (66.6 ± 18.9) and juniors (66.4 ± 23.8). 12-Item Grit Scale in both males and females revealed significantly lower/less gritty ($p < 0.05$) scores (mean \pm SD) for freshmen (3.56 ± 0.47) vs. sophomore (3.73 ± 0.41) and senior (3.76 ± 0.41) athletes. No between group gender differences were observed for RAI or grit. **CONCLUSION:** Our results are the first to compare indices of motivation and grit in a diversity of NCAA athletes and indicate several between group differences in self-determination and grit that may guide athletes towards improved individual and team performance.

2625 Board #289 May 31 9:30 AM - 11:00 AM
Relationships Among Coping Strategies And Training Intensity, Duration, And Frequency In Triathletes

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PURPOSE: The purpose of this study was to evaluate how coping strategies influence training volume and self-reported exercise intensity, duration, and frequency in triathletes. **METHODS:** Participants were 27 adult triathletes who established their own training regimen. Overall training volume was determined by exercise duration and intensity over 24 weeks. Exercise frequency, intensity, and duration were assessed through a physical activity recall questionnaire. Participants also completed a 41-item coping skills assessment. Total scores were calculated for positive coping strategies (range = 23-69) and negative coping strategies (range = 18-54). **RESULTS:** Overall training volume (intensity*minutes) over the 24 weeks for all participants was 38,803 ($\pm 15,704$) over 6-months. Over half of the participants (57.6%) reported exercise intensity to be vigorous with 36% reporting moderate-to-vigorous. More than 69% of the participants worked out longer than 45 minutes per session (duration) and for at least 1-2 times per week (27.3%) or more (36%) (frequency). The results of the bivariate correlations indicated that positive coping strategies was significantly associated with intensity ($r = 0.42$, $p = 0.011$), duration ($r = 0.41$, $p = 0.013$) and frequency ($r = 0.34$, $p = 0.035$). There was no significant relationship between training volume and positive coping strategies ($p = 0.300$). Interestingly, there were no significant relationships found among negative coping strategies and the other variables. Preliminary analyses using 3 separate simple linear regression were conducted to see the amount of influence positive coping strategies has on exercise intensity, duration, and frequency. Although positive coping strategies did not significantly explain the variance in exercise intensity, it approached significance ($p = 0.051$). Non-significant findings were found for duration ($p = 0.071$) and frequency (0.102). **CONCLUSIONS:** Study results illustrate the importance of understanding the

relationship between coping strategies and training for triathletes. Further research is needed to determine the use of coping strategies on all aspects of training in order to develop ideal preparation tactics for optimal performance.

2626 Board #290 May 31 9:30 AM - 11:00 AM
Personality and Trait Self-Handicapping in Baseball and Softball College Athletes

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Self-handicapping is a learned coping strategy to minimize threats to self-esteem when a person fears potential failure for an upcoming, evaluative event, but there is a paucity of research on self-handicapping and personality in athletes. **PURPOSE:** To examine the relationship between Big Five personality traits and trait self-handicapping in male and female college athletes. **METHODS:** Data were collected from softball ($n = 15$ females; age: 19.9 yrs) and baseball ($n = 28$ males; age: 20.6 yrs) athletes at a D-I university in the Midwest. Participants completed the Self-Handicapping Scale and Big Five Inventory - 2S. Independent t -tests examined gender differences for trait self-handicapping (SH) and personality [extraversion (E), negative emotionality (NE), conscientiousness (C), agreeableness (A), open-mindedness (OM)]. Pearson correlations identified personality traits related ($p < .10$) to SH, and these traits were included in a stepwise multiple regression to predict SH. **RESULTS:** Female athletes scored higher than male athletes on SH ($M_s = 32.0$ vs. 23.3 , $p < .01$) and NE ($M_s = 16.7$ vs. 12.9 , $p < .05$). Due to the gender difference for SH, correlations and regression analyses were done separately for each gender. For females, SH was correlated with NE ($r = .79$, $p < .001$), C ($r = -.46$, $p = .08$), and OM ($r = .51$, $p = .05$). The regression analysis revealed that NE was the only significant predictor of SH ($R^2 = .63$, $p < .001$). For males, SH was correlated with NE ($r = .53$, $p < .005$), C ($r = -.62$, $p < .001$), and A ($r = -.51$, $p = .005$). The regression analysis revealed that C was the only significant predictor of SH ($R^2 = .38$, $p < .001$). **CONCLUSION:** Higher self-handicapping in female athletes was an unexpected finding. Since negative emotionality was strongly related to SH in all athletes, but more for females, higher NE scores for females may partially explain their higher SH scores. Conscientiousness also was related to SH in all athletes, but more for males. Thus, athletes prone to experiencing distress and being less vigilant may self-handicap if they fear failure in an upcoming event. Sport psychologists should consider assessing personality, especially negative emotionality and conscientiousness, and monitoring emotions to minimize SH behaviors and potentially improve performance and well-being in athletes.

2627 Board #291 May 31 9:30 AM - 11:00 AM
Exercise Addicted Subject Show Positive Affective Responses Both Moderate And Intense Exercise

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The possible differences in affective responses to moderate and intense exercise in exerciser's addiction subjects are not reported in the literature and this result can help elucidate the reasons for the deployment exercise dependence. **Purpose:** Investigate the affective responses of exercise addiction subjects and controls in moderate and intense exercise. **Methods:** 17 male subjects (34.35 ± 5.70 yrs; 73.15 ± 9.36 kg; 1.75 ± 0.07 m; 24.78 ± 2.51 kg/m²; 13.17 ± 4.73 %FatMass), were distributed into a control group ($n = 10$) composed of runners without exercise addiction symptoms and an exercise addiction group ($n = 7$) composed of runners with exercise addiction symptoms. The subjects were submitted to two treadmill tests separated by 7 days: 1) 60%Vpeak; 2) 85%Vpeak. For these conditions, the subjects answered a Subjective Exercise Experiences Scale (SEES) in the following time-courses: baseline (B), immediately after (IA) and 30 minutes after finishing of the exercise (R). To evaluate the affect during effort, a Feeling Scale was recorded at last minutes of exercise to both intensities. The data were compared by two-way ANOVA with post-hoc Duncan test, with significance $p \leq 0.05$. The protocol was approved by Unifesp Ethics Committed (#2.096.523). **Results:** At 60%Vpeak, we not observed differences in SEES scale. At 85%Vpeak, the Fatigue subscale show similar responses between the groups, were an increased in IA when compared to B ($p < 0.001$ to both). The feeling Scale results show that to control group, when 60%Vpeak was compared with 85%Vpeak intensity, the first one intensity was pleasurable, while the second one was unpleasurable (3.10 ± 2.33 vs -1.90 ± 3.51 ; $p = 0.002$ respectively). To the exercise addiction group, both intensities was classified as pleasurable (3.00 ± 1.82 vs 1.00 ± 4.43 ; $p = 0.13$). **Conclusion:** The data suggest that both exercise intensities moderate and intense (independent of fatigue state) are capable to promote well-being and pleasure in exercise addiction subjects, while to the controls group, feeling pleasure was observed only in moderate intensity. **Financial Support:** AFIP, CAPES (001 financial code), CNPq (400129/2016-7).

2628 Board #292 May 31 9:30 AM - 11:00 AM

Student-athletes' Experience And Perception On Migration In Dual Career: The Amid Project

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Migration across borders in the European Union (EU) can promote beneficial career development in many elite sports. For student-athletes pursuing tertiary education the relocation of residence could involve challenges due to the variety of national policies. To overcome drop outs and decremental performances in Dual Career (DC) migration, the identification of the challenges faced by migrating student-athletes is a crucial aspect. **PURPOSE:** To investigate student-athletes' perception on current conditions, challenges, and recommendations on migration. **METHODS:** A 50-item questionnaire, assessing demographic data, history and progress in DC, experiences in migration, support measures and their perceived effect, needs and recommendations, was developed, validated, and filled in by 223 student-athletes. Differences in quantitative data from 5-point-Likert scales were tested by means of Kruskal-Wallis ($p < .05$). **RESULTS:** 52% of the sample (age=23.5±4.1 yrs, sports practice=16.8±8.2 hrs/week) already relocated for the academics (26%), sports (33%), or both (41%) paths of their DC and could report their specific experiences in support measures and challenges ($\chi^2(4)=2.11$, $p=.72$). Among these, 49% received financial support ($\chi^2(4)=19.57$, $p<.001$), 38% of it from the family. Decreases in performance were found in sports when relocating for academic reasons (2.2±1.1 points; $\chi^2(4)=6.65$, $p=.08$) and in academics when relocating for sports (3.3±1.3 points; $\chi^2(4)=2.25$, $p=.69$). Difficulties emerged in attendance at university (69%; $\chi^2(4)=15.55$, $p<.01$), exam (44%; $\chi^2(4)=2.19$, $p=.70$) and training (37%; $\chi^2(4)=3.36$, $p=.50$) schedule. **CONCLUSIONS:** The high percentage of relocating student-athletes confirms the relevance of mobility in DC. Academics and sports can equally be the reason for relocation. Institutions in both fields should be aware and supportive in DC migration, especially due to a possible decrease in performance. In contrast with the targeted ideals of EU, the financial contribution from parents indicates that DC migration could be feasible mainly for wealthy parts of the society. However, major difficulties appeared also in non-financial issues that can be tackled by enhanced organization, tutoring, and cooperation between institutions. The study was co-funded by the Erasmus+ Programme

2629 Board #293 May 31 9:30 AM - 11:00 AM
Cortisol and Testosterone Responses in Chess Players during an International Chess Tournament

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Chess is a strategic atypical sport and a highly cognitive task demanding mental and physical alertness, in which players are deeply committed and experience intense emotions. Evidence supports that chess elicits physiological responses and induces stress-associated hormonal changes.

PURPOSE: This study investigated potential changes in free salivary cortisol and testosterone in chess players during a tournament. **METHODS:** Thirty male active chess players participated in the study (age: 43.2±12.4 yrs, Elo score: 1903.2±341.5), competing in a 9-round chess tournament (Swiss pairing system). Unstimulated mixed saliva samples were collected in salivate swabs at 3 time points: baseline, after the 2nd and 3rd round and, for the 10 finalists also after the 6th and 7th round (19:00-23:25 pm.). The saliva samples were analyzed for cortisol and testosterone by ELISA and student T-test was used for statistics. **RESULTS:** Testosterone levels exhibited a trend of decrease, from 77.7±105.1 ng/ml at baseline to 38.7±46.6 ng/ml after the 2nd and 3rd round, to 25.3±20.7 ng/ml after the 6th and 7th round, however without reaching statistical significance ($p>.05$). Cortisol levels increased from 4.4±3.3 ng/ml at baseline to 7.6±6.8 ng/ml after the 2nd and 3rd round in all participants ($p<.05$). In the 10 finalists, however, cortisol showed no significant changes through the 3 time points (from 3.5±2.8 ng/ml to 6.0±4.8 ng/ml to 5.3±2.9 ng/ml; $p>.05$). Significant percentage changes of cortisol were found compared to baseline (277±384.5% ng/ml and 207.6±113.7% ng/ml; $p<.01$). Interestingly, in the finalists, cortisol to testosterone

ratio exhibited a significant increase only after the 2nd and 3rd round, from 0.1±0.1 to 0.4±0.3 ($p<.01$), contrary to the all participants' ratio, which declined from 1.4±6.8 to 0.4±0.3 ($p>.05$).

CONCLUSIONS: Our findings indicate that testosterone levels are not significantly affected by the stress of the game in contrast to cortisol levels, which are significantly increased. Interestingly, although cortisol levels of top chess players (finalists) did not show significant changes during the tournament, however their cortisol to testosterone ratio was elevated after the first rounds, implying an increased physiological stress of these players at the beginning of the tournament.

2630 Board #294 May 31 9:30 AM - 11:00 AM

Association Between Menstrual Dysfunction, Bone Stress Injuries and Risk for Disordered Eating in Female Collegiate Athletes

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(No relevant relationships reported)

Normal 0 false false EN-US X-NONE X-NONE /* Style Definitions */ table.MsoNormalTable {mso-style-name:"Table Normal"; mso-tstyle-rowband-size:0; mso-tstyle-colband-size:0; mso-style-noshadow:yes; mso-style-priority:99; mso-style-parent:""; mso-padding-alt:0in 5.4pt 0in 5.4pt; mso-para-margin-top:0in; mso-para-margin-right:0in; mso-para-margin-bottom:8.0pt; mso-para-margin-left:0in; line-height:107%; mso-pagination:widow-orphan; font-size:11.0pt; font-family:"Calibri", sans-serif;} **Purpose:** The purpose of this study is to evaluate the association between menstrual dysfunction (MD), bone stress injuries (BSI) and risk for disordered eating (DE) in female collegiate athletes. **Methods:** 79 division III collegiate female athletes, of all fields of sport, participated in a retrospective cross-sectional questionnaire where self-reported menstrual history, eating behaviors, and history of musculoskeletal injury data were collected. **Results:** 12.6% of athletes reported MD, 16.5% of athletes were found to be at risk for DE, and 17.9% reported a history of BSI. Of the 14 athletes that had a BSI, 20% (n=2) also had the presence of oligo/amenorrhea, although results were not significant. Of athletes who had DE, 30.8% (n=4) of athletes also reported having oligo/amenorrhea ($p=0.05$). 19.1% (n=9) of athletes who reported ever having used oral contraceptive pill (OCP) also reported having a BSI. 21.2% (n=11) of athletes that have ever used any hormonal contraceptive method (n=52) also reported having a BSI, however no significant difference existed between the two groups ($p=0.297$). **Conclusion:** Our data indicates one-fifth of division III female athletes with a history of MD also report a history of BSI. The statistically significant elevated risk for MD with DE observed adds to the literature demonstrating a direct correlation between triad risk factors in division III athletes. Comprehensive and structured screening methods for triad-related symptoms across all division athletics will help to prevent long-term health consequences. **Key Words:** Menstrual dysfunction, bone stress injuries, disordered eating, female athlete triad, collegiate, female athletes. <!--EndFragment-->

2631 Board #295 May 31 9:30 AM - 11:00 AM

Risk Of Burnout Syndrome In College Athletes As A Predictor Of Anxiety And Depression

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(No relevant relationships reported)

PURPOSE: To identify the association between the risk of suffering Burnout syndrome with the presence of anxiety and depression.

METHODS: 403 college athletes from a high-performance program were evaluated. Trained psychologists applied a psychometrical battery conformed by two scales: Goldberg's Anxiety and Depression scale (two subscales with 9 questions each, that results in "With/Without anxiety" and "With/Without depression") and Sport Burnout Inventory - Reviewed (19 questions and 3 sub-scales: Emotional Exhaustion, Depersonalization and Reduced Personal Realization; it brings four possible conclusions: "Low Risk", "Moderated Risk", "High Risk" and "With Burnout"). A logistic regression analysis was performed to predict the presence of anxiety or depression depending on the risk of Burnout syndrome existence.

RESULTS: The logistic regression model was statistically significant for some of the classifications in the Burnout inventory. For anxiety, Depersonalization was the only dimension with a significant association. Subjects with "Moderated risk" showed a higher probability of suffering anxiety ($p=0.013$). On the other hand, all three dimensions were significantly associated with a higher risk of presenting depression problems. Emotional Exhaustion ($p=0.009$) and Depersonalization ($p=0.007$) qualified as "Moderated risk" showed high probabilities of depression. Furthermore, Emotional Exhaustion "High risk" rates were also associated with depression scores ($p=0.045$). Finally, Reduced Personal Realization was associated with presenting this problem when "High risk" was classified ($p=0.005$).

CONCLUSIONS: Subjects who reported any risk of suffering Burnout syndrome were more prone to presenting depression but no anxiety. Evaluating the risk of

suffering Burnout Syndrome in college athletes could be a good way to predict the possibility of having depression problems. Similar studies are suggested to corroborate these results.

Table. Association between Burnout Syndrome ranges and anxiety and depression presence.								
	Anxiety				Depression			
	Low risk	Medium risk	High risk	With BO	Low risk	Medium risk	High risk	With BO
EE	1 (Reference)	1.13 (0.71 - 1.80)	1.89 (0.94 - 3.83)	2.27 (0.67 - 7.67)	1 (Reference)	1.84 (1.17 - 2.89) †	2.06 (1.02 - 4.17)*	1.97 (0.59 - 6.65)
D	1 (Reference)	4.43 (1.36 - 14.38)*	-§	-§	1 (Reference)	8.11 (1.79 - 36.72) †	-§	-§
RPR	1 (Reference)	1.49 (0.94 - 2.38)	1.79 (0.87 - 3.69)	1.34 (0.53 - 3.41)	1 (Reference)	1.11 (0.70 - 1.75)	2.99 (1.40 - 6.43) †	0.96 (0.38 - 2.43)

Data expressed as odds ratio (95% confidence intervals). BO: Burnout; EE: Emotional exhaustion; D: Depersonalization; RPR: Reduced personal realization. * p<0.05. † p<0.01. § The analysis couldn't be done because of the small sample size in this category.

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Board #296

May 31 9:30 AM - 11:00 AM

Relationships between Perceived Coaching Behaviors, Competitive Anxiety, and Athlete Burnout

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Previous studies found psychological and situational factors were related to athlete burnout, and competitive anxiety in sports could have detrimental effects on performance and significant relationship with burnout in athletes. Athletes' perceptions of coaching styles were associated with competitive anxiety and athlete burnout; however, limited research has investigated the overall relationship.

PURPOSE: to investigate the relationship between perceived coaching behaviors, competitive anxiety, and athlete burnout

METHODS: A total of 376 collegiate athletes from 11 different sports, whose ages ranged from 20 to 25 years old (296 males and 80 females; *Age* = 21.23yrs, *SD* = 1.09), completed a battery of questionnaires: a demographic questionnaire Sport Climate Questionnaire, Controlling Coach Behaviors Scale, Sport Anxiety Scale-2, and Athlete Burnout Questionnaire. Descriptive statistics were calculated, and structural equation modeling was conducted to test the hypothesized model. The bootstrap technique was used to test the mediation effect, and item and construct parceling techniques were utilized to increase the stability of the parameter estimates.

RESULTS: The hypothesized model presented an acceptable fit to the data. Specifically, $\chi^2(48) = 137.15$ ($p<.001$), CFI = .97, TLI = .96, SRMR = .04, and RMSEA = .06 with 90% CI [.05, .08]. Autonomy-supportive coaching was negatively related to athlete burnout ($\beta = -.18$), whereas controlling coaching and competitive anxiety were positively related to athlete burnout ($\beta = .33$ and $.35$, respectively). Intriguingly, only controlling coaching were significantly related to competitive anxiety ($\beta = .35$). The indirect path from controlling coaching to athlete burnout via competitive anxiety was significant ($\beta = .12$).

CONCLUSION: The magnitude of the direct effects indicated controlling coaching behaviors more influenced athlete burnout than autonomy-supportive coaching behaviors. The findings suggest that coaches should understand the importance of the athletes' perception of their coaching behaviors and the effect of coaching behaviors on competitive anxiety and burnout.

2633

Board #297

May 31 9:30 AM - 11:00 AM

Psychophysiological Stress Indicators In College Athletes: Comparison Of Physiological Responses With Different Types Of Stressors

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(No relevant relationships reported)

PURPOSE: To compare the physiological responses to different types of stressors in college athletes.

METHODS: 20 male college athletes (17 to 23 y) were evaluated. Psychophysiological assessment of stress was done by a ProComp™ Infiti Biofeedback System. Physiological responses were recorded and categorized as "stressed" (Heart Rate [HR] >90 b/min, Electromyography [EMG] >5 μ V, Skin Conductance [SC] >5 uS and Respiration [Resp] >16 br/min) and (not stressed);

The evaluation consisted of 7 stages lasting 2 min each (BASELINE, exposed to a PHYSIOLOGICAL stressor [unpleasant sounds], 1st REST, exposed to a COGNITIVE stressor [mathematical task], 2nd REST, exposed to an EMOTIONAL stressor [talk about a stressful memory] and 3rd REST). A statistical analysis was carried out with X², Phi coefficient, and Cochran's Q test.

RESULTS: Significant changes were found in the proportion of "stressed" subjects in the physiological responses of HR and SC, and a trend towards significance in EMG throughout the evaluation. The indicators that most approached the expected response (increase with stressor and decrease at rest) during the evaluation were HR and SC; EMG tended to approach. The significant differences observed in the proportion of subjects "stressed" by stages and by indicators were in BASELINE, 1st REST and 2nd REST, and with a trend towards significance in COGNITIVE, being Resp the indicator that showed the highest proportion. The effect size for significant differences was moderate to high (Table)

CONCLUSIONS: The subjects obtained expected responses (increase/decrease) over time in most of the indicators, except in Resp, so in our sample, it was not an indicator related to stress. The proportion of subjects "stressed" during stressing stages were not significant but were different during rests, which may mean that the greater proportion of subjects increased their physiological responses in a similar way to stressors but could recover differently during rests.

Table. Proportion of "Stressed" subjects by physiological response and stage.								
	Baseline	Physio-logical	1st rest	Cog-nitive	2nd rest	Emo-tional	3rd rest	p-value (Cochran's Q)
HR	2 (10%) a	7 (35%)	5 (25%) ab	18 (90%)	3 (15%) a	9 (45%)	6 (30%)	<0.001
EMG	10 (50%) bc	7 (35%)	13 (65%) b	14 (70%)	8 (40%) ab	12 (60%)	10 (50%)	0.053
SC	3 (15%) ac	5 (25%)	3 (15%) a	12 (60%)	11 (55%) b	13 (65%)	12 (60%)	<0.001
RESP	11 (55%) b	10 (50%)	10 (50%) ab	11 (55%)	10 (50%) ab	15 (75%)	10 (50%)	0.632
p-value (X ²)	0.002	0.430	0.004	0.082	0.048	0.267	0.283	
Phi	0.430	0.186	0.406	0.289	0.315	0.222	0.218	

Data expressed as frequencies (%), unless otherwise stated. Different letters denote significant differences between physiological responses within each stage ($p<0.05$). HR: Heart rate; SC: Skin conductance; RESP: Respiration; EMG: Electromyography.

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Board #298

May 31 9:30 AM - 11:00 AM

The Effect Of Crossfit On Self-talk And Goal Setting In At-risk Youth: A Pilot Study.

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At-risk youth experience limited support, lack consistency, and depend on governmental programs and could benefit from structured programs. CrossFit participants are encouraged to discuss workout goals and strategies and are reminded about workout efficiency. **PURPOSE:** Examine the effects that CrossFit has on the use of self-talk and goal setting techniques. **METHODS:** Sixteen participants identified as at-risk (e.g. living in single-parent homes or in low-income environments) participated in a CrossFit program. Participants ranging from 11 to 14 years old completed 12 weeks of CrossFit for one hour, three days per week. Participants completed two Likert-type questionnaires (Goal Setting questionnaire and Self-talk questionnaire). Survey scores served as dependent variables. Paired samples t-tests were calculated to examine changes over time on both surveys. All statistical analyses were conducted using SPSS 25.0 (IBM, Armonk, NY). Significance level was set *a priori* at 0.05. **RESULTS:** 16 participants (84%) completed both pre and post Goal Setting surveys, while 10 (52%) completed both pre and post Self-Talk questionnaire surveys. Significant differences were found between scores for total score (Mean Pre: 14.4 \pm 2.9, Mean Post: 17.9 \pm 2.5; $t_{(1,15)} = 3.13$, $p = 0.007$); question 2, "Once I set a goal, I don't give up until I achieve it" (Mean Pre: 1.4 \pm .13, Mean Post: 2.2 \pm .24; $t_{(1,15)} = 2.42$, $p = 0.029$) and question 6 "When I set a goal, I think about what I need to do to achieve that goal" (Mean Pre: 2.9 \pm .23; Mean Post: 3.7 \pm .70; $t_{(1,15)} = 2.82$, $p = 0.013$) with scores improving after the intervention. No significant differences were found for the Self-Talk questionnaire ($n=10$, total score ($p>0.05$)). **CONCLUSION:** This pilot study provides preliminary evidence that CrossFit for at-risk youth enhances goal setting skills. The introduction of CrossFit classes appears to create structure for goal setting as strategies/goals are discussed before workouts and accomplishments/ results are recorded and reviewed. However, it does not appear that CrossFit increases

self-talk which could be due to no formal instruction in the current format of CrossFit classes. Future investigations should include impacts of self-talk and goal setting with intentional training, a larger participant pool, and qualitative methods.

2635 Board #299 May 31 9:30 AM - 11:00 AM
Preliminary Evidence Of A Relationship Between Injury And Sport Camera Use In Winter Sliding Sports

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PURPOSE: The accessibility of digital technologies has led to an increased use of video cameras in sliding winter sports. However, very little is known on the risks associated with the use of such equipment. In other contexts, camera use was associated with a social facilitation effect involving an increase in performance (Yu et al., 2015). In winter sliding sports like snowboard and alpine skiing, the culture is characterized by a valorization of risk taking (Anderson, 1999). This effect could translate in greater risk taking when a camera is around (Rodrigue et al., 2012). The aim of this study was to explore the relationship between camera use and injury risk in winter sliding sports, while considering psychosocial factors associated with injuries including age, sex, perceived skill level, intentional risk taking and personality traits (impulsivity and sensation seeking). **METHODS:** The study was a self-reported follow-up survey conducted online among Canadian winter sliding sports athletes before and after a winter ski season within an interval of 4 months. **RESULTS:** Among the 224 adolescents and adults (121 men and 103 women) who completed the surveys, 32.6% were aged 14-25 years, 32.3% aged 26-25 years and 36.2% aged 36 years +. Descriptive statistics indicates that 37.1% were filmed during sports practice at least once during past 12 months prior to the study and 42.0% were filmed at least once during the follow-up ski season. Among them, 25.7% reported that they take more risks when they are filmed "sometimes", "often" or "always". A logistic regression analysis predicting the occurrence of an injury by the end of the ski season indicates that camera use during the ski season is significantly associated with injury risk ($OR = 0.25, p < 0.001$) even after including psychosocial factors usually associated with injury risk in the model, including intentional risk taking, perceived skill level and sensation seeking also being significant predictors of injury. **CONCLUSIONS:** These results suggest a possible injury risk associated with the use of a camera on the slopes, partially explained by a social facilitation effect, but it is unclear at this moment if this risk could also involve the camera itself depending on the type of use (i.e. on a selfie stick). These results should be supported by objective data from an experimental design.

2636 Board #300 May 31 9:30 AM - 11:00 AM
Cross-cultural Invariance Of The Mental Toughness Index Among American And Mexican Athletes

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(No relevant relationships reported)

The popularity of *mental toughness* (MT) in English-speaking countries is well recognized. However, its worldwide cultural relevance remains to be fully disclosed. Gucciardi et al. (2016) and Morgan et al. (2018), using the Mental Toughness Index (MTI), reported intra-cultural invariance of MT in Australasia and in the U.S. and Greece, respectively. To date, there has been no effort to unearth the degree of the universality of the term between Mexico and USA via MTI.

PURPOSE: To examine the invariance of MT across two different cultural groups of athletes and to further validate MTI.

METHODS: The MTI was completed by 97 Mexican and 173 US athletes. The MTI consisted of eight items with a seven-point response scale. The U.S. samples consisted of roughly half male and half female athletes, whereas the Mexican was predominantly male (64%). The U.S. sample consisted of athletes from a number of sports, such as American football, basketball, baseball, and softball. Half of the Mexican sample reported playing soccer and almost all other sports had fewer than five athletes. Invariance testing was conducted using multiple group confirmatory factor analysis with increasingly restrictive models. We first fitted a unidimensional model within each sample to ensure good model-data fit. Then we estimated configural (equal number of dimensions), metric (configural + equal loadings), and scalar invariance models (metric + equal intercepts). Scalar invariance is the minimum type of invariance to infer cross cultural equality. To evaluate the model-data fit, we used the comparative fit index (CFI), root mean square error of approximation (RMSEA), and the differences between these indices for increasingly restrictive models.

RESULTS: The model-data fit in both samples was very good ($CFI_{Greeks} = .984$, $RMSEA_{Greeks} = .08$; $CFI_{Mex} = .998$, $RMSEA_{Mex} = .03$). The scalar invariance model was selected as the best fitting ($CFA_{scalar} = .908$, $RMSEA_{scalar} = .08$) but with a slightly different item intercept for two items (Item 4, < .5; Item 7, < .3).

CONCLUSION: These analyses support partial scalar invariance of MT. As such, the analysis establishes a common metric of MT across samples, which allows comparisons to be made on their MT scores.

2637 Board #301 May 31 9:30 AM - 11:00 AM
Relationships between Aggression and Head Impact Kinematics in Ice Hockey

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Sustaining head impacts in sport regularly may be damaging to long-term neurological health. Further, some research has suggested a relationship between sports aggression and concussion, therefore, being able to identify players at-risk of sustaining these head impacts may be beneficial in monitoring their safety on ice.

PURPOSE: To examine relationships between player self-reported aggression in ice hockey and head impacts sustained in a collegiate club season.

METHODS: Nineteen collegiate male ice hockey (19.9±1.2 years old, 1.8±0.06 m, 78.5±5.7 kg) players completed the Competitive Anger and Aggression Scale (CAAS), a valid 12-item survey used to evaluate anger and aggression during sport competition. Penalty minutes (PM) and games played (GP) statistics were taken from the official game records. Head impact kinematics were recorded via tri-axial accelerometers (Triax, Nowalk, CT) that each player wore for games/practices. Spearman correlation was performed to examine relationships between CAAS scores, PM, GP, and head impact kinematic variables (number of impacts, mean linear and rotational acceleration, and cumulative linear acceleration).

RESULTS: Neither CAAS scores (mean anger: 26.8±4.9, aggression: 22.2±7.3) nor PM (mean 20.9±22.7, range: 0-95) were significantly related to any other variables. GP was significantly correlated with number of impacts ($r=0.606, p=0.006$), mean rotational acceleration ($r=0.583, p=0.009$), and cumulative ($r=0.542, p=0.02$). Mean number of impacts was 71.5±51.6 (range: 6-168); mean linear and rotational acceleration were 36.8±3.8g and 3.5±0.7 krad/sec².

CONCLUSIONS: The main finding is no relationship between self-reported anger and aggression during sport and/or sustaining penalty minutes and head impact kinematics, which suggests that hockey athletes who play with more intensity do not necessarily sustain more head impacts while playing. Unsurprisingly, GP was related to impacts, suggesting that more playing time is related to sustaining more and/or greater head impacts. CAAS and PM as markers of playing aggression may not be helpful in determining athletes who sustain more head impacts.

2638 Board #302 May 31 9:30 AM - 11:00 AM
Iron Supplementation and the Female Athlete Triad in High School Distance Runners

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(No relevant relationships reported)

PURPOSE: The female athlete triad, defined as decreased energy availability, menstrual changes, and low bone mineral density (BMD), is common in female high school distance runners. Previous research has shown that the Triad and iron deficiency are interrelated. However, there has been no data indicating how the relationship between female athlete triad, iron deficiency, and iron supplementation presents clinically in this population.

METHODS: 38 female, high-school aged middle and long-distance runners were recruited through social media, coach contact, or direct study outreach. Evaluation included: a validated survey examining components of disordered eating (DE) and menstrual irregularities, height and weight measurements, serum lab draws (ferritin, 25-hydroxy vitamin D, estradiol, IGF-1, free T3), and dual-energy x-ray absorptiometry (DXA) scan to evaluate BMD. The Female Athlete Triad Cumulative Risk Assessment Score was used to calculate a risk score on each athlete measured by DE, age of menarche, menstrual irregularities (amenorrhea or oligomenorrhea), DXA BMD, and number of bone stress injuries. Statistical method used was Mann-Whitney U tests. P-values less than 0.05 were considered statistically significant.

RESULTS: Participants had an average ferritin of 31.0 (SD=17.6). The average cumulative risk score was 2.76 (SD=1.79), i.e. moderate risk. Of the individual components of the triad, 76% of runners displayed disordered eating/eating disorder, 22% had delayed menarche, 19.4% oligomenorrhea, 25% amenorrhea, and 37% had lumbar spine z-scores of <-1. Forty three percent of runners used iron supplementation, and serum ferritin was increased in the group when compared to

the non-supplementing athletes ($p=0.067$). The cumulative risk score in runners supplementing with iron was 3.5, while the non-supplementing group had a risk score of 2.5 ($p=0.093$).

CONCLUSIONS: Findings show that high school-aged female distance runners possess multiple components of the female athlete triad, putting them at greater risk for sustaining a bone stress injury. Runners supplementing with iron have an expected increase in ferritin iron levels compared to the non-supplementing group, however they also have increased female athlete triad risk scores compared to non-supplementing counterparts.

E-44 Free Communication/Poster - Immunology III

Friday, May 31, 2019, 7:30 AM - 12:30 PM

Room: CC-Hall WA2

2639 Board #303 May 31 11:00 AM - 12:30 PM

Effect of Competitive Training on Antiviral Immune Activity in Collegiate Gymnasts

Jessica Alley, Hilary Green, Laurel Smeins, Matt Jefferson, Ruth Litchfield, Marian Kohut. *Iowa State University, Ames, IA.* (Sponsor: Warren Franke, FACSM)

(No relevant relationships reported)

Regular moderate exercise has numerous health benefits, including positive effects on immune function, although periods of intense training may increase susceptibility to respiratory tract pathogens such as influenza virus. **PURPOSE:** To determine the effect of intense athletic training on the antiviral immune response profile and to examine the effect of ingestion of eggs on this response. **METHODS:** Female participants from a Division I varsity gymnastics team were recruited and either consumed whole eggs daily (E ; $n=7$) or maintained their normal diets (NE ; $n=6$) for the duration of the study. Blood was collected at three time points: before the high intensity pre-season training began ($T1$), one month into pre-season ($T2$), and two months after $T2$ at the end of pre-season ($T3$). Peripheral blood mononuclear cells (PBMCs) were isolated from whole blood, cultured ex vivo, and challenged with influenza A/PR/8/34 for 24 hours. Cell supernatants were analyzed using a multiplex cytokine array assay. **RESULTS:** Statistical analyses revealed lower levels of cytokines involved in both innate ($IL-1\beta$, $IL-6$, $TNF\alpha$) and T cell-mediated immunity ($IFN\gamma$, $IL-2$, $IL-7$) produced in response to virus stimulation at $T2$ (6.8, 87.3, 351, 731, 82.0, and 3.2 pg/mL, respectively) compared to $T1$ (12.1, 317, 534, 2469, 311, and 5.5 pg/mL, respectively) and $T3$ (17.4, 268, 712, 3018, 212, and 5.1 pg/mL, respectively; $p \leq 0.05$, paired t-tests). PBMCs from gymnasts who became ill during the study period ($n=3$) produced less $IFN\alpha$ (427 vs. 1442 pg/mL) at $T2$ and more $sCD40L$ (11.6 vs. 5.8 pg/mL) at $T3$ than those who remained healthy ($p \leq 0.05$, independent t-tests). When egg consumption was examined, a mixed ANOVA with repeated measures revealed a significant treatment by time interaction and follow-up post hoc tests identified differences in inflammatory cytokine production at $T3$ (12.3 vs. 23.3 and 496 vs. 963 pg/mL for $IL-1\beta$ and $IL-6$, respectively, in E vs. NE ; $p \leq 0.05$). **CONCLUSION:** These preliminary data suggest that, during intense training, both innate and adaptive antiviral defenses are impaired but that egg consumption may attenuate training-associated inflammation. Increases in immunosuppressive proteins, such as $sCD40L$, may also increase susceptibility to illness in athletes. Funding was provided by the Iowa Egg Council and Egg Nutrition Center.

2640 Board #304 May 31 11:00 AM - 12:30 PM
Treadmill Running Attenuates Experimental Colitis in Wild-Type Mice Fed High-Fat Diet and Dextran Sulfate Sodium

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(No relevant relationships reported)

Purpose: To investigate the therapeutic effect of treadmill running against ulcerative colitis induced by high-fat diet (HFD) and mild dextran sulfate sodium (DSS) in wild-type (WT) mice.

Methods: At age of 10 weeks, C57BL/6 male mice were assigned to either standard chow (SC, $n=10$) or HFD ($n=10$) or HFD+DSS (HFD+DSS, $n=10$) or HFD+exercise training+DSS (HFD+EX+DSS, $n=10$). Mice in the HFD+EX+DSS group was subjected to a moderate treadmill running with 50 minutes per session and 5 days per week for 11 weeks. Mice in the DSS groups were fed with DSS (2% w/v) in the drinking water during the last 3 weeks of the 11-week treatment period. Hepatic histology, hepatic genes of inflammation and fibrosis, and tight junction proteins in colon were assessed as primary outcomes.

Results: HFD+DSS exacerbated hepatic steatosis in conjunction with greater weight loss, shortened colon length ($p=0.02$), enlarged spleen ($p=0.03$), and greater infiltration

of neutrophils and monocytes into circulating blood ($p<0.001$ & $p<0.001$, respectively) and colon ($p<0.001$ & $p<0.001$, respectively) compared to HFD alone. The pathology of HFD+DSS-induced ulcerative colitis was accompanied by upregulated hepatic inflammatory and fibrosis genes such as $Ly6d$ ($p=0.020$), $Lgals$ ($p=0.021$), $Timp-1$ ($p<0.001$), $Col1a1$ ($p<0.001$) and increased serum inflammatory markers such as $IL-6$ ($p<0.001$), $IL-17a$ ($p<0.001$), $GRO-\alpha$ ($p=0.03$), and $MCP-1$ ($p=0.42$), as well as downregulated colon tight junction proteins such as $ZO-1$ ($p=0.01$) and occludin ($p=0.01$). However, treadmill running alleviated the severity of colitis phenotypes induced by HFD+DSS treatment via suppression of upregulated hepatic inflammatory and fibrosis genes and stimulation of downregulated colon tight junction proteins.

Conclusion: The current findings suggest that exercise training alleviates the severity of HFD+DSS-induced ulcerative colitis by modulating genes of hepatic inflammation and fibrosis and colon tight junction proteins in WT mice.

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2641 Board #305 May 31 11:00 AM - 12:30 PM

Effect of MCT-1 Polymorphism on Lactic Acid Clearance in Resistance Trained Females

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(No relevant relationships reported)

The monocarboxylate transporter one (MCT-1) protein is a carrier protein that plays a vital role in cellular respiration. MCT-1 is known to aid in the transportation of carboxylates, including lactic acid, out of the blood stream and back into muscle tissue. There is a common single-nucleotide polymorphism (SNP) in the MCT-1 gene (T1470A)

that is believed to play a role in the clearance rate of circulating lactic acid following intense exercise. **PURPOSE:** The purpose of this study was to investigate the role of the MCT-1 SNP on lactic acid production and clearance rates in resistance trained, females. **METHODS:** Twenty-one female participants (age= 20.81 \pm 2.06 years) who resistance train three or more times per week were recruited for this study. Lactic acid measurements were taken pre-test and 0, 10, 20, 30, 40 minutes post-test. In order to induce lactic acid production, a standard thirty second Wingate test was used. The MCT-1 gene of each participant was isolated from saliva and amplified using Polymerase Chain Reactions (PCR). Once isolated and amplified, each participants MCT-1 gene was sequenced using Next Generation Sequencing. A two-way mixed factorial ANOVA [genotype (AA,TA,TT) x time (pre, 0, 10, 20, 30, 40)] was used to examine interactions between genotype and time. Three follow-up repeated measures ANOVA's (individual groups x time) were utilized to examine how each group contributed to this interaction. Alpha values were set at .05 and Bonferroni corrections were used in all analyses. **RESULTS:** Further, a significant interaction (genotype x time) was observed ($p=0.001$). Follow-up ANOVA indicated that each had a main effect for time ($p=0.001$ for each group). Additionally, the AA group cleared lactic acid at a significantly faster rate ($p=0.01$) than the TT group for the 10-20 minute time period. **CONCLUSION:** These results indicate that the MCT-1 SNP likely plays a role in lactate clearance in resistance trained females.

2642 Board #306 May 31 11:00 AM - 12:30 PM

Exercise Preconditioning-Induced Modification of Gut Microbiota Increases Survival in Cecal Ligation and Perforation (CLP)-Induced Sepsis

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(No relevant relationships reported)

PURPOSE: To investigate whether exercise preconditioning-induced modification of gut microbiota increases survival in cecal ligation and puncture (CLP)-induced sepsis.

METHODS: C57BL/6N male mice at age of 4 weeks were randomly assigned to either control ($n=10$) or exercise preconditioning ($n=10$). Mice in the exercise group were subjected to an 8-week-high-intensity treadmill running. Prior to sepsis, the effect of exercise preconditioning on gut microbiota was explored by 16S ribosomal RNA amplification sequencing. Survival probability, organ damage, and pro- and anti-inflammatory cytokines were assessed to investigate whether or not exercise preconditioning-induced changes in gut microbiota modulate host response to CLP-induced sepsis. **RESULTS:** Along with increased β diversity, exercise preconditioning induced the modification of gut microbiota at species level dominated by the phyla *Bacteroidetes*, *Firmicutes*, and *Verrucomicrobia* and to a less extent by the phylum *Cyanobacteria*. Preconditioned mice had higher survival ($p<0.05$) and less organ damage in sepsis compared to control mice. At 8-hr post-sepsis, the preconditioned mice had lower peritoneal interleukin (IL)-1 β ($p=0.020$) and IL -6 ($p<0.001$) but higher peritoneal interferon (IFN)- γ ($p=0.002$), IL -10 ($p<0.001$), and transforming

growth factor (TGF)-1 β ($p < 0.001$) compared to the control mice. In addition, the preconditioned mice has lower blood growth-regulated oncogene (GRO)- α ($p = 0.001$), monocyte chemoattractant protein (MCP)-1 ($p < 0.001$), macrophage inflammatory protein (MIP) 2 ($p < 0.001$), and tumor necrosis factor (TNF)- α ($p = 0.003$) compared to the control mice. At 20-hr post-sepsis, the preconditioned mice had lower peritoneal IL-1 β ($p < 0.001$) and IL-6 ($p < 0.001$) but higher peritoneal TGF-1 β ($p < 0.001$) in conjunction with higher blood IL-17A ($p = 0.002$) and TGF-1 β ($p = 0.029$) compared to the control mice. **CONCLUSIONS:** The current findings suggested that exercise preconditioning-induced modification of gut microbiota might contribute to increased survival in sepsis by modulating host response toward the establishment of a balance between pro- and anti-inflammation. Supported by the National Research Foundation funded by the Korean Government (NRF-2018R1D1A1B07048153 and NRF-2016R1A6A3A11932432).

2643 Board #307 May 31 11:00 AM - 12:30 PM
Impact of Fitness on Receptor Expression of Monocytes Cultured with Palmitate Following Acute Exercise

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(No relevant relationships reported)

A high-fat meal elicits acute pro-inflammation noted by lipemia and an increased expression in monocyte adhesion molecules. Few studies have investigated the effect of exercise as a potential method to reduce the deleterious postprandial immune response. **PURPOSE:** Therefore, the purpose of this study was to investigate the effect of exercise on the expression of adhesion receptors on lipid-exposed pro-inflammatory monocytes in fit and unfit females. **METHODS:** 5 fit (VO₂ peak ≥ 35 mL/O₂/kg/min) and 5 unfit (VO₂ peak < 30 mL/O₂/kg/min) females performed 30 min of moderate intensity (60% VO₂ peak) cycling. Blood samples were obtained pre-, immediately, 1hr, and 2hr post-exercise. Whole blood was stimulated with palmitate (10 μ g/mL) and cultured for 2 and 4 h at each timepoint. Monocytes were stained with antibodies against CD14 and CD16 to identify pro-inflammatory subsets. Additionally, antibodies against CD11c, CD36, CD62L, and VLA4 and were analyzed via flow cytometry. Post-exercise changes in monocyte receptor expression following incubation with palmitate were assessed by paired sample t-tests. **RESULTS:** Within intermediate monocytes, unfit females observed a significant change in VLA-4 with 4 h palmitate incubation at 1hr post-exercise (pre % change: -21.74 ± 20.53 vs. 1hr post % change: -6.98 ± 13.64 , $p = 0.04$). In non-classical monocytes, unfit females observed a significant change in CD11c with 2 h palmitate incubation at 2hr post-exercise (pre % change: -25.04 ± 19.85 vs. 2hr post % change: -3.36 ± 23.14 , $p < 0.01$). Fit females observed significant changes in non-classical monocyte receptor expression of both CD36 (pre % change: 2.20 ± 29.51 vs. post % change: -35.57 ± 27.23 , $p = 0.03$) and CD62L (pre % change: -21.47 ± 18.71 vs. 4.66 ± 4.71 , $p = 0.034$) incubated with palmitate for 4 h immediately post-exercise. **CONCLUSION:** The impact of fitness is highlighted by a decrease in CD36 and blunted decrease in CD62L in lipid-exposed non-classical monocytes following acute exercise in fit females. The VLA-4 and CD11c decrease observed in lipid-exposed pro-inflammatory monocytes of unfit females was blunted following acute exercise. Future research is warranted that investigates the impact of exercise and fitness on the monocyte adhesion cascade following consumption of a high-fat meal.

2644 Board #308 May 31 11:00 AM - 12:30 PM
Immunoregulatory Effects of Oat Avenanthramides during Downhill Running in Young Men and Women

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Reported Relationships: T. Zhang: Industry contracted research; PepsiCo & Ceapro Inc..

PURPOSE: Avenanthramides (AVA) are a group of di-phenolic acids found only in oats, providing antioxidant protection and inhibiting inflammation. Downhill running (DR), an eccentric exercise, activates a series of peripheral immune cells and inflammatory responses in the skeletal muscle. The objective of the study is to evaluate the effects of oat AVA supplementation on eccentric exercise-induced leukocytes changes in the blood of human subjects.

METHODS: 12 male and 12 female subjects were randomly assigned to high-AVA (H-AVA) or low-AVA (control) groups. Two treadmill-based DR sessions were separated by an 8-week washout period followed by 8-weeks of oat AVA supplementation by receiving two cookies containing high (206 mg/kg) or low (0 mg/kg) AVA daily. Blood samples were collected before DR and at various time

points (0, 4, 24, 48, and 72h) after DR. Granulocyte- and Granulocyte Macrophage-Colony Stimulating Factor (G-CSF and GM-CSF) were measured using multiplex immunoassays (R&D System). Peripheral blood leukocyte sub-populations were quantified using the flow cytometer (BD Accuri C6) and presented as percentage. Data were analyzed using repeated measures ANOVA.

RESULTS: DR increased plasma G-CSF at 0h and 4h post-DR ($P < 0.05$), with a significant interaction between oat supplementation and AVA dosage ($P < 0.05$). DR did not affect GM-CSF, but H-AVA showed a trend of lower GM-CSF at 24h post-DR ($P = 0.091$). H-AVA decreased DR-induced CD11b⁺CD45⁺ leukocytes by 15% at 0h and by 14% at 4h post-DR compared to control ($P < 0.05$, time \times AVA dosage). CD14⁺CD11b⁺CD45⁺ leukocytes was elevated at 4h post-DR ($P < 0.01$), but decreased by oat supplementation at pre- and 24h post-DR by 16% and 24% respectively ($P < 0.05$, time \times oat supplementation). H-AVA showed 52% higher CD56⁺ lymphocytes than control at 4h post-DR after supplementation ($P < 0.05$). DR significantly reduced CD56⁺CD16⁺ lymphocytes at 4h post-DR ($P < 0.05$) before oat supplementation, but increased by 36% in H-AVA compared to control at pre-DR after supplementation ($P = 0.070$).

CONCLUSIONS: High AVA supplementation inhibited DR-induced colony stimulating factors (G-CSF and GM-CSF) expression. While both dietary groups decreased circulatory monocytes (CD14) activation after DR, H-AVA inhibited neutrophils (CD11b) and increased NK cells (CD56) activations.

2645 Board #309 May 31 11:00 AM - 12:30 PM
Differential Natural Killer Cell Cytotoxicity Response To Post-Exercise Autologous Serum Based On Cytomegalovirus Serostatus

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(No relevant relationships reported)

Cytomegalovirus (CMV) is a beta-herpes virus present latently in most people worldwide. CMV decreases the exercise-induced mobilization of Natural Killer (NK) cells and lowers the post-exercise-increase in NK cytotoxic activity (NKCA), perhaps due to alterations in NK subsets. NKCA is also impacted by cytokines and stress hormones released into serum after exercise. Whether this effect is altered by CMV is not yet known.

PURPOSE: To determine the effect of exercise-induced changes in cell subsets, cytokines, and hormones on exercise-induced changes in NKCA in CMV+ and CMV- individuals.

METHODS: 13 physically active adults (7 women and 6 Men; age=31.9 \pm 7 years) cycled 30-min at 115% of their lactate threshold power. Peripheral blood was collected pre-, post-, and 1h post-exercise. Mononuclear cells isolated from pre-exercise blood were incubated with target cells (K562 or U266) in the presence of autologous serum from pre-, post- and 1h post-exercise for 4h. NKCA was calculated from number of lysed target cells. CMV serostatus was determined by ELISA. The effect of CMV and time on NKCA was assessed by linear mixed models.

RESULTS: Eight subjects were CMV+. 1h post-exercise autologous serum significantly enhanced NKCA per cell against U266 cells in CMV+ individuals (Pre vs. post vs. 1h post = 0.283 ± 0.053 vs. 0.331 ± 0.053 vs. 0.468 ± 0.053 , $p < 0.05$). Incubating pre-exercise NK cells with post-exercise or 1h post-exercise serum did not impact NKCA in CMV- individuals (Pre vs. post vs. 1h post = 0.367 ± 0.037 vs. 0.297 ± 0.037 vs. 0.397 ± 0.037 , $p > 0.05$).

CONCLUSIONS: CMV status impacted the ability of serum from the recovery from exercise to enhance NKCA/cell. Future experiments will identify whether CMV status impacts glucocorticoids and cytokines concentration in 1h post-exercise serum.

2646 Board #310 May 31 11:00 AM - 12:30 PM
Carbohydrate Intake Attenuates Post-Exercise Plasma Levels of Cytochrome P450-Generated Oxylipins

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Oxylipins are bioactive oxidation products derived from n-6 and n-3 polyunsaturated fatty acids (PUFAs) in the linoleic acid and α -linolenic desaturation pathways.

PURPOSE: This study determined if carbohydrate intake during prolonged and intensive cycling countered post-exercise increases in n-6 and n-3 PUFA-derived oxylipins. **METHODS:** The research design utilized a randomized, crossover, counterbalanced approach with cyclists (N=20, overnight fasted state, 7:00 am start) who engaged in four 75-km time trials while ingesting two types of bananas (Cavendish, mini-yellow), a 6% sugar beverage, and water only. Carbohydrate intake was set at 0.2 g/kg every 15 minutes, and blood samples were collected pre-exercise

and 0 h-, 0.75 h-, 1.5 h-, 3 h-, 4.5 h-, 21 h-, 45 h-post-exercise. Oxylipins were measured with the Vanquish UHPLC coupled to a Quantiva triple quadrupole mass spectrometer (Thermo Fisher Scientific, Haverhill, MA) using reference standards. **RESULTS:** Significant and substantial fold-increases (immediately post-exercise/pre-exercise) were measured for plasma levels of arachidonic acid, eicosapentaenoic acid (EPA), docosahexaenoic acid (DHA), and 43 of 45 oxylipins. Significant interaction effects (4 trials x 8 time points) were found for plasma arachidonic acid ($P<0.001$) and DHA ($P<0.001$), but not EPA ($P=0.255$), with higher post-exercise values found in the water trial compared to the carbohydrate trials. Significant interaction effects were measured for 12 of 45 oxylipins. The data supported a strong exercise-induced increase in plasma levels of these oxylipins during the water trial, with carbohydrate ingestion (both bananas types and the sugar beverage) attenuating oxylipin increases, especially those (9 of 12) generated from the cytochrome P-450 (CYP) enzyme system. These trials differences were especially apparent within the first three hours of recovery from the 75-km cycling bout. **CONCLUSIONS:** Prolonged and intensive exercise evoked a transient but robust increase in plasma levels of oxylipins, with a strong attenuation effect linked to acute carbohydrate ingestion, especially those generated through the CYP enzyme system. Supported by Dole Foods, Westlake Village, CA

2647 Board #311 May 31 11:00 AM - 12:30 PM
Effects of Exercise in Different Environmental Conditions on Leukocyte Counts and Subsets
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 (No relevant relationships reported)

PURPOSE: To observe the effects of aerobic exercise in different environmental conditions on leukocyte counts. **METHODS:** Recreationally active men ($n=7$; 23.9 ± 2.4 yrs; 182.9 ± 5.6 cm; 12.8 ± 3.6 %BF; 47.3 ± 5.9 ml·kg⁻¹·min⁻¹) volunteered to complete four exercise trials; a maximal graded exercise test, and an aerobic exercise protocol in low temperature (LT; 5°C), moderate temperature (MT; 22°C), and high temperature (HT; 35°C). The exercise protocol consisted of a 60-minute cycling trial at 60% VO₂max, a 15-minute rest period, and a time to exhaustion trail at 90% VO₂max (TTE). Blood draws were completed before (PRE) and after (60P) the 60-minute trial; immediately after TTE (90P), and one hour post-TTE (REC). Leukocyte count (WBC); lymphocyte number and ratio (LY# and LY%); monocyte number and ratio (MO# and MO%); and granulocyte number and ratio (GR# and GR%) were analyzed via hematology analyzer. Changes were analyzed using a two factor within-subjects repeated measures ANOVA. **RESULTS:** A significant time effect was observed for WBC ($F=2.68$, $p=0.046$, $\eta^2_p=0.348$). Post hoc tests indicated WBC increased at all time points relative to PRE in all trials combined ($p=0.001-0.026$). A significant interaction was observed for LY# ($F=6.59$, $p=0.001$, $\eta^2_p=0.568$), with significant increases from PRE to 60P during HT ($p=0.015$), but not during LT or MT ($p>0.05$). LY# was also elevated at 90P relative to PRE in each trial ($p=0.002-0.011$). A significant time effect was observed for MO# ($F=4.09$, $p=0.026$, $\eta^2_p=0.45$) and GR# ($F=25.51$, $p<0.001$, $\eta^2_p=0.836$). With trials combined, MO# increased from PRE to 90P ($p=0.019$) and GR# increased at each timepoint relative to PRE ($p=0.001-0.008$). A significant time effect was observed for LY% ($F=21.31$, $p<0.001$, $\eta^2_p=0.81$), MO% ($F=8.73$, $p=0.001$, $\eta^2_p=0.636$), and GR% ($F=27.37$, $p<0.001$, $\eta^2_p=0.846$). With trials combined, LY% decreased at REC ($p>0.001$) relative to PRE, MO% decreased at all timepoints relative to PRE ($p<0.001-0.015$), and GR% increased at all timepoints relative to PRE ($p<0.001-0.047$). **Conclusion:** Temperature may not impact acute exercise-induced increases in total leukocytes, however, exercise in the heat (35°C) may increase circulating lymphocyte count when compared to exercise in moderate (22°C) and cold (5°C) temperatures.

E-45 Free Communication/Poster - Concussion III
 Friday, May 31, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

2648 Board #312 May 31 11:00 AM - 12:30 PM
Identification Of Blood Biomarkers Of Mild Traumatic Brain Injury In Collegiate Football Players
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Football has one of the highest incidence rates of mild traumatic brain injury (mTBI) compared to other contact sports, but on field identification relies on sub-optimal subjective assessments. **Purpose:** We aimed to characterize changes in blood biomarkers of mTBI in NCAA Division I football players in response to repeated head-impacts during a competitive season. **Method:** We studied 30 collegiate football players (21 linemen; 9 non-linemen). Resting serum samples drawn prior to pre-season camp, at the end of pre-season camp, and at the end of the competitive season, were analyzed for biomarkers of mTBI including S100B, GFAP, NSE, UCHL1, NFL, and BDNF by ELISA. The frequency and magnitude of game and practice head-impacts were recorded using helmet-accelerometers. Changes in serum biomarkers of mTBI between linemen and non-linemen across the different timepoints were analyzed by repeated measures ANOVA. When significant differences were found, *Pearson's* correlation coefficients were used to determine linear correlations between biomarkers of mTBI and the frequency and magnitude of head impacts. **Results:** All players had similar levels of S100B before the start of the season (pre-camp, $p>0.05$), however linemen exhibited higher levels of S100B than non-linemen after camp and at the end of the season (post-camp; 30.6%, post-season: 22.5%; $p<0.05$). While both linemen and non-linemen had greater levels of serum BDNF and NSE at the end of the season, when compared to pre- and post-camp levels ($p<0.05$), the largest increases were seen amongst linemen ($p<0.05$). In the linemen group, the average magnitude of head impacts across the 2 weeks of pre-season camp was positively correlated with serum BDNF ($r=0.806$, $p=0.009$). The increase in serum S100B observed in linemen at the end of the season was highly correlated with both maximum ($r=0.794$, $p=0.011$) and average gyroscopic forces ($r=0.669$, $p=0.049$) experienced by players between the post-camp and post-season timepoints. **Conclusion:** Linemen exhibited a greater increase in serum biomarkers of mTBI than non-linemen where repeated low-moderate head-impacts are less frequent. Furthermore, S100B was highly associated with the frequency and magnitude of head-impacts during a college football season, suggesting a potential role as diagnostic tool for mTBI in contact sports.

2649 Board #313 May 31 11:00 AM - 12:30 PM
Evaluating Acute Sport-related Concussion In The Primary Care Setting: Are We Dropping The Ball?
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Concussed athletes are increasingly introduced into the medical care continuum via the primary care setting. As such, primary care physicians (PCPs) are expected to make more decisions regarding return-to-play, symptom management, and specialist referral than ever before. Concussion-specific history and physical examination is vital for this decision-making process.

PURPOSE: To review clinic documentation and determine how PCPs are evaluating concussed athletes in clinic relative to published consensus and guidelines.

METHODS: We conducted a retrospective records review for all patients evaluated by PCPs with no formal sports medicine training at a single large academic medical center. We restricted our review to pediatric patients (7-18 yrs) diagnosed with sport-related concussion between 2014-2017. **RESULTS:** We included 490 patients (age= 14.7 ± 2.2 years; 184 females). Patients presented most frequently to pediatricians (60%) at a median of 3 days from injury (range 0-64 days, IQR 1-6). Most patients participated in football (25.9%), soccer (19.8%), and basketball (15.1%). Prior concussion history was documented in 28.8% of visits. Providers documented headache presence or absence in 94% of patients, compared with nausea (52.2%), dizziness (51.8%), vision changes (45.7%), cognitive complaints (45.7%), emotional changes (17.1%), sleep difficulties (15.8%) and neck pain (13.5%). Basic

neurologic examination was documented in 95.5% of visits compared to detailed neurologic assessment including strength, sensation, cranial nerves, and cerebellar function (26.9%), clinical cognitive assessment (13.5%), balance testing (41%), and neck exam (45.7%). Return-to-play was frequently discussed (94.5% of visits) and 13.1% of PCPs referred the patient to a dedicated sports medicine provider. **CONCLUSIONS:** Symptom-based return-to-play algorithms cannot be effective if the signs and symptoms driving their decision-making aren't being properly evaluated and documented. The PCPs caring for the patients in our retrospective study often omit important components of the history and physical examination for concussed athletes. New tools are needed to empower PCPs to more completely evaluate and manage these patients, and PCPs should be encouraged to thoroughly document the care provided.

2650 Board #314 May 31 11:00 AM - 12:30 PM
Single Versus Dual-Task Performance Using a Novel Dual-Task Assessment in a Healthy Sample

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(No relevant relationships reported)

PURPOSE: The dual-task (DT) paradigm consists of concurrent performance of a cognitive and motor task. Varying DT methodologies have been used to observe subtle changes associated with sport concussion (SC). However, previously employed DT methodologies may not be translatable to the clinical setting. The purpose of the current study was to compare performance on commonly used cognitive and motor tasks administered separately and concurrently in a healthy collegiate sample. **METHODS:** Participants consisted of 60 (32 female, 28 male) recreationally active adults (Age: 20.5 ± 1.34 years, Height: 171.7 ± 9.33 cm, Mass: 69.25 ± 12.23 kg). Participants completed the single task (ST) assessment which consisted of the Standardized Assessment of Concussion (SAC) and four trials of the timed tandem gait (TTG) test separately. Participants then completed the SAC and TTG concurrently for the DT assessment. For the SAC, paired t-tests were used to compare ST and DT performance for immediate recall (10-item list), concentration (digit span, months in reverse order), and delayed recall domains as well as the composite score. For the TTG test, paired t-tests compared the best (fastest) time of the ST trials to the average values for each SAC domain. All analyses were performed with $\alpha = 0.05$.

RESULTS: SAC composite scores significantly improved by 2.3 ± 3.61 points from ST to DT performance ($p < 0.001$). Comparisons of all ST and DT domain and composite scores for the SAC and TTG are presented in Table 1.

CONCLUSION: The DT assessment resulted in improved cognitive performance and decreased (slower) motor performance as compared to ST performance. Our findings align with related literature using more sophisticated assessment tools. The current findings suggest altered allocation of cognitive resources using commonly used clinical measures of cognition and motor control prior to and following a SC. Future research should investigate the current DT methodology in concussed athletes.

Domain	ST	DT	Mean Difference	p
SAC (points)				
Immediate Recall	24.4 ± 2.46	26.7 ± 2.98	2.3 ± 2.82	< 0.001
Concentration	4.5 ± 0.72	4.1 ± 1.06	0.4 ± 1.03	0.004
Digits	3.5 ± 0.72	3.3 ± 0.87	0.2 ± 1.16	0.32
Months	1.0 ± 0.00	0.8 ± 0.44	0.3 ± 0.44	< 0.001
Delayed Recall	8.5 ± 1.35	8.8 ± 1.21	0.4 ± 1.10	0.013
Composite	37.3 ± 3.58	39.6 ± 4.18	2.3 ± 3.61	< 0.001
Time to Complete TTG (sec)				
Immediate Recall	11.3 ± 2.02*	14.4 ± 3.00	3.1 ± 2.09	< 0.001
Concentration	11.3 ± 2.02*	12.0 ± 2.21	0.7 ± 2.98	0.08
Digits	11.3 ± 2.02*	11.8 ± 2.24	0.5 ± 1.62	0.019
Months	11.3 ± 2.02*	12.8 ± 2.52	1.4 ± 2.09	< 0.001
Delayed Recall	11.3 ± 2.02*	13.1 ± 2.47	1.8 ± 1.94	< 0.001
*All DT TTG values were compared to the best (fastest) time achieved during ST performance.				

2651 Board #315 May 31 11:00 AM - 12:30 PM
The Performance of Adolescent Athletes on Baseline Concussion Assessments

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PURPOSE: The purpose of this study is to examine the baseline performance of adolescent athletes on the King-Devick test (KD), modified Balance Error Scoring System (mBESS), and Post Concussive Symptom Inventory (PCSI) to determine whether age or sex significantly influence performance or reporting on these assessments. **METHODS:** A retrospective cohort study was conducted on athletes' baseline concussion assessments as completed as part of their school or organizations' concussion surveillance program. Testing was recommended prior to or at the start of each sports season and included a concussion history and risk factor questionnaire, KD, mBESS, and PCSI. The influence of age, sex, and correlations between tests were also examined. **RESULTS:** Data from eight schools and one sports organization was available for review. Data collected from 389 athletes (64% M, 36% F) were included in the analysis. The average age was 15.9 (+/-1.5), range 12.1-19.2. The average KD score was 47.6 (+/- 9.7, range 28.0-88.6 s), mBESS 25.8 (+/- 3.2, range 12-30), and PCSI score was 5.2 +/- 8.2, range 0-52). Gender did not influence test performance on any of the measures. Only KD was influenced by age with improved performance noted at older ages ($p < 0.01$). Overall, the three test measures showed poor correlation among these athletes. **CONCLUSIONS:** KD, mBESS, and PCSI baseline performance is reported in a cohort of adolescent athletes. Test performance was not influenced by gender and only KD was associated with age. The poor correlation between tests supports the need for a comprehensive baseline concussion surveillance program. Further studies are necessary to examine the utility of these measures in managing recovery from injury in this population.

2652 Board #316 May 31 11:00 AM - 12:30 PM
Cardiovascular Autonomic Changes Following a Bout of Low-intensity Exercise in Recently Concussed and Healthy Athletes

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Concussion can negatively impact several physiological processes, one of which is the cardiovascular system. While measurements of heart rate variability (HRV) in concussed patients may appear similar to healthy controls at rest, physiological stressors such as exercise may expose cardiovascular autonomic dysfunction present after injury. **PURPOSE:** To compare cardiovascular autonomic modulation of sport-related concussion (SRC) participants with age- and sex-matched healthy controls (CON) during 10' of rest, 20' of exercise and 20' of recovery. **METHODS:** Student-athletes (15.9 ± 1.3 years; N=12, 8 SRC + 4 CON) were assigned to a 20' exercise bout of treadmill walking at 40% age-predicted HRmax. SRC participants exercised between Day 3 and Day 7 following their concussion. HRV and blood pressure were collected throughout the testing session. Descriptive statistics, a series of two-way mixed ANOVAs, and post hoc pairwise comparisons with Bonferroni correction were performed using SPSS 22. **RESULTS:** There was no significant interaction between injury and mean arterial pressure (MAP) ($p = 0.07$). The main effect of time showed recovery MAP was significantly lower than during exercise, $F(2,844,28.442) = 6.412$, $p = 0.002$, partial $\eta^2 = 0.391$ and the main effect of group showed that the SRC group had a significantly higher MAP than CON, $F(1,10) = 13.103$, $p = 0.005$, partial $\eta^2 = 0.567$. The main effect of time showed that low-frequency normalized units (LFnu) was significantly higher at seated rest and during exercise than recovery, $F(2,852,28.522) = 11.485$, $p < 0.001$, partial $\eta^2 = 0.535$ with no differences between SRC and CON ($p = 0.578$). There was no significant interaction between injury and time for LFnu ($p = 0.797$). **CONCLUSIONS:** SRC participants exhibit subtle differences in cardiovascular autonomic responses during a bout of treadmill walking. A greater MAP in SRC compared to CON suggests a blunted post-exercise hypotensive response. These data may indicate that, at least acutely, concussion impacts cardiovascular autonomic modulation responses to low-intensity aerobic exercise. The aforementioned findings could have clinical implications for the management of concussions in adolescent athletes.

2653 Board #317 May 31 11:00 AM - 12:30 PM
Systolic Blood Pressure Response to Orthostasis after Concussion is Related to ADRA2A Gene Receptor Subtypes

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Orthostasis causes a gravity-dependent redistribution of blood volume to the lower extremities. The baroreflex coordinates effector organs of the cardiovascular autonomic nervous system (CV-ANS) to produce a proportional response to mitigate an aberrant change in systolic blood pressure (SBP). In autonomic dysfunction (AD), there may be a lag or impaired accommodation leading to dramatic changes in SBP. Growing evidence indicates that AD is a part of the post-injury period after concussion. The impact of genetic variability of CV-ANS receptors including that of alpha-2 adrenoceptor (ADRA2A) gene polymorphisms remains undefined. **Purpose:** To evaluate the effect of ADRA2A gene variants on SBP responses to orthostasis in recently concussed athletes. **Methods:** A prospective study was performed in 13 concussed college athletes (gender: 10 female, 3 male; age: 20 ± 1 yrs; height: 1.70 ± 0.11 m; weight: 74 ± 17 kg). Beat-to-beat SBP was assessed digitally at rest for 10 minutes in the supine (SUP) position and then for 3 minutes in the standing (STND) position within 48 hours (48H) of concussion; SBP was averaged and a change score computed (Δ SBP = STND SBP - SUP SBP). Fast-Fourier transform was performed and power calculated for the low frequency (LF) spectra in each position (e.g., SUP LF-SBP, STND LF-SBP); the variables were \log_{10} transformed for parametric analyses. A saliva sample was obtained from each participant and a commercial laboratory identified the ADRA2A single nucleotide polymorphism (rs1800544) using PMR-array. **Results:** Data are presented as group mean (±SD). There were no ADRA2A [C/C: n=5; C/G: n=5; G/G: n=3] group differences for demographics, SUP and STND SBP or LF-SBP. A significant group main effect ($p < 0.05$) was observed for Δ SBP and post-hoc tests revealed that the G/G [-21(±3)] response was significantly ($p < 0.05$)

lower than the C/G [7(±18)] group. A 3 X 2 RMANOVA for LF-SBP was performed. A significant group, position and interaction effect ($p < 0.05$) was observed; post-hoc tests were not significant, but trending for an effect in the G/G group. **Conclusion:** The ADRA2A receptor, whose activation is known to inhibit the release of norepinephrine and reduce peripheral vasoconstriction, contributed to a blunted SBP response to orthostasis in G/G homozygotes compared to other variants within 48H of concussion.

2654 Board #318 May 31 11:00 AM - 12:30 PM
Moderate Intensity-interval-training With Blood Flow Restriction And Body Cooling For People With Post-concussion Syndrome

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PURPOSE: To examine the effects of a 12-session aerobic exercise program with blood flow restriction (BFR) and body cooling (BC) on people diagnosed with post-concussion syndrome (PCS) less than a year.

METHODS: A single blind randomized controlled trial of aerobic exercise with BFR and BC was conducted. Twenty-five adults with PCS were assigned to the experimental group (n=14, 8 females and 6 males, 38 ± 11 yrs) or the control group (n=11, 9 females and 2 males, 33 ± 10 yrs). Both groups rode a recumbent elliptical machine for 21 minutes at moderate intensity (60% of predicted maximum heart rate) twice a week for six weeks, but only the experiment group received BFR and BC while riding. PCS Symptom Checklist (26 items with a total score of 156) was used daily to track the number and severity of PCS symptoms during the 6-week intervention and the 6-week follow-up period. To examine the fluctuations of symptom number and severity, the variance of overall checklist scores and sub-domain scores for each individual during the 6-week intervention and the 6-week follow-up period was calculated. Mann-Whitney U test was used to test the group differences.

RESULTS: The fluctuation of overall symptom severity during the 6-week intervention was significantly less in the experimental group ($p = 0.03$). Less variations of severity in cognition and mood domains were observed in the experimental group ($p = 0.02$ respectively). During the 6-week follow-up period, the number of PCS symptoms remained more stable in the experimental group ($p = 0.02$). There is a trend that after the intervention ended, less symptom severity fluctuation was observed in the experimental group ($p = 0.05$). The number of PCS symptoms in the cognition and sleep domains reduced after the 6-week intervention ended and remained stable during the 6-week follow-up period ($p = 0.007$ and $p = 0.02$). Furthermore, the severity of mood and sleep symptoms remained more stable in the experimental group ($p = 0.04$ for both domains).

CONCLUSIONS: Aerobic exercise with BFR and BC alleviated the post-concussive symptoms of people who suffered PCS less than a year. More stable recovery was found in individuals who exercised at 60% of predicted maximum heart rate under BFR and body cooling as compared to those who underwent the exercise without BFR and BC.

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2655 Board #319 May 31 11:00 AM - 12:30 PM
Comparison of Baseline Concussion Tests in Youth and Collegiate Football Players

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As proper medical care for sports concussions is increasingly emphasized, administering baseline testing can be a valuable component of a comprehensive concussion management strategy, especially for athletes who participate in contact/collision sports. **PURPOSE:** To compare baseline measurements of Youth (middle school) and Collegiate (NCAA Division II) American football players on three tests used for the evaluation of sports concussion. **METHODS:** Sixty-two healthy football players (31 Youth: 13.2 ± 0.5 yr; 31 Collegiate: 20.3 ± 1.6 yr) performed baseline concussion testing before their respective seasons. Testing included balance (BAL; twenty second, bipedal standing on a Wii Balance Board for four conditions; eyes open [O], eyes open + cognitive task [OC], eyes closed [C], eyes closed + cognitive task [CC]), oculomotor function (KD; King-Devick) and multiple object tracking (MOT; NeuroTracker). Postural sway values (95% Ellipse Area [EA]) for each BAL condition, KD total time and MOT speed thresholds (Core 1, 2 & 3) for each group were compared. **RESULTS:** EA was significantly lower in three (O, C, CC) of the four BAL tests in Collegiate vs. Youth players (O: 0.83 ± 0.70 vs. 1.48 ± 1.08 cm², $P = 0.006$; C: 1.20 ± 1.00 vs. 2.20 ± 1.16 cm², $P < 0.001$; CC: 1.29 ± 1.53 vs. 6.18 ± 13.20 cm², $P = 0.045$). EA was not different between Collegiate and Youth players in

the OC condition (1.63 ± 3.04 vs. 5.85 ± 15.96 cm², $P = 0.153$). KD total time was significantly faster in Collegiate vs. Youth players (38.44 ± 6.18 vs. 51.47 ± 10.04 s, $P < 0.001$). Collegiate players had faster speed thresholds on two (Core 1 & 2) of the three MOT tests (Core 1: 5.55 ± 0.84 vs. 4.90 ± 1.27 m·s⁻¹, $P = 0.020$; Core 2: 3.29 ± 0.82 vs. 2.89 ± 0.75 m·s⁻¹, $P = 0.047$). Speed threshold was not different between the Collegiate and Youth players in Core 3 of MOT (2.21 ± 0.45 vs. 2.00 ± 0.63 m·s⁻¹, $P = 0.143$). **CONCLUSION:** Collegiate players had better baseline scores on a majority of the clinical concussion tests. These findings highlight the importance of recurrent baseline testing and/or use of age-specific normative values in concussion evaluation. Moreover, youth players had greater variability in their test results, thus medical personnel should exercise caution when relying solely on normative scores to evaluate the neurologic function of youth suspected of having a concussion.

2656 Board #320 May 31 11:00 AM - 12:30 PM
The Effects of Test Duration on Concussion Evaluation Outcomes

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(No relevant relationships reported)

There are many forms of evaluating traumatic brain injury in sports medicine. This may include "paper and pen" neuropsychological tests, ...which often lend themselves to the sports medicine environment. A reliable, and inexpensive test that can be used on the sideline without any additional devices is highly desirable. However, the chosen "length" (number of questions/tasks) of these instruments are rarely justified, if at all. **PURPOSE:** The purpose of this experiment was to determine if duration of testing makes a difference in outcomes. From our experiences as clinicians, we have observed the frustration build in the injured athlete as the test continues. We hypothesize that there is an optimal duration to the test, and as such, with an extended and unnecessary duration, we contend that lower scores may be present due to other extrinsic variables including boredom and frustration. **METHODS:** A convenience sample of 55 subjects (mean height=175.8 cm, mass=88.2 kg) were each given a 30-question and a 70-question version of the Stroop test, and a 30-question and a 120-question version of the Symbol Digit Modalities Test (SDMT). Each had their mental status assessed by each version of the test. **RESULTS:** Fifty-five subjects completed the Stroop test long version (70 questions). The time for testing averaged 81 sec and number of missed questions averaged 1.5. With regard to the short version (30 question) Stroop test, 28 subjects took the test. Results averages 32 seconds to take the test, and number missed averaged 1.0 questions. As for the SDMT short version (45 question test), 47 subjects completed the test in an average of 47.1 sec while missing an averaged 0.4 questions. The long version of the SDMT contained 120 questions. Twenty-five subjects completed the test with an average of 0.62 questions missed. Time was not obtained in this trial segment due to a technical error. **CONCLUSIONS:** This preliminary study suggests that the duration of testing time may in fact alter the performance of the subject. Further research on this topic is warranted.

2657 Board #321 May 31 11:00 AM - 12:30 PM
The Effects Of Subconcussive Impacts On The Neurocognitive Function Of Men's Collegiate Lacrosse Players From Pre-season To Post-season

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There is an estimated 1.6 to 3.8 million sports-related mild traumatic brain injuries (mTBI) per year in the United States. Football is more commonly studied than other sports, even though men's lacrosse has almost as great a risk of mTBI. Since many players of this age group are in schools of higher education, mTBI can inhibit their ability to learn in the classroom. **PURPOSE:** To examine the effects of total number of impacts, cumulative magnitude, and cumulative rotation, as measured by accelerometer, on neurocognition, as measured by time to complete the Trails A task in pre- and post-season. **METHODS:** We examined 10 male freshmen NCAA Division II collegiate lacrosse players in pre- and post-season (January and May). Subjects wore the Vector mouthguard, which contains accelerometers, during full contact practices and 18 games. Vector mouthguard recorded impact number and magnitude. Subjects' cognition was evaluated by C3logix Trails A test. **RESULTS:** The data was analyzed by comparing athletes' mean scores of Trail A between pre- and post-season with paired samples t-test and correlating it with the total number of impacts, cumulative impact, and cumulative rotation with computation of Pearson correlation coefficients. Statistical significance was determined by p-value<.05. The association between completing the Trails A task and the following variables was statistically significant with a positive Pearson coefficient: total number of impacts (0.80, 0.006), cumulative impact (0.74, 0.014) and cumulative rotation (0.71, 0.022). **CONCLUSIONS:** The athletes took longer to complete the Trails A task in post-season if they experienced an

increased total number of impacts, cumulative impact, or cumulative rotation. These changes may indicate the number of impacts, cumulative impact, and cumulative rotation affects athletes' cognitive abilities without clinical symptoms or reporting of mTBI. The results of this pilot study suggests further investigation is warranted.

2658 Board #322 May 31 11:00 AM - 12:30 PM
The Reliability of a Companion KEMS Concussion Test

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(No relevant relationships reported)

The Kleiner Evaluation of Mental Status (KEMS) instrument was developed 8 years ago and has undergone continual evaluation and improvement. This instrument has previously been shown to be brief, reliable valid, and discriminating, as well as "practical for the sidelines". For the past 8 years we have evaluated many instruments for validity, specificity, and discriminating qualities of each task. **PURPOSE:** The purpose of this study was to alter the sequence and content of the instrument without affecting its accuracy. We sought to produce a "Version B" of the KEMS instrument, and to evaluate it against our initial and well-studied counterpart, thus creating a second reliable instrument to be used in pre- and post-testing, and for serial assessments. Both versions are equally-weighted, 12-question, cognitive assessment tools that include; simple orientation (SO), complex orientation (CO), immediate recall (IR), delayed recall (DR), concentration (C), and staged commands (SC). **METHODS:** A convenience sample of 48 subjects (mean height=177.3 cm, mass=89.8 kg) were divided into two equal groups. Each had their mental status assessed by one version of KEMS before, and the other version after, competing in an amateur boxing bout. The sequence of KEMS-A vs. KEMS-B was determined a priori. Descriptive data are presented as percentage (%) of responses. **RESULTS:** The mean percent of correct answers for Version A was 86.3%, vs. 87.5% for Version B. The number correct per category were the same for both versions (SC, IR, IR, CO, SO, SC, CO, C, C, DR, and DR), indicating an acceptable instrument. **CONCLUSIONS:** We conclude that this instrument, along with other modalities, should be part of the standard protocol to assess concussion in athletes.

E-46 Free Communication/Poster - Injury Risk Assessment

Friday, May 31, 2019, 7:30 AM - 12:30 PM
 Room: CC-Hall WA2

2659 Board #323 May 31 11:00 AM - 12:30 PM
Lifestyle Behaviors and Common Injuries Among Collegiate eSport Athletes

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eSports is a \$1.5 billion industry with over 250 million viewers globally. Although there is controversy over its qualifications as a sport, the International Olympic Committee (IOM) has deemed eSports a sporting activity and over 80 colleges and universities have varsity eSports teams with 22 offering scholarships. Despite its success little is known on the health, injury concerns, and management, of eSports players.

PURPOSE: To understand lifestyle behaviors, exercise habits, and common injuries of eSports players in the collegiate setting.

METHODS: A survey was developed based on a literature review assessing gaming habits. The survey was administered to collegiate varsity eSport players between the ages of 18-22 years of age from 9 colleges and universities in various geographic settings across the United States. Facts were collected anonymously. Descriptive statistics were used to determine frequencies, averages, and standard deviations.

RESULTS: 63 subjects completed the survey 94% (n=59) male and 6% (n=4) female. The most common complaints were eye fatigue 51% (n=32), back/neck pain 41% (n=26), wrist pain 35% (n=22) and hand pain 30% (n=19). The majority of individuals practiced between 3-6 hours/day 59% (n=37) and 16% (n=10) >7 hours/day. Time spent in game play before a standing break diverged from 1 hour in 38% (n=24), to 2-3 hours in 40% (n=25), and >4 hours 19% (n=12). The majority of participants report being conscientious about diet 68% (n=43) and exercise 64% (n=40) with 65% (n=41) exercising ≥30 minutes/day and averaging 3 (SD=1.7) days exercising/week. However, 24% (n=15) reported no exercise at all. Average cups of a caffeine beverage a day was 1 (SD=0.8).

CONCLUSION: The health and injury profiles of eSports players are similar to sedentary workers as opposed to traditional athletes. The assessment and management

of eSports players must be reflective of their healthcare needs. Pre-participation examinations should evaluate vision and eye strain, assess social/addictive behavior, and evaluate physical activity and nutrition habits. Healthcare teams may include primary care Physicians, Physical/Occupational therapists, Athletic Trainers, Exercises Physiologists, Psychologists/Psychiatrists, Optometrist/Ophthalmologists and Registered Dietitians.

2660 Board #324 May 31 11:00 AM - 12:30 PM
Varsity Swimming Programs in China and U.S.: A Comparison Study

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PURPOSE: To examine the difference between varsity swimming programs in two universities, one in China and one in US.

METHODS: 14 varsity female swimmers, 1 physical therapist, 1 academic counselor, 2 coaches, and 1 athletic directors from the University of Illinois at Urbana-Champaign (UIUC), U.S. and 14 varsity swimmers (female=7), 1 coach, and 1 athletic directors from the Southeast University (SEU), China were voluntarily for a semi-structure interview each ranging from 30 to 50 minutes. The interview questions include recruitment procedures, training and competition, support system, budget, coaches' training philosophy and swimmers' motivation for training. All of interviews were tape-recorded, transformed to transcript, coded and analyzed.

RESULTS: Key features and difference between two programs are summarized below:

Items	SEU	UIUC
Recruitment	Using one single swimming test to determine the selection	Long-term monitoring for selection; two-side communications available between coaches and swimmers
Training (Hours; Load)	10 hours per week; 20000-26000 yards per week	20 hours per week; 50000-70000 yards per week
Competition (Dual meet; Championship)	0 times per season; 2-3 times per season	7-8 times per season; 2-3 times per season
Support Team	The coach takes duty for all aspects	Consist of 1 athletic trainer, 1 physical therapist, 1 nutritionist and 1 psychologist
Budget	44,000 \$ per year	260,000 \$ per year
Coaches' Training Philosophy	Improvement of athletic performance and academic achievement	Improvement of athletic performance and academic achievement; whole-person development
Swimmers' Motivation for Training	External motivation: Reward Internal motivation: Athletic spirit and self-improvement	Internal motivation: Interest of swimming, self-challenging, responsibility for team, and the sense of achievement

CONCLUSION: A variety of differences were found between China and US varsity swimming programs, which should explain the swimming performance level differences between two countries at both the university and national levels.

2661 Board #325 May 31 11:00 AM - 12:30 PM
Pre-Race Risk Screening and Stratification Predicts Adverse Events - SAFER Study In 76654 Distance Runners

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PURPOSE: The purpose of this study was to determine if a pre-race medical screening and risk stratification program predicts adverse events (ability of a runner to finish the race, or develop a medical complication) during an endurance running event.

METHODS: This prospective study, conducted during the Two Oceans marathon races (21.1km and 56km) in South Africa over 4 years, involved 76654 consenting race entrants. Race entrants completed a pre-race medical screening questionnaire at registration (3-4 months before the race), and were risk stratified into four groups: very

high risk (VHR; existing cardiovascular disease - CVD), high risk (HR; risk factors for CVD), intermediate risk (IR; existing other chronic disease, medication use or injury), and low risk (LR). All runners in the VHR and HR categories were provided with educational information to decrease the risk of medical complications, and were also advised to undergo a pre-race medical assessment. Runners were tracked from registration to starting and finishing the race, and medical encounters (ME) were documented. Main outcome variables were the did-not-start rate (DNS; % runners registering but not starting) and the adverse event rate (AE) [defined as % starters that did-not-finish (DNF) or had an ME] in each risk category.

RESULTS: The DNS rate (%: 95% CI) for runners was similar in all risk categories (VHR=19.5; 17.9-21.2, HR=18.8; 18.0-19.7, IR=18.4; 18.0-18.9, and LR=18.6; 18.2-19.1)(p=0.604). The DNF rates in the VHR (2.2; 1.6-3.0)(p=0.005), HR (1.8; 1.5-2.1)(p=0.017), and IR (1.9; 1.8-2.1)(p<0.001) were significantly higher compared to the LR (1.4; 1.2-1.5). The overall AE rates for runners in the VHR (2.3; 1.8-3.0) (p=0.0017), HR (1.8; 1.5-2.1)(p=0.0323), and IR (2.0; 1.9-2.2)(p<0.001) were significantly higher compared to the LR (1.5; 1.3-1.6).

CONCLUSIONS: A pre-race medical screening, risk stratification and educational intervention program did not change the DNS in the risk categories. However, runners in the higher risk categories, that chose to start the race, were more likely to suffer an adverse event (not finish the race or present with a medical encounter) compared with runners in the lowest risk category.

2662 Board #326 May 31 11:00 AM - 12:30 PM
High School Sport Specialization and Prior Injury in Collegiate Football Players

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Sport specialization has become more common in young athletes and recent evidence suggests sport-specialized training is related to an increased risk of sports injury.

PURPOSE: The purposes of this study were to 1) assess the percent of high school sport specialization among collegiate football players and 2) determine whether sport specialization was related to rate of prior injury.

METHODS: 101 NCAA Division III Collegiate Football players (Age: 20.38±1.35 years, height 1.83±0.06 m, body mass 96.12±14.95 kg) participated in the study. At the beginning of their intercollegiate season, the players completed a survey about high school sport specialization participation and prior high school and college sport injuries. Sport specialization was classified as low, moderate or high based on the players' responses to questions on a) playing a primary sport in high school, b) quitting other sports to focus on the primary sport and c) training for football >8 months/year in high school.

RESULTS: In this study sample, 25.7% (n=26) of players reported being highly sport specialized and 40.6% (n=41) being moderately sport specialized in high school. Football was the primary high school sport reported for 67.3% (n=68) of players. Prior injury that limited or stopped their sports participation was reported in 83.2% (n=84) of players. While the collegiate football players classified as moderate and high sport specialists reported a higher incidence of prior injury relative to players classified in low sport specialization, the association was not statistically significant (Odds Ratio=2.66 (95% CI 0.92-7.67), p=0.07). The number of all prior injuries reported by moderate or high sport specialists (2.15±1.45) was not significantly greater than low sport specialists (1.74±1.62) (p=0.20). Similarly, the number of high school injuries reported by moderate or high sport specialists (1.30±1.30) was not significantly greater than low sport specialists (0.85±1.08) (p=0.09).

CONCLUSIONS: The prevalence of high school sport specialization in this sample of football players was consistent with prior reports of football players. While results support previous findings of higher mean numbers of prior injury with increasing sport specialization, the association was not statistically significant.

2663 Board #327 May 31 11:00 AM - 12:30 PM
Classification of Collegiate Athletes Based on Their Injury History

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 (No relevant relationships reported)

Sports-related injuries can have a significant impact on an athlete's performance and career. While some injuries are inevitable, many can be prevented. Cluster analysis is a useful statistical technique that can assign individuals into groups (i.e., latent subgroups) based on common characteristics. **PURPOSE:** To utilize cluster analysis to 1) identify the latent subgroups based on athletes' injury history; and 2) examine the characteristics of latent subgroups among athletes. **METHODS:** A total of 1,538 college athletes competing in the South Eastern Conference in NCAA division I were segmented by three criteria; 1) Injury parts indicate the body part sustaining the injury,

2) Injury types describe the detail of their injury status such as strain, contusion or tendonitis. 3) Injury duration refers to how long the athlete was unable to participate in training. K-means clustering analysis with the Euclidean similarity of injury log vectors was conducted to label players. The number of groups(k) was determined by applying the average silhouette method. The characteristics of clusters were analyzed descriptively, and the sports were allocated to each group followed by the athlete clusters. **RESULTS:** Five clusters were identified by the maximum average silhouette coefficient (0.153) among coefficients for randomly drawn k's between 2 to 20. The first group, mainly baseball, men's basketball, and men's tennis, had injury to their ankle, arm, and hamstring for contusion and strain for a few weeks. The second group was mostly from football, with injury to their ankle, knee, and shoulder with the most extended injury durations. The third group, mostly football or track and field, were the athletes likely to have knee inflammation, and the duration was nearly half of a year. The injured body parts of the fourth group were back, finger, and hamstring, and the types of injuries were fracture and tendonitis. This cluster was mainly women's basketball and track and field athletes. The members of the last group had head injury (e.g., concussion), and were soccer, softball or volleyball athletes. **CONCLUSION:** This study may help practitioners in recognizing the likelihood of an athletes' injury according to their sport. Additionally, coaches could also consider this information in daily practices.

2664 Board #328 May 31 11:00 AM - 12:30 PM
Ready To Tri: Characteristics Of Recreational Triathletes
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Purpose: The sport of triathlon has been increasing in popularity, especially among recreational athletes. As triathletes compete in races ranging from around 16 miles to 140.6 miles or more and train in 3 disciplines simultaneously, it is difficult to identify consistent risk factors for injury among these athletes. The aim of this study was to evaluate characteristics of a group of recreational triathletes in regards to their medical history, training habits, and musculoskeletal injuries.

Methods: Endurance athletes were recruited for participation from local triathlon clubs and upon presentation to the University of Miami Sports Medicine clinic. Triathletes over the age of 18 years were considered for participation. After consenting, they were sent a link via e-mail to complete an online survey.

Results: Twenty-two triathletes completed the survey. The average age was 46.5 years old (range 24-60 years). Seventy-three percent reported an injury in the past year, and 32% reported multiple injuries. The lower extremity represented 66% of injuries. The knee accounted for 27%, followed closely by the hip at 23%. The back and shoulder accounted for 15% each. Other reported locations of injuries were the foot, ankle, leg, and neck. Athletes spent the most training time per week biking at 4.9 hours, followed by running at 3.9 hours, and then swimming at 2.3 hours. Almost 60% reported weight training for an average of 2 hours per week. Of these, 77% reported at least 1 injury, but only 23% had multiple injuries. Only 14% participated in some type of yoga or Pilates. The majority of athletes, 59%, trained with the help of a coach. Only 18% reported working with a nutritionist, and less than 5% reported working with a sports psychologist. Thirty-six percent reported having a current, chronic medical condition. The most common conditions were asthma and anxiety. Sixty-four percent used some type of vitamin or supplement, with multivitamins being the most common (35%). A gluten free diet was followed by 21%, and 16% reported following a vegetarian or vegan diet.

Conclusion: Establishing a better understanding of the characteristics of recreational triathletes along with trends in their training habits can help guide further research on injury risks and lead to training recommendations for injury prevention.

2665 Board #329 May 31 11:00 AM - 12:30 PM
Caregiver Awareness of Safe Pitching Recommendations in Youth Fastpitch Softball Pitchers
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PURPOSE: Fastpitch softball is one of the fastest growing sports among young females in the US. The current participation rate is similar to that of youth baseball. While there are published guidelines for safe pitching practices in softball, these guidelines are not well publicized like those in baseball, and thus may not be well monitored or enforced by caregivers or coaches. A potential consequence could be compromised safety and increased injury incidence among young softball pitchers.

The purposes of this study were to: 1) evaluate caregivers' knowledge of safe pitching guidelines for youth fastpitch softball, and 2) obtain pitching and injury data for youth fastpitch softball pitchers

METHODS: A 30-item study-specific survey was administered to caregivers of youth softball pitchers in 10U-18U age brackets. Knowledge of safe pitching practices, arm pain and injury, and pitching volume and type. 115 surveys were completed, 50.4% of which were completed by the player's mother.

RESULTS: Only 14.7% of caregivers reported knowledge of published softball pitching guidelines while 16.5% relied on safe pitching guidance from coaches, internet, or USSA-ASA recommendations. Of the 115 respondents, 57.4% pitched year round. Caregivers estimated that 26.1% pitched less than 65 pitches per game, 60.8% pitched more than 66 pitches per game, and 13% did not know how many pitches were thrown per game. 74% surveyed stated pitches were counted by the caregiver, spouse, or coach, but 26% of caregivers did not know whether pitches were counted or not during play. A total of 76 softball players reported arm pain, 33% of which were shoulder pain, 13.9% were upper arm pain, and 11.3% were elbow pain. 22% of respondents sought medical care for arm pain. Of 16U and 18U players who reported arm pain, 72.1% missed play due to arm pain

CONCLUSIONS: Caregivers need to be a primary target for education of pitching guidelines. Protection of pitching volume-related arm pain or injuries may be possible through increased awareness efforts at the national, regional and local levels. Increased involvement of caregivers in monitoring pitching volume may also positively impact early detection or prevention of chronic arm injuries and missed play in youth softball pitchers.

2666 Board #330 May 31 11:00 AM - 12:30 PM
The Ability of Internal and External Workload to Predict Injuries in College Female Soccer Players
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Wearable micro-technology devices like heart rate (HR) monitors and global positioning system (GPS) units enable sport medicine teams to monitor athlete workloads during training and games. These data are valuable to help optimize sport performance and prevent injuries. Previous research has evaluated the utility of workload parameters such as internal load (IL) and external load (EL) to predict injury risk in male athletes, but it is unknown if these same variables are applicable in females. **PURPOSE:** To investigate the correlation between IL and EL measured by micro-technology in female college soccer players and examine their utility to predict risk of injury on lower limbs. **METHODS:** Twenty-three NCAA Division One women soccer players 19.2 ± 1.2 years old, 168.2 ± 7.3 cm, and 64.0 ± 7.8 kg were recruited. Data were collected during all practice and game play over the 14-week season. Workload measures were categorized as being either acute (A) or chronic (C) and were derived by a HR monitor (Polar Team 2, Polar Electro OY, Kempele, Finland) and GPS unit (Optimeye S5, Catapult Innovation, Melbourne, Australia). IL consisted of ratings of average HR (Avg-HR), training impulse (TRIMP i.e., HR x time), age estimated maximum HR (Max HR), and perceived exertion (S-RPE). EL consisted of total distance (TD), average speed (Avg-Spd), high speed running distance (HSR), and estimated maximum speed (Max Speed). **RESULTS:** There were significant correlations between S-RPE and TD ($r = .82$, $p < .001$), TRIMP and TD ($r = .75$, $p < .001$), Avg-HR and Avg-Spd ($r = .80$, $p < .001$) and high HR zone and HSR ($r = .60$, $p < .001$). Seven, lower limb injuries were recorded, primarily consisting of hip and knee strain. Acute Avg-HR and A to C ratio of Avg-Spd were significantly ($p < .05$) higher in injured as compared to the non-injured group. **CONCLUSION:** IL and EL were significantly correlated in this group of female soccer players. The injured group had overall higher intensity values prior to injury than the non-injured group. However, both very high and very low workload variables preceded injury incidents. Sport medicine teams are advised to consider individualizing training protocols to maximize performance and minimize injury as both very high and very low workloads may predict injury in female college soccer players.

2667 Board #331 May 31 11:00 AM - 12:30 PM
State-level Implementation of Health and Safety Policies Within Secondary School Athletics: 2018 Update

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In 2017, a study released the findings of state-level implementation of health and safety policies to prevent catastrophic injuries within secondary school athletics. However, it is unknown if improvements have been made since this initial review.

Purpose: To provide an update on the assessment of state-level health and safety policies pertaining to the leading causes of sudden death and catastrophic injuries within secondary school athletics in the United States.

Methods: Utilizing the methodology described in Adams et al. (2017), we aimed to provide an update to the current policies adopted at the state level for the 2017-2018 academic year. State high school athletic association policies, enacted legislation and Department of Education policies were reviewed for all 50 states and the District of Columbia. States that mandated policies within the rubric created by Adams et al. (2017) were awarded points (0-100) and ranked from 1 (best) to 51 (worst). The median and mean percent was calculated and the rankings were updated.

Results: Twenty-one states were found to mandate new policies in the 2017-2018 academic year (results are as of August 15, 2018). The median is now 47.75% (+0.65% change). The mean from 2017 was 47.65% (not originally reported), and is now 49.61% (+1.96%). States ranked 1 through 10 were New Jersey, North Carolina, Massachusetts, Kentucky, Florida, Missouri, South Dakota, Washington, Wisconsin and Hawaii. New Jersey has obtained the first-place rank (+11.99%, +3 spots in the ranking), while Florida is now ranked 5th (+14.2%, +18 spots in the ranking). Other substantial changes included Nebraska (+10%, +17 spots in the ranking), Kansas (+10.6%, +12 spots in the ranking) and South Carolina (+6.37%, +6 spots in the ranking). States ranked 40 through 51 were Louisiana, Connecticut, Oklahoma, Michigan, Minnesota, North Dakota, Iowa, Wyoming, New Hampshire, Montana, California, Colorado.

Conclusion: Many states continue to make positive changes with the implementation of health and safety policies for managing the leading causes of sudden death and catastrophic injury in sport. However, continued advocacy for the initiation, development and implementation of these policies are warranted to optimize the health and safety of secondary school athletes.

2668 Board #332 May 31 11:00 AM - 12:30 PM
Relative Age And Sports Performance In Elite Athletes According To Gender And Sport Modality

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(No relevant relationships reported)

The effect of relative age is a topic to consider in the selection of elite athletes to ensure that a good detection of sporting talents is being carried out during the athlete's growth and maturation phase.

PURPOSE: Evaluate the relationship of relative age with sport performance of elite athletes according to gender and sports modality of sports and to evaluate differences between men and women.

METHODS: We analyzed the data of 1285 athletes who were selected and attended the High Performance National Center in Chile between 1992 and 2017. The athletes came from different sports disciplines which were divided into Combat Sports, Sports with Ball, Strength and Resistance and Art and Precision sports. Only athletes presenting complete data on date of birth and sports discipline were included, while all Paralympic athletes were excluded. The age of the athletes varied from 8 to 49 years old, with a total of 59.4% men. With the data of month of birth and sports discipline we organized athletes in 4 quartiles. Athletes were classified by sport discipline and gender, and statistical analysis was carried out through Chi square to see differences between the groups.

RESULTS: No effect of relative age was observed in the overall sample, however there was a slight decrease in those born in the 4th quartile, with a total of 23% of the total births, without significant differences between the quartiles without variation when analyzing by gender and sports performance. Of the 4 sports disciplines, Strength and Resistance and Combat sport showed an increase of those born in the first quartil and a decrease of those born in the last 3 months of the year, without significant differences between the groups. In sports with a balloon, this effect was not observed, while in Art and Precision sports a slight increase was observed in those born in the last months.

CONCLUSIONS: Although an effect of relative age was not observed in elite athletes who train in High Performance Center in Santiago, an important decrease was found in those born in the last 3 months, especially in strength and endurance and combat sports, leaving the doubt if younger athletes are being considered during the selection of sports talents and if they are having the same opportunities to compete as their peers who were born a few months earlier.

2669 Board #333 May 31 11:00 AM - 12:30 PM
Muscular Strength and Lean Mass Development of Young Male and Female Swimmers Throughout Adolescence

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The Knowledge of differences in strength and lean mass development across chronological ages may help to understand the relationship between both in each sex and to guide training programs. **PURPOSE:** To compare the strength and muscle mass between different ages categories and sexes in young swimmers. **METHODS:** Cross-sectional study. 74 swimmers (55 males and 21 females) aged between 10 to 20 years old were evaluated. They were divided according to the training categories (category 1: 12-13 years; category 2: 14-15 years; category 3: 16 years or more). The athletes underwent evaluation of lean mass (Kg) using the dual-energy X-ray absorptiometry (DXA) method, and evaluation of knee extensor muscular peak torque (Nm) and total work (J), using an isokinetic dynamometer. **RESULTS:** Category 1 for male athletes presented lower values than category 2 for knee extensors peak torque (81.9±17.0 vs 128.0±32.9Nm, p<0.05), total work (99.2±24.5 vs 165.9±49.2J, p<0.05) and lean mass (29.1±5.1 vs. 42.8±9.7kg, p<0.05). Moreover, category 2 for male athletes presented lower values than category 3 for knee extensors peak torque (128.0±32.9 vs. 182.4±26.6Nm, p<0.05), total work (165.9±49.2 vs 238.8±40.2J, p<0.05) and lean mass (42.8±9.7 vs 56.9±3.5kg). In the female group, there were difference only between category 1 and 3 for peak torque (76.7±12.2 vs 128.5±17.0Nm, p<0.05) and total work (95.3±19.1 vs 168.3±21.9J, p<0.05). There were no differences for lean mass between the female categories. There was no significant difference between sexes for lean mass, peak torque and total work in category 1. Only lean mass was significantly higher (p<0.05) in males than in females in category 2, and peak torque, total work and lean mass were higher (p<0.05) in males than in females in category 3. **CONCLUSIONS:** The increase in muscle strength is coincident with the increase in boys' muscle mass. Unlike the boys, the girls' muscle mass was not different between age categories evaluated, but the muscle strength became higher during the time, probably due to neuromuscular adaptation. After 15 years of age, the difference in muscle performance between the sexes became significant. Separating training sections after 15 years old might be important since their levels of muscle strength and lean mass are significantly different.

2670 Board #334 May 31 11:00 AM - 12:30 PM
Knowledge about Sports Injuries, Their Risk Factors and Prevention Among University Football players, 2018

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PURPOSE: In Sudan, football is the most prevalent sport amongst youth. Sport injuries amongst young football players are common. In order to design effective sports injury prevention strategies it is important to know the knowledge and understand the attitudes of players about sports injuries.

METHODS: This study was descriptive cross-sectional institutional based study in the University of Khartoum. Total coverage of football teams of faculties of medicine, dentistry, pharmacy, engineering, economy and business was performed and data was collected through an author designed self-administered questionnaire comprising of socio-demographic data, knowledge, and attitude about common sports injuries experienced in football players. Data was analysed with SPSS version 24.

RESULTS: The study included 90 football players from 6 colleges. 50% have experienced a sport injury in the last 2 years and 50% haven't. Inadequate warm-up exercise (27%) and over practice (12%) were selected by participants as the major risk factors of sports injury in football players. Regarding the knowledge about common sports injuries 49% players have average knowledge, 31% players poor and only 20% players have good knowledge. Faculty of medicine team showed the highest amount of knowledge. Faculty of engineering and faculty of business showed the lowest level of knowledge. General attitude of football players towards sport injuries and their prevention show 72% players with positive attitude. A significant association between the knowledge and attitude of the players (P=0.013) was found. 74.4% of the players do not their current educational curriculum adequately addresses sport injuries, their

risk factors and prevention. **CONCLUSIONS:** University football teams need to be educated on sports injuries and their prevention through relevant trainings or courses that increase students' knowledge and influence their attitudes motivating safe practice in sports.

E-47 Free Communication/Poster - Disability

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2671 Board #335 May 31 11:00 AM - 12:30 PM Effect of Exercise Mode and Intensity on Subsequent Postprandial Carbohydrate and Fat Metabolism in Persons with Spinal Cord Injury

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PURPOSE: To determine the effects of pre-meal exercise mode and/or intensity on postprandial energy expenditure, substrate partitioning, and blood substrate and hormone concentrations in persons with spinal cord injury (SCI).

METHODS: Nine adult men with chronic (≥ 1 yr) thoracic SCI consented to participation. Following assessment of neuromuscular strength and cardiorespiratory fitness, participants completed four experimental trials. On the first trial before the meal, participants completed ~ 42.5 min of circuit resistance exercise (CRT). The CRT energy cost was measured and subsequent exercise trials were designed to be isocaloric. Participants then completed seated control (CON), high intensity interval arm cycling (HIIT), and moderate intensity continuous arm cycling (MICT) trials in randomized order. Immediately after exercise or sitting, trial participants consumed a liquid mixed meal. During exercise and for 150 min following the meal, expired gases were collected continuously and analyzed via indirect calorimetry and blood samples were taken every 30 min.

RESULTS: Participants exercised at 52 ± 6 , 53 ± 7 , and 65 ± 5 % $\dot{V}O_{2peak}$ for a cost of 120 ± 19 , 120 ± 22 , and 122 ± 33 kcal during MICT, CRT, and HIIT, respectively. Only CRT appeared to have an elevated EE at 150 min post-exercise (1.43 ± 0.15 vs 1.34 ± 0.13 kcal \cdot min⁻¹ in other conditions). The greatest increases in accumulated whole-body fat oxidation during recovery were seen in CRT and HIIT (15.1 ± 3.2 and 13.3 ± 4.8 g \cdot 150 min⁻¹, respectively) compared to MICT and CON (11.9 ± 4.7 and 10.6 ± 4.1 g \cdot 150 min⁻¹, respectively). As with energy expenditure, only CRT appeared to have elevated fat oxidation at 150 min post-exercise (83.1 ± 19.1 vs 64.8 ± 67.9 mg \cdot min⁻¹ in other conditions). In accordance, integrated area under the curve (iAUC) of blood triglycerides and glycerol was lowest and highest, respectively, in CRT. Blood glucose was similar in all conditions, but CRT showed the lowest iAUC for insulin.

CONCLUSIONS: Pre-meal exercise changed postprandial energy metabolism in persons with SCI. Independent of exercise energy expenditure, intensity is an important determinant of post-exercise energy expenditure. Furthermore, exercise mode incorporating resistance and high intensity exercise appears to stimulate greater fat oxidation during recovery.

2672 Board #336 May 31 11:00 AM - 12:30 PM Blood Pressure in Response To Hand Grip Exercise In Individuals With Intellectual Disabilities

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BLOOD PRESSURE IN RESPONSE TO HAND GRIP EXERCISE IN INDIVIDUALS WITH INTELLECTUAL DISABILITIES

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Individuals with intellectual disabilities (ID) have limited work capacity, potentially due to autonomic dysfunction. Preliminary data suggests a blunted heart rate response to exercise in this population, and potentially altered hemodynamics. **PURPOSE:** To compare the hemodynamic response to 2-minutes of isometric handgrip exercise (HGE) at 30% of maximal voluntary contraction in individuals with ID to a control group without ID. **METHODS:** Adults with ID (n=15, age 30 \pm 8yrs, BMI 25 \pm 3 kg/m²) and adults without ID (n=16, age 30 \pm 8yrs, BMI 26 \pm 6 kg/m²) had heart rate and blood pressure continuously recorded via an ECG-lead and finger-plethysmography

in the seated position. Isometric Recordings were acquired for the last 2 min of quiet rest, HGE, and the first 2 min of recovery. Spontaneous baroreflex sensitivity (BRS) and sympathetic activation (SAP LF) were calculated. **RESULTS:** Individuals with ID showed smaller increases compared to individuals without ID for diastolic blood pressure and mean arterial pressure (interaction, $p < 0.01$; Table), and no significant increase in systolic pressure or pulse pressure, in contrast to the control participants (interaction $p < 0.01$). Heart rate, BRS and SAP LF response to HGE were not different between groups ($p > 0.05$). **CONCLUSION:** Individuals with ID exhibit a blunted blood pressure response to isometric HGE compared to individuals without ID, and this may explain the limitations these individuals experience with performing exercise. The research leading to these results has received funding from the People Programme (Marie Curie Actions) of the European Union's Seventh Framework Programme (FP7/2007-2013) under REA grant agreement n°625455.

	Control			ID			Effects		
	Base-line	HGE	Recovery	Base-line	HGE	Recovery	Time	Group	Interaction
Stroke volume (ml)	87.3 \pm 17.7	87.6 \pm 17.6	94.4 \pm 18.6	88.4 \pm 14.0	83.2 \pm 18.3	89.2 \pm 12.4	<0.01	0.64	0.12
Cardiac output (L/min)	6.16 \pm 1.12	7.00 \pm 1.41	6.61 \pm 1.11	6.22 \pm 0.89	6.28 \pm 1.60	6.35 \pm 0.96	0.02	0.46	0.06
RRI (ms)	851 \pm 86	762 \pm 124	858 \pm 100	863 \pm 122	819 \pm 150	856 \pm 116	<0.01	0.57	0.05
SAP (mmHg)	133 \pm 9	150 \pm 11 ¹	138 \pm 12 ²	135 \pm 10	140 \pm 10	135 \pm 7 ²	<0.01	0.29	<0.01
DAP (mmHg)	81 \pm 7	92 \pm 9 ¹	82 \pm 9 ²	83 \pm 8	87 \pm 10 ¹	82 \pm 7 ²	<0.01	0.62	<0.01
MAP (mmHg)	102 \pm 8	116 \pm 10 ¹	104 \pm 10 ²	105 \pm 7	109 \pm 8 ¹	104 \pm 6 ²	<0.01	0.68	<0.01
PP (mmHg)	52 \pm 5	58 \pm 6 ¹	56 \pm 6	53 \pm 9	53 \pm 10	54 \pm 7	0.02	0.40	<0.01
BRS* (ms/mmHg)	11.0 \pm 3.1	7.7 \pm 3.4	12.3 \pm 4.2	11.0 \pm 4.2	9.0 \pm 3.0	10.8 \pm 4.2	<0.01	0.99	0.06
SAP LF* (mmHg ²)	12.5 \pm 7.6	16.1 \pm 11.4	14.1 \pm 8.2	12.2 \pm 9.6	13.4 \pm 13.7	16.2 \pm 13.8	0.17	0.38	0.21

RRI, R-R interval; SAP, systolic arterial pressure; DAP, diastolic arterial pressure; MAP, mean arterial pressure; PP, pulse pressure; BRS, baroreflex sensitivity; SAP LF, low frequency component of SAP variability; HGE, handgrip exercise

¹=difference between baseline and HGE, $p < 0.05$; ²=difference between HGE and recovery, $p < 0.05$

*analyses performed on log transformed variables

2673 Board #337 May 31 11:00 AM - 12:30 PM

Hematological Biomarkers are Associated With Cardiorespiratory Fitness and Level of Lesion in Individuals With Spinal Cord Injury

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(No relevant relationships reported)

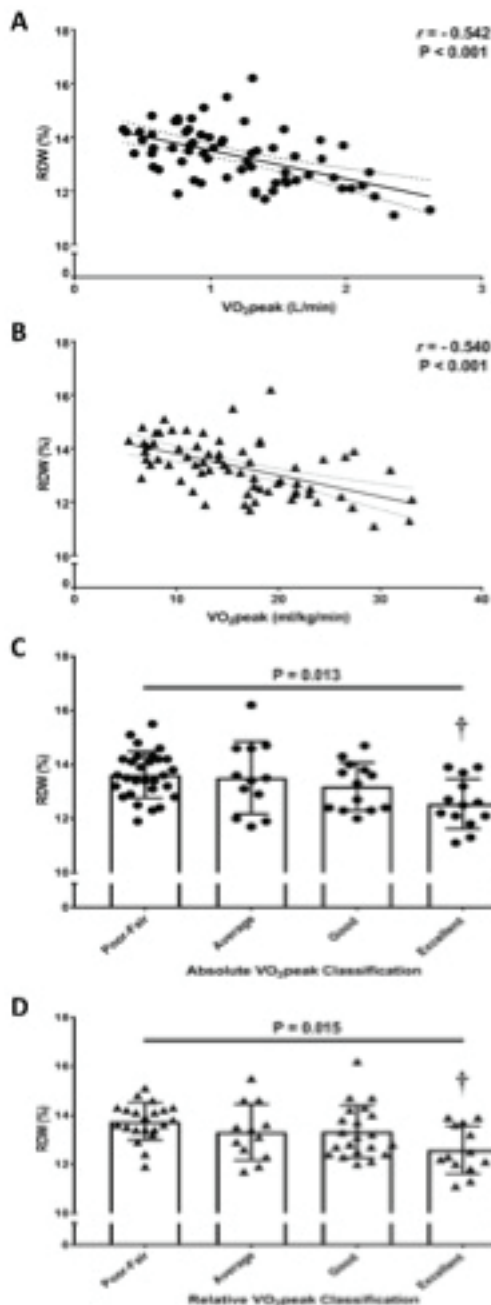
PURPOSE: Spinal cord injury (SCI) is characterised by low cardiorespiratory fitness (CRF) levels and an increased risk of cardiovascular (CV) disease. We aimed to assess: (1) differences in hematological biomarkers between individuals with tetraplegia (TETRA) and paraplegia (PARA) and, (2) associations between hematology profile and cardiorespiratory fitness (CRF).

METHODS: Cross-sectional data from 67 participants (TETRA; n = 21; age: 42 \pm 11 yrs, 6F/15M. PARA; n = 46; age: 43 \pm 10 yrs, 9F/37M) with chronic SCI (> 1 yr) were collected at two research centers. Peak oxygen uptake ($\dot{V}O_{2peak}$) was determined using an upper-body arm-crank exercise test to volitional exhaustion and hematological biomarkers measured using an automated hematology system, respectively.

RESULTS: RDW was significantly ($P < 0.01$) higher in TETRA ($13.9 \pm 0.6\%$) compared to PARA ($13.0 \pm 1.1\%$). Besides mean corpuscular hemoglobin concentration (tetraplegia = 336 ± 8 vs. paraplegia = 349 ± 15 , $P < 0.01$) there were no other significant differences in hematological outcomes between injury groups. Large negative associations were found between absolute (Fig. 1A) and relative (Fig. 1B) $\dot{V}O_{2peak}$ with RDW. Multiple linear regressions accounting for sex as a co-variate did not influence the strength of these associations. Classifying participants by population-specific absolute (Fig. 1C) and relative (Fig. 1D) $\dot{V}O_{2peak}$ revealed significant differences in RDW.

CONCLUSION: These strong negative associations between CRF and RDW in individuals with SCI parallel those previously observed in able-bodied individuals. Higher RDW values (i.e. anisocytosis) is an independent risk factor for increased CV mortality, heart failure, and coronary heart disease and may reflect several underlying

exacerbated metabolic responses such as oxidative stress and systemic inflammation. These data emphasize the importance of maintaining a high CRF in individuals with SCI.



- 2674** Board #338 May 31 11:00 AM - 12:30 PM
Attenuated Cardiac Autonomic Function in Response to Hand Grip Exercise Among Individuals with Intellectual Disability
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 (No relevant relationships reported)

Individuals with intellectual disability (ID) are at a greater risk for co-occurring health conditions, such as cardiovascular disease (CVD). Previous research has indicated autonomic dysfunction, an important contributor to CVD risk, to be present in individuals with ID. However, autonomic dysfunction and its potential impact on work capacity has not been thoroughly investigated in individuals with ID. **PURPOSE:** To assess cardiac autonomic function between individuals with ID and a matched control

group during isometric handgrip (HG) exercise. **METHODS:** Individuals with ($n=13$; 30 ± 7 yrs, 27.0 ± 6.9 kg/m²) and without ID ($n=19$; 28 ± 7 yrs, 25.5 ± 3.7 kg/m²) had cardiac autonomic function assessed via heart rate variability (HRV) in two-minute sections, before, during, and after seated isometric HG exercise at 30% of maximal voluntary contraction. ECG recordings were acquired and analyzed in the time (root mean square of successive differences (RMSSD) and percentage of RR intervals differing by <50ms (PNN50)), and frequency domains (low and high frequency (LF, HF), and LF/HF ratio). Data were log-transformed in the case of non-normal distribution, but raw data are presented below. **RESULTS:** HG exercise elicited a decrease in RMSSD, LF, and HF ($p<0.05$) in both groups that returned to baseline values during recovery. Controls reduced pNN50 during HG and recovered to values higher than seated, however, no changes were observed in ID (interaction, $p=0.03$). LF/HF ratio did not change in either group. **CONCLUSION:** Individuals with ID appear to have attenuated cardiac autonomic responses (i.e., depressed sympathetic tone or incomplete vagal withdrawal) to a sympathoexcitatory task, such as isometric HG exercise. These data suggest that autonomic dysfunction likely exists among individuals with ID even during submaximal intensities and may contribute to the low work capacity in this population. However, a greater sample size is required to fully elucidate these findings.

	Control			ID			Repeated Measures ANOVA		
	Seated	Handgrip	Recovery	Seated	Handgrip	Recovery	Condition Effect	Group Effect	Interaction Effect
RMSSD (ms ²)	40±11	30±12	45±14	36±16	30±14	36±12	0.00 ^{1,2}	0.24	0.10
pNN50 (%)	19±11	12±10 ¹	25±14 ^{2,3*}	15±16	10±12	14±10	0.00	0.17	0.03
Frequency-Domain									
LF (ms ²)	1491±1093	944±744	1849±1009	763±596	658±714	1100±890	0.00 ²	0.03	0.26
HF (ms ²)	602±402	343±239	732±500	424±424	266±231	381±222	0.00 ^{1,2}	0.07	0.11
LF/HF Ratio	339±272	382±341	412±402	291±284	303±238	325±226	0.54	0.47	0.91

¹ Handgrip different from seated position, $p<0.05$

² Recovery different from seated position, $p<0.05$

³ Recovery different from handgrip, $p<0.05$

*Different from ID group, $p<0.05$

All data are reported as mean ± standard deviation

- 2675** Board #339 May 31 11:00 AM - 12:30 PM
Over-ground Walking Economy In Hemiparetic Stroke
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Hemiparetic stroke causes residual gait deficits that impair gait economy/efficiency. Although gait economy is traditionally assessed during sub-maximal treadmill walking, natural over-ground gait mechanics and associated over-ground economy cannot be ascertained using this method, as walking on a treadmill artificially distorts the extent of hemiparetic gait inefficiency by altering gait mechanics. **PURPOSE:** To examine economy of over-ground walking in those with chronic, hemiparetic stroke. Additionally, we sought to determine whether gait speed and distance walked relates to over-ground gait economy in this population. **METHODS:** Twenty-five chronic, hemiparetic stroke survivors underwent a peak exercise test with metabolic monitoring and two 6-minute walk (6MW) tests both with and without a portable metabolic measurement system. Gait economy was calculated as measured $\dot{V}O_2$ during the 6MW divided by predicted $\dot{V}O_2$ for non-stroke age-matched subjects, according to a standard estimation equation utilizing ground speed. **RESULTS:** 6MW distance covered with the portable system (306.3 ± 138.8 meters) was highly correlated ($r=0.93$, $P<0.001$) to distance walked without the system (282.8 ± 113.2 meters), indicating that the lightweight equipment did not impede walking performance. Mean $\dot{V}O_2$ during the 6MW (12.5 ± 3.2 ml/kg/min) was 67% of mean $\dot{V}O_{2\text{ peak}}$ (18.63 ± 5.42 ml/kg/min) and all subjects had impaired gait economy, according to commonly accepted criteria for gauging economy deficits, as the mean measured $\dot{V}O_2$ was 45% higher than the average predicted $\dot{V}O_2$ (8.6 ± 2.3 ml/kg/min) ($p<0.001$). Results further demonstrated a moderate association between gait economy and both gait speed ($r = -0.5$, $P<0.05$) and distance walked ($r = -0.49$, $P<0.05$). **CONCLUSION:** Stroke disability substantively impairs over-ground gait economy, with hemiparetic walking economy associated with walking speed and distance walked. Future research should focus on determining the extent to which economy of gait in over-ground walking can be improved with exercise rehabilitation, as well as determining which types of exercise training and therapy modalities are most beneficial to improving gait efficiency after disabling stroke. Supported by VA Rehabilitation Research and Development Career Development Award and NIH Grant 1T35AG036679.

E-48 Basic Science World Congress/Poster - Sleep and Athletic Performance

Friday, May 31, 2019, 7:30 AM - 12:30 PM
Room: CC-Hall WA2

2676 Board #340 May 31 11:00 AM - 12:30 PM
Cardiac Autonomic Function and Sleep Duration Changes Due to Time-of-Day Practices/Conditioning in College Football Players

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Sleep duration (SD) is critical for exercise recovery, however collegiate student athletes are typically sleep deprived secondary to early morning workouts, class responsibilities, late day competitions and travel. Optimal cardiac autonomic function (CAF) is indicative of an athlete's ability to recover and handle the next practice/conditioning session. Measures of CAF include heart rate variability (HRV) and resting heart rate (RHR) that can be obtained during the last cycle of sleep. **PURPOSE:** The purpose of this study was to compare the impact of time-of-day practices/conditioning during two six-week periods on HRV, RHR, and SD in college football players. The two six-week periods compared were off-season early morning (6:00 am) summer conditioning and in-season fall afternoon (3:30 pm) practices. **METHODS:** Thirteen male college football players were fitted with WHOOP wearable activity/recovery tracking devices that use photoplethysmography and accelerometry to determine HRV (RMSSD), RHR (bpm), and SD (hrs/day). Both HRV and RHR are measured during the last sleep cycle to determine CAF. The WHOOP device was worn throughout the entire day and night, including during practices, conditioning, and sleep. Data were downloaded to the user's smartphone daily then uploaded into SPSS for statistical analyses. The six-week summer conditioning occurred at 6:00 am while the six-week fall practices occurred at 3:30 pm. **RESULTS:** A series of three paired sample t-tests were performed to compare HRV, RHR, and SD between the two six-week time periods for time-of-day comparisons. Both HRV (100.2 vs 82.2, $p=0.002$) and SD (4.5 vs 5.3, $p=0.002$) were significantly different between the two six-week practice/conditioning time periods while RHR was not significantly different (56.6 vs 58.2, $p=0.201$). **CONCLUSIONS:** Both SD and one measure of CAF (HRV) differed based on time-of-day practices/conditioning in college football players. Athletes appeared to have higher CAF (HRV) during the six-week summer conditioning (6:00 am) period, while increased SD during the fall six-week practice (3:30 pm) period. Supported by The American Athletic Conference Research Consortium Grant

2677 Board #341 May 31 11:00 AM - 12:30 PM
Immediate and Residual Effects of Sleep Extension on Performance and Motivation in Tactical Athletes

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PURPOSE: Investigate the immediate and residual impacts of sleep extension on performance in tactical athletes. **METHODS:** A randomized controlled trial (Sleep extension = EXT vs Control = CON) was conducted on 50 (EXT: 20.12 ± 2.01 years vs CON: 19.76 ± 1.09 years) tactical athletes enrolled in the Reserve Officers' Training Corps. Participants wore actigraphs for 15 consecutive nights and completed a cognitive/motor battery after 7 habitual sleep nights, after 4 sleep extension nights, and after the resumption of habitual sleep for 4 nights. The CON group remained on habitual sleep schedules for the duration of the study. **RESULTS:** During the intervention, the EXT group significantly increased mean sleep time (1.36 ± 0.71 hours, $p < .001$). After sleep extension, there were significant between-group differences on the mean score change since baseline in Psychomotor Vigilance Test reaction time ($p = .026$), Trail Making Test - B time ($p = .027$), standing broad jump (SBJ) distance ($p < .001$), and motivation to perform the cognitive tasks ($p = .003$) and the SBJ ($p = .009$), with the EXT group showing a greater enhancement in performance/motivation. After resuming habitual sleep schedules, significant between-group differences on the mean score change since baseline persisted on SBJ distance ($p = .001$) and motivation to perform the SBJ ($p = .035$), with the EXT showing greater enhancement in performance/motivation. **CONCLUSION:** Increasing sleep duration resulted in immediate performance benefits in psychomotor vigilance, executive functioning, standing broad jump distance, and motivation levels. Benefits on motor

performance and motivation were evident four days after resumption of habitual sleep schedules. Sleep duration appears to positively impact performance and motivation levels in tactical athletes. The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government

2678 Board #342 May 31 11:00 AM - 12:30 PM
Sleep Quality and Psychosocial Variables Predict Common Cold in Marathon Runners

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General population studies show that poor sleep and psychological stress predict common cold and recent work shows that early life adversity can have long lasting effects on immunity across the lifespan. However, the influence of these lifestyle and psychosocial factors on common cold in athletes remains poorly understood (Walsh NP, 2018, *Eur J Sports Sci*, **18**: 820-31).

PURPOSE: To investigate the influence of sleep quality and psychosocial variables on upper respiratory symptoms (URS) in runners before and after a marathon.

METHODS: In a cohort, observational study 305 runners (68% male, age: 45 ± 9 years) were monitored during the 2-weeks before and after the Snowdonia marathon that takes place in the fall. URS incidence was monitored daily using Jackson common cold questionnaire; whereby, criteria for a URS bout was a symptom score ≥ 6 on two or more consecutive days. Criteria for a repeated URS bout in the same participant required at least five consecutive days with a symptom score of zero between URS bouts. Participants completed questionnaires assessing personality, trait anxiety, perceived stress and the occurrence of early life adversity. Training load (weekly) and self-reported sleep quantity and quality (daily) were monitored. Chi-square analyses compared pre and post marathon URS. Logistic regression was used to determine predictors of URS pre and post marathon.

RESULTS: URS incidence was similar in the two weeks pre- and post-marathon ($P > 0.05$; 39 vs. 42 URS bouts, respectively). When accounting for sex, age and prior illness, participants who experienced early life adversity were twice-as-likely to report a URS bout pre-marathon (OR, 2.20; $P < 0.05$). Other significant predictors of URS incidence pre-marathon were lower emotional stability (OR, 0.77; $P < 0.05$), higher perceived stress (OR, 1.08; $P < 0.05$) and higher trait anxiety (OR, 1.05; $P < 0.01$). During the two weeks after the marathon, participants were twice as likely to suffer a URS bout if they reported lower sleep quality (OR, 2.34, $P < 0.01$). Higher state anxiety immediately before the race (OR, 1.04, $P < 0.05$) also predicted URS post-marathon.

CONCLUSION: Self-reported sleep quality and early life adversity predict common cold in marathon runners.

2679 Board #343 May 31 11:00 AM - 12:30 PM
Effects of Nap After Morning Exercise on Afternoon Performance and Overnight Sleep in Athletes

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(No relevant relationships reported)

One-half of Japanese athletes have problems with sleep and daytime sleepiness. Nap is used to reduce mental and physical fatigue and improve afternoon performance. However, the impact of nap on athletes' performance is not clear. Few studies have been reported on how to spend a day towards the afternoon performance as recovery after morning exercise. **PURPOSE:** To examine the effects of a 90-min daytime nap after morning high-intensity exercise on afternoon performance and nocturnal sleep.

METHODS: Eight healthy athletes were recruited for this study. They performed high-intensity intermittent exercise in the morning. The exercise session began at 10:30-11:00. The high-intensity intermittent exercise consisted of 12 sets, 1-min bouts of cycling at 100% of VO₂max and 4-min bouts at 0% of VO₂max at 60 rpm, and then continuous cycling at 100% of VO₂max until exhaustion. After the exercise session, the participants consumed lunch at 13:00. Nap/no-nap trials were performed at 14:30-16:00 randomly for cross-over design and were separated by at least 1 week. The participants consumed dinner at 19:30. The bedtimes and wake-up times were adapted to each participant and kept consistent between the nap/no-nap trials. The sleep efficiencies of the daytime nap and nocturnal sleep were monitored using a sheet-shaped body vibrometer. Sleepiness, reaction time, and blood samples were measured before and after the nap/no-nap trials. Each measurement before trials and after trials was compared by two-way repeated measures of analysis of variance. **RESULTS:** The sleep efficiency in the daytime nap trial was 84.4 ± 4.1%. In the nap trial, sleepiness

was significantly reduced (nap score, -4.1 ± 1.4 ; no-nap score, 0.9 ± 1.2 score; $P < 0.05$) and the reaction time was significantly shortened (nap, -6.9 ± 3.7 ms; no-nap, 7.1 ± 4.3 ms; $P < 0.05$). In addition, growth hormone (nap, 0.8 ± 0.3 ng/mL; no-nap, 0.0 ± 0.0 ng/mL; $P < 0.05$), histidine, and cystine levels increased significantly in the nap trial. The nocturnal sleep efficiencies following the daytime nap were not disturbed (nap, 93.6 ± 1.5 %; no-nap, 94.9 ± 1.7 %; $P > 0.05$). **CONCLUSION:** The present study suggested that a 90-min daytime nap after morning high-intensity exercise reduces sleepiness, shortens reaction times and does not disturb nocturnal sleep in athletes.

2680 Board #344 May 31 11:00 AM - 12:30 PM
Sleep Profile And Performance Of Young Futsal Athletes
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 (No relevant relationships reported)

Futsal is characterized as a high intensity game, which requires good physical conditioning, reaction speed and decision-making in a short time. In this scenario, sleep is an important factor to promote a good physical and cognitive recovery. However, studies show that adolescents suffer from interrupted or sleep deprivation, which damages their physical and psychological recovery. **Purpose:** To investigate the sleep pattern of futsal athletes and their performance during the competitive futsal game. **Methods:** 26 futsal players, male, aged 13-17 years were recruited. Volunteers answered sleep questionnaires, including Pittsburgh Sleep Quality Index, Epworth Sleepiness Scale and Morningness-Eveningness Questionnaire. Before and after the match, they answered the Sleep Diary. Separated by category, the athletes played an official futsal game, in which was held assembling a scout of each athlete during the match (passes, assists, shots, interceptions, fouls, yellow/red card). A descriptive analysis and distribution of relative frequencies were performed. In addition, Student t-test was used and a significance level at $P < 0.05$. The study was approved by UNIFESP Ethics Committee (#1130/2015). **Results:** The athletes had 15.08 ± 1.44 years and BMI 20.85 ± 2.21 kg/m², being 38.46% (n=10) of U-14, 34.62% of U-16 (n=9) and 26.92% of U-17 (n=7). Most of the athletes present good quality sleep (84.62%), low daytime sleepiness (65.38%) and indifferent chronotype (69.23%). In the sleep diary, no significant difference was observed in sleep quality score (pre = 7.15 ± 2.88 vs post = 7.07 ± 2.81 ; $p=0.90$) and total sleep time (pre = 551.19 ± 95.95 min vs post = 548.92 ± 112.78 min; $p=0.93$) before and after the game. However, pre-game 34.62% reported having a sleep quality equal to the usual, 42.31% had a better sleep and 23.08% had a worse night's sleep. In the post-game, 50% reported having a night of sleep as usual, 26.92% had better sleep and 23.08% had a worse night's sleep. In the scout analysis, the athletes presented positive performance (positive points minus negative points) 19.23 ± 16.4 even losing the match. **Conclusions:** We concluded that there are no changes in the sleep pattern of young futsal athletes at pre and post-game. In addition, although the performance of the athletes was positive, this was not enough for them to win.

2681 Board #345 May 31 11:00 AM - 12:30 PM
Sleep-wake Cycle Analysis of Wheelchair Rugby Athletes During Two Phases of The Season
 Victor Sanz-Milone¹, Fernanda Versuka Narciso², Marco Tulio De Mello², Andressa Silva², Milton Misuta¹, Andrea Maculano Esteves¹. ¹Universidade Estadual de Campinas (UNICAMP), Campinas, Brazil. ²Universidade Federal de Minas Gerais (UFMG), Belo Horizonte, Brazil.
 (No relevant relationships reported)

PURPOSE: Sleep is directly responsible for the recovery of energy spent during wake period, besides being fundamental in the development and maintenance of metabolic activities of the organism. The objective of the study was to evaluate the wake-sleep cycle of wheelchair rugby athletes during two stages of the regular season of the sport. **METHODS:** Six professional wheelchair rugby athletes of the Minas Quad Rugby team of Belo Horizonte (MG/BR), this team has national relevance being two times national champions and having players that are frequently called to represent the Brazilian national team during official competitions. The athlete used the actigraph, a watch like equipment responsible for measuring the wake-sleep cycle utilizing an accelerometer and noninvasive procedure. It is considered to be gold standard to this kind of measure. The equipment was used for 10 consecutive days in two moments: 1) pre-season; 2) competitive period with the actigraph the athletes also received the sleep diary, it is a registration of any occurrences while using the equipment. The actigraph provided the following measurements: time he laid down, time he slept, time he woke up, time he got up, also sleep latency, sleep efficiency, total sleep time and wake after sleep onset. In addition, the players still responded to an anamnesis, and the questionnaires of daytime sleepiness (Epworth), subjective quality of sleep (Pittsburgh) and chronotype. **RESULTS:** Results showed that wheelchair rugby athletes had

poor sleep quality in both stages. The athletes also demonstrated oscillations in the sleep-wake cycle depending on their routines, that is during the rest days the players presented different sleep measurements when compared with training session days and with competition days, at this time of the study there were significant results found analyzing the following variables: total sleep time ($p=0.04$), sleep efficiency ($p<0.01$) and wake after sleep onset ($p=0.01$). GLM-ANOVA.

CONCLUSIONS: With the current study it can be concluded that professional wheelchair rugby players have poor sleep quality and their sleep oscillates during the regular season of the sport, even more, the athletes have sleep oscillations depending on the characteristics of their routine.

2682 Board #346 May 31 11:00 AM - 12:30 PM
Poor Sleep Quality is Associated with Elite Soccer Injuries
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PURPOSE: The present study proposed to investigate a relationship between sleep quality and quantity and muscular injuries in elite soccer players.

METHODS: The current investigation was a prospective cohort study of elite soccer players competing for two teams at the highest level of Brazilian competition. Data were collected for 23 players for one season (6 months). The players' sleep behavior was monitored using self-report sleep diaries and a wrist activity monitor the actigraph Actiwatch 2 (Philips Respironics®, Andover, MA) was used to continuously measure athletes rest-activity or sleep-wake cycles. The actigraph was worn on the non-dominant wrist of each athlete beginning on the first day of the assessment and remained there for 10 consecutive days. A specific database for injury recording was assembled and completed in conjunction with the medical team of each team on the day of the athlete's injury. Spearman's correlation coefficient was used to calculate the correlation between the variables. **RESULTS:** Our results indicated a moderate negative correlation between sleep efficiency and injury characteristics of the 23 soccer players (Absence time: $r=-0.524$, $p=0.01$; Injury severity: $r=-0.674$, $p<0.01$; Amount of injury: $r=-0.624$, $p<0.01$). The linear regression analysis indicated that for each increase in the score for sleep efficiency, amount of injury (number) decreased 0.06 ($R^2 = 0.44$) and absence time after injury (days) decreased 1.43 ($R^2 = 0.23$). Additionally, the results showed that for each increase in the Wake After Sleep Onset, amount of injury increased 0.02 ($R^2 = 0.30$).

CONCLUSIONS: It can be concluded that soccer players with poor sleep quality or nonrestorative sleep are prone to the risks of musculoskeletal injuries. Supported by UFMG, FAPEMIG, CAPES and CNPQ.

F-06 Thematic Poster - Bone and Integrative Physiology

Friday, May 31, 2019, 1:00 PM - 3:00 PM
Room: CC-101A

2708 Chair: Kelly Massey, *Milledgeville, GA.*
(No relevant relationships reported)

2709 Board #1 May 31 1:00 PM - 3:00 PM
Growth or Destruction: Bone Marrow Edema Pathways
Arya Minaie, Karen Myrick, Bernadette Mele, Richard Feinn, Thomas Martin, Juan Garbalosa. *Quinnipiac University, Hamden, CT.*
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PURPOSE: Bone Marrow Edema (BME) is a common incidental finding on MRI in athletes. While the etiology and composition are not well understood, it has been linked to potential long-term adverse events such as osteoarthritis. The purpose of this study was to 1) describe the fat fraction (FF) of BME lesions in female athletes and 2) establish if demographic risk factors can predict magnetic resonance spectroscopy (MRS) compositional results.

METHODS: A prospective cohort of Division I female athletes, without previous ligamentous tears or surgery of the knee, were recruited to undergo a 1.5T screening MRI of each distal femur. Three readers assessed the MRI's separately for the presence of BME as well as a quantitative KOSS score. Subjects were invited two weeks later, to be scanned using a 3T MRI with Single-voxel 1H Spectra to evaluate the fat: water ratio of the BME lesions using the aid of the readers to guide voxel placement to avoid the femoral cortex and target the zone of maximal BME. Measured peaks were reported as FF = (Fat Content / (Fat Content + Water Content)) * 100. A multilevel linear mixed model was used to determine significant findings in bone marrow composition.

RESULTS: Seven female athletes (mean age: 19.1 ± 1.2 years, weight: 69.7 ± 10.0 kg, height: 166.9 ± 5.0 cm, and BMI: 25.0 ± 3.3 kg/m²) met our inclusion criteria. Eight knees were positive for BME, with 6 negative, demonstrating a total KOSS distribution between 0-2 (median; 1.0). There were no differences in water or fat content by BME status, however, positive knees had a higher FF than negative knees (p=0.058; 12.4% ± 1.3% vs. 11.0% ± 0.8%). The effect size of the difference was very large (d=1.30). In two athletes with unilateral BME, the FF of the knee with BME was greater than that of the knee without BME. BMI, sport, leg dominance, and KOSS score were not significantly correlated with FF.

CONCLUSIONS: To the best of our knowledge, this study is the first of its kind to describe the FF of knees with and without BME in female athletes. The increased FF found in BME-positive knees supports the case for the sequential development of fat metaplasia following acutely transient BME. Future research should be aimed at following individuals with BME over time with T1-weighted MRI imaging to look for non-age related changes in FF.

2710 Board #2 May 31 1:00 PM - 3:00 PM
The Effects of Leptin and Estradiol Administration on Cancellous Bone Microarchitecture in Male Rats
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Both leptin (Lep) and estradiol (E2) influence bone formation. However, the combinatory effects of Lep and E2 on bone microstructure require further elucidation. Purpose: To investigate whether central Lep gene expression and/or systemic E2 treatment alter cancellous bone microstructure in male rodents. Methods: 3-month-old male Sprague-Dawley rats (n=28) were assigned to the following groups: 1) Vehicle-Lep (Veh-Lep) (n=7), 2) E2-Lep (n=9), 3) Veh-green fluorescence protein control (Veh-GFP) (n=5), or 4) E2-GFP (n=7). Lep or GFP (control) were delivered into the third ventricle of the brain at a dose of 1 mL of rAAV1 (2.3 x 10¹³ vg/mL). E2 (25 µg/kg diluted in 0.5 mL/kg sesame oil) or Veh (sesame oil, 0.5 mL/kg) were injected subcutaneously on a daily basis. At day 24, femurs were excised and analyzed via ex vivo micro-CT. The outcomes reported were: 1) cancellous bone volume/total volume (cBV/TV, %), 2) trabecular thickness (Tb.Th, mm), 3) trabecular number (Tb.N, #/mm), 4) trabecular separation (Tb.Sp, mm), and 5) trabecular pattern factor (Tb.Pf). Separate One-Way ANOVAs were performed and Tukey's post hoc tests were used when appropriate. Results: Both E2 treated groups exhibited directionally higher cBV/TV when compared with Veh-GFP (controls), while Veh-Lep displayed

directionally lower cBV/TV vs controls, although, these values did not reach the level of statistical significance. In comparison, the Veh-Lep group exhibited 40% lower cBV/TV vs E2-GFP, characterized by 35% lower Tb.N and 64% higher Tb.Sp (all p<0.05). Veh-Lep also exhibited higher Tb.Pf than E2-GFP (p<0.01), indicating a less connected trabecular network. Correspondingly, Veh-Lep displayed 36% lower cBV/TV and higher Tb.Pf values compared to E2-Lep (p<0.05). No significant differences were observed between the E2-GFP and E2-Lep groups for any cancellous outcome. Conclusion: Our data indicate that neither the combination nor individual administration of E2 and Lep produced higher cancellous bone outcomes than Veh-GFP controls. However, E2 treated groups exhibited higher cBV/TV than Lep treated groups. Further investigation is necessary to determine whether E2 stimulated bone accretion and/or whether Lep suppressed bone gain in our male rodent model.

2711 Board #3 May 31 1:00 PM - 3:00 PM
Markers of Bone Formation Are Augmented Following Three Months of Ballistic Training
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The osteogenic index (OI) has been used to estimate the potential effectiveness of an exercise protocol on bone adaptations. It is speculated that splitting a training program into multiple daily sessions while incorporating rest periods in between loading sessions is more advantageous than all loading occurring during a single bout of exercise.

PURPOSE: To test the hypothesis that two (2EX) vs one (1EX) session per day of ballistic resistance exercise produces greater adaptations in markers of bone turnover when equated for total exercise volume but differing in OI.

METHODS: Seventeen healthy individuals (6M/11W; 21.7 ± 3.7 y (mean ± SD), body mass (kg): 67.3 ± 11.2; height (cm): 165.2 ± 11.6; body fat (%): 31.3 ± 9.0) volunteered for the study. Participants performed ballistic non-linear periodized resistance training three days per week in either the 1EX (3M/8W) or 2EX (3M/3W) group. An acute exercise test (AET; 10 sets of 10 plyo-jumps; Plyopress 625 III) was done at pre- (PreTr) and post-intervention (PostTr). Serum markers of bone turnover were analyzed immediately prior to (PreEx) and following (0 and 60 minutes PostEx) the AET using immunoassays. These included markers of bone formation (BAP, Osteocalcin, P1NP) and resorption (TRAP, CTx), and a hormonal marker (Vitamin D). PreTr vs PostTr changes in biomarker AET-induced responses were compared across groups using integrated area under the curve (AUC) analyses from the 90 minutes surrounding the AET (PreEx to 60 minutes PostEx) and 2x2 RMANOVA using GraphPad Prism software.

RESULTS: There were no significant group × time interactions for any bone biomarker (p≥0.05). However, there were significant main training effects for BAP and P1NP, such that AUC concentrations increased by 9.9% and 14.3% respectively, following training (Mean ± SD; BAP PreTr: 2002 ± 1653 vs. PostTr: 2201 ± 1783 U/L*90min, p=0.01; P1NP PreTr: 5898 ± 7321 vs. PostTr: 6742 ± 7124 µg/L*90min, p=0.03).

CONCLUSION: Exercise-induced markers of bone formation increased following 12 weeks of ballistic periodized resistance training, with no differences between exercise programs differing in OI. Markers of bone resorption did not change following training. This indicates that the ballistic exercise training program stimulated favorable changes in bone turnover, regardless of training frequency.

2712 Board #4 May 31 1:00 PM - 3:00 PM
Cortical and Trabecular Bone Morphology in Response to Exercise and a Ketogenic Diet
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Adopting a ketogenic diet (KD) is becoming increasingly popular, partly due to favorable impacts on blood glucose and body composition. Recent research has demonstrated possible negative effects of a KD on bone morphology in mice, but interactions with exercise, which sometimes accompanies health-oriented diet changes, have not been examined. **PURPOSE:** To determine the effects of a KD and aerobic

exercise on cortical and trabecular bone morphology in mice. **METHODS:** Forty C57BL6 mice were randomized into 4 groups (n=10/group): 2 groups were fed a low-fat control diet (16% protein, 72% carbohydrate, 12% fat) with one group performing vigorous intensity (blood lactate >4mM post-exercise) daily treadmill exercise (CEX), while the other served as sedentary controls (CSED). The remaining 2 groups were fed a high-fat, carbohydrate-deficient KD (16% protein, 84%fat) with one exercise group (KEX) and one sedentary control group (KSED). Treatment diets began 6 weeks pre-euthanasia and the exercise intervention occurred during the final 3 weeks. Femurs were analyzed for bone morphology using micro-computed tomography. Analysis variables included bone volume, ratio of bone to total volume, thickness, and bone mineral density (BMD) for both cortical and trabecular bone; trabecular number, spacing, and connectivity were also included. **RESULTS:** Two-way factorial ANOVA revealed an exercise effect on trabecular thickness (p=0.002) and an interaction between diet and exercise for trabecular BMD (p=0.038). Post-hoc analysis showed 5.8% thicker trabeculae in exercise groups, CEX & KEX, compared to sedentary groups, CSED & KSED, (47.7±0.6µm vs. 45.1±0.5µm, p<0.05). Trabecular BMD was 3.0% higher in CEX compared to CSED (776.7±5.8mgHA/cm³ vs. 754.0±5.2mgHA/cm³, p<0.05), whereas trabecular BMD was statistically similar between KEX and KSED (757.5±6.2mgHA/cm³ vs. 759.5±5.5mgHA/cm³, p=0.99). No other significant effects or interactions were found. **CONCLUSION:** The positive effect of exercise on bone morphology shown in this research is in line with that found in the literature. Our results did not identify any detriments in bone morphology in response to a ketogenic diet alone, but BMD changes induced by exercise in mice fed a control diet were negated by the ketogenic diet.

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2713 Board #5 May 31 1:00 PM - 3:00 PM
The Association between Quantified Training Load and Bone Adaptation

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PURPOSE: Habitual mechanical loading during pubertal stages has consistently been associated with current and future anabolic effects on bone characteristics. However, the specific aspects of mechanical loading that bring about anabolic effects are yet to be established. The present study investigated the relationship between soccer specific loading patterns and subsequent bone adaptation in youth soccer players.

METHODS: 17 elite adolescent soccer players (mean ± SD = age: 16.3±0.5 years; height: 1.79±0.07m; body mass: 74.9±6.7 kg) gave informed consent to take part in a study approved by the National Research Ethics Service. Peripheral quantitative computed tomography scans of the tibia of the dominant leg were taken at the beginning of pre-season training and 12-weeks later. Tibial mass (g), trabecular area (mm²), cortical area (mm²) and density (mg·cm⁻³), periosteal circumference (mm) and strength strain index (SSI) (mm³) at the 4, 14, 38 and 66% sites were measured. During the 12 week training period, workload was quantified using a global positioning system (GPS). The following metrics were analysed: session duration (min), total distance covered (m), and high-speed running distance (17.0 km·h⁻¹). Changes in bone characteristics were assessed using paired sample t-tests, and associations between GPS metrics and bone adaptation were assessed using Person's correlation coefficient.

RESULTS: Tibial mass increased by 2.9, 1.2 and 0.7% at the 4, 14 and 38% tibial sites (P < .05). SSI (38%; 2337.1±340.9 compared to 2383.1±317.3, P = .05) and cortical area (38%; 380.9±23.2 mm² compared to 383.1±30.8 mm², P = .02) increased following 12-weeks of soccer specific training. Average session duration was positively correlated with increased trabecular area (4%; P=.02, r=0.61) and periosteal circumference (38%; P=.03, r=0.55). Average high-speed running was positively correlated with changes in SSI (14%; P=.05, r=0.51) and cortical density (38%; P=.05, r=0.52).

CONCLUSIONS: Soccer specific training increases tibial bone characteristics at the 4, 14 and 38% sites. Moreover, session duration and high-speed running were associated with increased tibial strength, size and density following 12-weeks of soccer specific training. These factors should be considered when recommending exercise for bone health.

2714 Board #6 May 31 1:00 PM - 3:00 PM
Circulating Sclerostin and MicroRNA-21 Are Predictors of Bone Mineral Density in Postmenopausal Women

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Sclerostin is a potent inhibitor of the Wnt signaling pathway, which inhibits osteoblasts to form new bone (Turner et al., 2009). MicroRNAs (miRNAs) are short, non-coding RNAs that fine tune posttranscriptional gene expression. Recent research has shown that some circulating miRNAs (c-miRNAs) are upregulated in osteoporotic fracture individuals (Seeliger et al., 2014). Since both sclerostin and miRNAs regulate signaling pathways in bone, together they may be potential biomarkers of bone health.

PURPOSE: To examine the relationships between serum sclerostin and specific c-miRNAs and to predict bone mineral density (BMD) based on circulating sclerostin and miRNA levels. **METHODS:** Seventy-three postmenopausal women aged 60 to 85 years old participated in this study. Body composition and aBMD of the total body, lumbar spine and hips were measured by DXA. Osteoporosis was determined using aBMD T-scores at lumbar spine, femoral neck, or total hip according to WHO criteria (aBMD T-score ≤ -2.5). Serum levels of sclerostin and bone resorption markers (CTX, TRAP5b) were measured by ELISA. Total RNA was extracted from serum, and relative expression levels of c-miRNAs (miR-21, -23a, -24, -100, -125b) were analyzed using miRNA assays and real-time PCR. **RESULTS:** There were no significant correlations between serum sclerostin and c-miRNAs. Serum sclerostin was significantly negatively correlated with CTX (r = -0.252, p<0.05). Sclerostin levels were significantly lower in the osteoporotic group (n=10, 0.560 ± 0.158 ng/mL) compared to the normal BMD group (n=14, 0.776 ± 0.190 ng/mL) (p<0.05). Stepwise regression analysis showed that miR-21 and sclerostin levels were significant predictors of BMD at all sites (standardized coefficient β (sclerostin)= 0.398 to 0.520, standardized coefficient β (miR-21)= -0.248 to -0.317, adjusted R²= 0.238 to 0.332, p<0.001). **CONCLUSION:** Our results indicate that circulating sclerostin and miR-21 are significantly associated with bone mineral density in postmenopausal women. Further studies are needed to examine the common signaling pathways that sclerostin and miR-21 regulate in bone metabolism.

2715 Board #7 May 31 1:00 PM - 3:00 PM
The Effect of Running Vs Cycling on Bone Markers Response

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BACKGROUND: The Physical Activity Guidelines for American Adults recommend the equivalent of 150 minutes of moderate intensity aerobic activity each week without specifying the exercise modality. Running (weight bearing) and cycling (non-weight bearing) are common aerobic activities. However, they differ in their mechanical impact on the bone. Bone turnover (formation & resorption) can be reflected by circulating bone markers, bone specific hormones and cytokines (osteokines) released from the dynamic remodeling of bone. **PURPOSE:** To compare the bone marker response to running versus cycling at the same moderate-intensity target Heart Rate (HR). **METHODS:** 13 healthy male adults (23.7 ± 1.0 yr.) completed 4 laboratory visits. Participants performed two progressive exercise tests to exhaustion on cycling ergometer (CE) and treadmill (TM) to determine peak VO₂ and peak HR. On subsequent separate days, in a randomized order, participants performed a 30-min constant exercise challenge at 70% HR reserve (HRR) on CE and TM. Blood was drawn before (Pre), immediately post (IP) and 1h into recovery (Rec) and analyzed for lactate, osteocalcin, sclerostin and parathyroid hormone (PTH). Two-way ANOVA was used to evaluate within-person differences with time (Pre/IP/Rec) and exercise modalities.

RESULTS: 70% HRR was successfully clamped during CE and TM (CE 156.7 ± 0.4; TM 159.3 ± 0.7 bpm). Exercise on CE elicited higher IP lactate (6.2 ± 1.1 Vs 2.9 ± 1.1 nmol/l, p<0.01) and 13.7% lower O₂ uptake. At IP sclerostin increased significantly (p=0.0007) only in TM (49% Vs. 16% p=0.004). PTH had similar transient increase at IP in both modalities (p<0.001). No significant changes were observed in osteocalcin in both modalities.

CONCLUSIONS: 30 min of running and cycling at 70% HRR lead to a metabolic bone response immediately after the exercise in both modalities. While PTH, an essential factor for calcium metabolism and bone formation, increased significantly

and similarly at IP in both modalities, sclerostin (inhibitor of bone formation) increased significantly only in TM. This may reflect higher impact on the bone during running compared to cycling.

2716 Board #8 May 31 1:00 PM - 3:00 PM
Bone Mineral Density Comparisons Between Contact and Non-Contact Male and Female Collegiate Athletes

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(No relevant relationships reported)

Bone mineral density (BMD) and bone mineral content (BMC) have been suggested to be greater in athletes than non-athletes. However, less research has been done comparing the nature of the sport and the impact that has on BMD and BMC in male and female collegiate athletes. **PURPOSE:** To determine the effects of BMD and BMC between full contact (FC), limited contact (LC) and non-contact (NC) sports in male and female athletes. **METHODS:** Data from 45 male (FC [football]: 18, LC [basketball, baseball, soccer]: 21, NC [cheer, tennis, golf]: 6) and 33 female (FC: 0, LC [basketball, softball, soccer]: 16, NC [cheer, tennis, volleyball, swimming, rifle, track]: 17) Division I athletes was collected via whole body dual-energy x-ray absorptiometry (DXA). One-way ANOVAs (male and female) were run to compare BMD, BMC and, body fat percentage (BF%) between sports. **RESULTS:** A main effect significant difference was noted between BMD ($F(2,44) = 9.79, p < 0.01$) and BMC ($F(2,44) = 12.15, p < 0.01$) in male athletes. Post-hoc LSD analysis revealed that significance in all variables was between FC (BMD: 1.46 ± 0.09 g/cm³) compared to LC (1.36 ± 0.89 g/cm³, $p < 0.01$) and NC (1.31 ± 0.11 g/cm³, $p < 0.01$). Similarly, difference in BMC were between FC (4322.9 ± 564.3 g) compared to LC (3639.6 ± 485.0 g, $p < 0.01$) and NC (3403.3 ± 295.6 g, $p < 0.01$). BF% was not significantly different between any group ($p = 0.09$). No significant differences were noted with female athletes in any of the variables: BMD (LC: 1.22 ± 0.07 g/cm³, NC: 1.24 ± 0.07 g/cm³, $p = 0.29$); BMC (LC: 2797.6 ± 382.7 g, NC: 2883.8 ± 361.7 g, $p = 0.51$); BF% ($p = 0.29$). **CONCLUSION:** The nature of the sport may have an impact on an athlete's BMD and BMC, but only if the athlete competes in a FC sport, where sufficient sustained compression occurs to increase bone formation.

F-07 Thematic Poster - Brain, Performance and Concussions

Friday, May 31, 2019, 1:00 PM - 3:00 PM
 Room: CC-101B

2717 Chair: Dane B. Cook, FACSM. University of Wisconsin-Madison, Madison, WI.

(No relevant relationships reported)

2718 Board #1 May 31 1:00 PM - 3:00 PM
Head Impact Exposure Alters Neural Synchrony and Complexity in Collegiate Athletes

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(No relevant relationships reported)

White matter connects neighboring and distant cortical regions and is the basis for brain circuits. Regular exercise strengthens these connections, but athletes participating in contact sports, including water polo, are at risk for repeated head impacts capable of damaging white matter and impairing brain circuit function. One way of measuring functional connectivity of these circuits is through resting-state electroencephalography (EEG). **PURPOSE:** To test the hypothesis that repeated head impact exposure reduces fast-rhythm ('gamma') synchrony and an associated increase in slow-rhythm complexity. **METHODS:** Intercollegiate water polo players (9 Men; 10 Women) were tested before and after the season. During the testing, each player sat with eyes closed for five minutes wearing a 32 dry-electrode EEG cap (sampling rate = 500 Hz). From the pre-processed EEG data, we computed debiased weighted phase lag index (dWPLI) as a measure of gamma (30-50 Hz) synchrony and multiscale entropy (MSE) as a measure of neural complexity. Athletes were monitored during competitions for head impacts using cap-worn inertial sensors to quantify peak linear acceleration (PLA), rotational acceleration (PRA), and rotational velocity (PRV). Cumulative exposure (twPCA) was computed per athlete by summing principal component 'magnitude' scores (representing PLA, PRA, and PRV) weighted by time (1/days) relative to post-season assessment. Mediation analysis was performed using

a series of linear regression analyses to test the relationships among twPCA, gamma dWPLI, and MSE at fine (500 Hz), moderate (33-250 Hz), and coarse (12-30 Hz) timescales. **RESULTS:** Greater twPCA was associated with a loss of gamma dWPLI [$r(17) = .709, p < .001$]. There was a significant indirect effect of twPCA on MSE across moderate time-scales [$\beta = 0.456$; 95% CI(0.048, 1.0432), $p = 0.04$]. Approximately 25% of the variance in MSE was accounted for by the mediator, gamma dWPLI ($R^2 = 0.247$). There was no mediation effect on MSE at fast or coarse time-scales ($p > .06$). **CONCLUSIONS:** One season of repeated head impact exposure altered brain dynamics in a dose dependent manner. The loss of fast-rhythm synchrony in athletes sustaining the greatest exposure contributed to a loss of complexity that could represent distributed and inefficient information processing at rest.

2719 Board #2 May 31 1:00 PM - 3:00 PM
Concussion History Impairs Cerebrovascular Reactivity in Special Operations Forces Personnel

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Concussion has been an increasingly prevalent blast-related injury in Special Operations Forces (SOF) personnel over the last decade. Recent studies suggest physiological deficits, such as cerebrovascular function, may outlast clinical recovery following injury. Cerebrovascular reactivity (CVR) measures the cerebral blood flow response to variations in carbon dioxide partial pressures. Understanding how concussion history affects CVR may better inform physiological assessment and long-term outcome management following concussion. **PURPOSE:** To investigate how concussion history influences CVR in SOF personnel. **METHODS:** Thirty-nine SOF personnel completed a demographic survey self-reporting concussion history (concussion history = 22 (56.4%); age = 34.3yrs \pm 3.7 yrs) They were instrumented with transcranial Doppler (TCD) ultrasound to assess middle cerebral artery velocity (MCAv). Baseline TCD data were collected for 2 minutes. Changes in MCAv were measured in response to 5 breath-holding trials (30s breath-hold/30s rest) and 5 hyperventilation trials (30s hyperventilation/30s rest). We employed mixed effects models with quadratic mean structures to assess group differences in MCAv response to breath-holding and hyperventilation tasks. **RESULTS:** Baseline resting MCAv did not significantly differ ($t_{39} = -0.47, p = 0.64$) between those with (MCAv = 50.8 ± 7.7 cm/s) and those without (MCAv = 49.6 ± 8.1 cm/s) concussion history. The MCAv response did not differ between those with and without concussion history during breath-holding ($F_{1,1909} = 0.20, p = 0.90$) or hyperventilation ($F_{1,1909} = 0.31, p = 0.58$). Among SOF personnel with concussion history, those with ≥ 3 had significantly diminished CVR response relative to those with 1-2 concussions during the breath-holding ($F_{1,1125} = 4.84, p = 0.03$) and the hyperventilation ($F_{1,1125} = 5.07, p = 0.02$) tasks. **CONCLUSIONS:** Changes in MCAv did not differ under resting conditions; however, SOF personnel with a greater concussion history showed impaired CVR when tested with physiological breathing stressors. While long-term neurophysiological effects of blast-related injury are currently unknown, assessing CVR response may provide further insight into cerebrovascular function and overall physiological health following blast exposure.

2720 Board #3 May 31 1:00 PM - 3:00 PM
Prefrontal Cortex Neural Function and Decision-making Performance Following a Long Duration Incremental Exercise Protocol in the Heat while Wearing Personal Protective Equipment

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(No relevant relationships reported)

There is no research to date evaluating the effects of rapid and uncompensable core temperature (T_c) acquisition, as which occurs when one is wearing personal protective equipment (PPE), on neural function in prefrontal cortex and decision-making performance. **PURPOSE:** To study the effects of rapid and uncompensable T_c acquisition on neural function in prefrontal cortex and decision-making performance during a pre-and post-exercise Go/No-go test. **METHODS:** Fifteen male subjects (mean age, 32.7 ± 12.2 years) performed an incremental exercise test to a termination criterion in CONTROL and GEAR. Electroencephalography (EEG) data was recorded during a Go/No-go test pre- and post-exercise. Decision-making performance was also monitored during the pre- and post-exercise Go/No-go test. Heart rate (HR), thermal comfort scale (TCS), thermal sensation (TS), and rating of perceived exertion (RPE) were recorded at each 0.5°C increase in T_c. **RESULTS:** There were significant differences in time to termination (TTT) (CONTROL = 77.3 ± 12.6 min; GEAR = 50.3

± 6.9 min), pre-exercise HR (CONTROL = 76.8 ± 4.8 bpm; GEAR = 86.5 ± 5.1 bpm) and post-exercise HR (CONTROL = 161.1 ± 11.9 bpm; GEAR = 179.6 ± 6.8 bpm). Additionally, there were significant differences between CONTROL and GEAR end-exercise Tc (CONTROL = $38.57 \pm 0.3^\circ\text{C}$; GEAR = $39.01 \pm 0.3^\circ\text{C}$), TCS (CONTROL = 3.57 ± 0.6 ; GEAR = 4.63 ± 0.3), and TS (CONTROL = 7.57 ± 0.5 ; GEAR = 8.67 ± 0.3). Lastly, there was a $0.04^\circ\text{C}/\text{min}$ increase in Tc during GEAR and $0.02^\circ\text{C}/\text{min}$ increase in Tc during CONTROL. An analysis of frontal theta EEG power results showed a significant decrease when comparing pre- and post-exercise values during a Go/No-go test in GEAR ($F_{(1,14)} = 6.069$, $p = 0.027$). There was also a significant difference when evaluating incorrect responses between pre- and post-exercise values in GEAR ($F_{(1,14)} = 5.515$, $p = 0.026$). These differences were not observed during CONTROL. **CONCLUSION:** These data suggest that a long duration incremental exercise test while wearing PPE in the heat results in decreased cognitive control. This could have implications individuals in occupations that wear PPE and need to make critical decisions while experiencing rapid and uncompensable Tc heat storage.

2721 Board #4 May 31 1:00 PM - 3:00 PM
Concussion and the Pupillary Light Reflex:
Implications for Special Operations Forces Personnel

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Pupillary light reflex (PLR) is regulated by smooth radial muscles differentially innervated by sympathetic and parasympathetic pathways. The PLR has been posited as an autonomic nervous system (ANS) function index and a concussion biomarker. Few studies have examined static and dynamic PLR parameters in Special Operations Forces (SOF) combat and combat support soldiers. **PURPOSE:** To examine cross-sectional relationships between concussion history and PLR parameters in SOF personnel with and without concussion history. **METHODS:** The SOF personnel self-reported age and concussion history (0, 1, 2, and ≥ 3), and completed an assessment battery including PLR. We measured seven PLR parameters including initial and final pupil diameters, constriction and dilation velocities, constriction latency, time to 75% initial diameter recovery, and average maximum constriction velocity. These parameters were averaged across both eyes and separately regressed on concussion frequency while controlling for age (*a priori* $\alpha = 0.05$). **RESULTS:** The SOF personnel ($n = 76$; mean age = 33.5 ± 3.6 years) reported the following concussion histories: ≥ 3 concussions ($n = 19$; 25%), two ($n = 8$; 10.5%), one ($n = 7$; 9.2%), and none ($n = 42$; 55.3%). Initial ($\beta = -0.07$; 95% CI: -0.13, -0.02) and final ($\beta = -0.05$; 95% CI: -0.09, -0.004) pupil diameters were smaller with age increases in SOF personnel, controlling for concussion history. Similarly, those who reported ≥ 3 concussions had significantly smaller initial pupil diameter compared to those without concussion history, controlling for age ($\beta = -0.53$; 95% CI: -0.98, -0.08). Those who reported ≥ 3 concussions also exhibited slower average ($\beta = 0.46$; 95% CI: 0.07, 0.84) and maximum ($\beta = 0.64$; 95% CI: 0.12, 1.15) constriction velocities than those without a concussion history, controlling for age. **CONCLUSIONS:** The SOF personnel with greater head injury history had altered static and dynamic pupillary light responsivity, which may indicate prolonged ANS dysfunction. Our group's previous neuroimaging findings demonstrate prolonged physiological deficits beyond self-reported symptom resolution and clinical recovery from concussion. The PLR is a rapid, non-invasive, cost effective tool that may assess deficits warranting further clinical investigation.

2722 Board #5 May 31 1:00 PM - 3:00 PM
Development of a Lower Body Negative Pressure
Device to Reduce Intracranial Pressure in Hospitalized
Patients with Traumatic Brain Injury

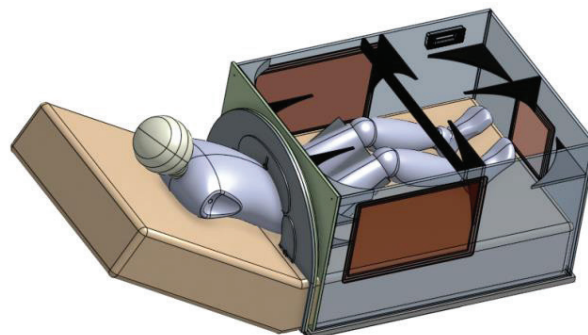
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(No relevant relationships reported)

Elevations of intracranial pressure (ICP) are common in patients with a severe traumatic brain injury (TBI) with sustained elevations predicting morbidity and mortality. Aggressive management of elevated ICP is recommended and there is a need for non-invasive treatments that are complementary to existing surgical options. Using direct invasive recordings of ICP in three healthy subjects via implanted Ommaya reservoirs, this laboratory observed a robust reduction in ICP during lower body negative pressure (LBNP) in the head-down tilt (HDT) position. **PURPOSE:** Develop a novel LBNP device that is suitable for use with hospitalized patients, which will be safe and well tolerated by patients with TBI, and will improve intracranial stability, patient disability and reduce the time from admission to discharge from the ICU. **METHODS:** Working with a team of ICU nurses, neurointensivists, engineers

and physiologists, a comfortable, stable LBNP chamber was developed with sufficient access to the patient to allow standard of care for severe TBI patients. Studies to test this device in the ICU are ongoing and will impose low level LBNP (-20mmHg) 8 hours/day for 3 days. Throughout all interventions, hemodynamics and cerebral perfusion pressure will be monitored to maintain perfusion greater than 60mmHg and ICP will be carefully monitored for changes in intracranial pulse pressure. **RESULTS:** See figure for ICU based LBNP chamber design.

CONCLUSION: Previous work by our group (Petersen et al, J Physiol 2018) showed that low level LBNP can reduce ICP safely in healthy controls. We have built a novel LBNP chamber for use with hospitalized patients that may lower ICP non-invasively in patients, thus improving patient outcomes.



2723 Board #6 May 31 1:00 PM - 3:00 PM
Locus of Control Ratings do not Predict Concussion
Reporting Intentions in Intercollegiate Athletes

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(No relevant relationships reported)

Identification of all sport-related concussion continues to be challenging in part due to the lack of reporting by athletes. It is estimated that approximately 50% of all sport-related concussions at the collegiate level go unreported, however, reasons for failing to disclose a potential concussion are still unclear. In order to improve concussion reporting, we must identify factors that contribute to an athletes' intentions to report. Student-athletes that identify as having more control over the outcomes in their life may feel a stronger sense of control over whether they will report a suspected concussion to a medical professional.

PURPOSE: To examine the relationship between locus of control ratings and concussion reporting intentions in student-athletes.

METHODS: Student-athletes from three universities were invited to complete a Qualtrics survey ($n=206/498$ response rate = 41.36%, male=34.46%). The Levenson Multidimensional Locus of Control (LOC) scale is a 24 item survey that measures Internal Locus of Control (8 items), Powerful Others (8 items), and Chance (8 items). All items were answered on a six-point Likert scale ranging from 1 (strongly disagree) to 6 (strongly agree). Three separate Spearman's rank-order correlations were used to determine whether LOC sub-scores (Internality, Powerful Others and Chance) correlated concussion reporting intentions ($\alpha=0.05$).

RESULTS: Locus of control sub-score ratings did not significantly correlate direct intentions; Internality ($r_s = .055$, $p = .545$), Powerful Others ($r_s = -.125$, $p = .169$), or Chance ($r_s = -.065$, $p = .474$). In addition, indirect intentions were not related to the LOC subscales; Internality ($r_s = .082$, $p = .367$), Powerful Others ($r_s = -.111$, $p = .223$), or Chance ($r_s = -.062$, $p = .497$).

CONCLUSION: Although LOC plays a role in predicting sport-related injuries risk and outcomes, it does not seem to significantly correlate with concussion reporting intentions in the current study. Results of this study suggest the importance of considering the multiple factors that may explain an athletes intentions to report concussions beyond just how much control they perceive to have over the outcomes in their life.

2724 Board #7 May 31 1:00 PM - 3:00 PM Acute Exercise Effects on Fatigue in Individuals Living With Post-Traumatic Stress

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(No relevant relationships reported)

Evidence has emerged highlighting the beneficial effects of exercise in reducing symptoms of Post-Traumatic Stress (PTS) and comorbid psychological conditions (e.g., anxiety, depression). However, most of these studies fail to address the effects of exercise on other disabling symptoms of PTS. **Purpose:** Examine changes in self-reported fatigue following an acute bout of moderate intensity continuous aerobic exercise (MICE) and a bout of high-intensity interval exercise (HIIE), relative to a no-exercise inactive control (SED), in participants with subsyndromal PTS. **Methods:** Using a within-subjects design, participants [$N=25$, 16 females; age ($M \pm SD$); 25.6 ± 9.1 yrs] completed three randomly ordered 35-min conditions (HIIE, MICE, SED). Participants reported an average PCL-5 score of 47.64 (exceeds cut-point for probable PTS of 33). Additionally, participants reported having at least one symptom in each of the major DSM-5 clusters of PTS. Fatigue was assessed before (Pre), immediate after (Post0), 20-min after (Post20), and 40-min after (Post40) each condition. **Results:** Significant Condition, Time, and Condition x Time effects were seen [all $P < 0.001$]. For HIIE, fatigue increased from Pre to Post0 [Cohen's $d = 0.90$], decreased from Post0 to Post20 [$d = 0.67$], and decreased from Post20 to Post40 [$d = 0.42$]. Fatigue was not different Pre to Post40 HIIE [$P = 0.31$]. For MICE, Fatigue increased slightly from Pre to Post0 [$d = 0.33$], decreased from Post0 to Post20 [$d = 0.91$], and showed no change from Post20 to Post40 [$P = 0.36$]. Fatigue was reduced from Pre to Post40 MICE [$d = 0.29$]. Finally, fatigue decreased from Pre to Post0 SED [$d = 0.48$], showed no change from Post0 to Post20 or from Post20 to Post40, and was marginally reduced Pre to Post40 [$d = 0.32$]. **Conclusion:** Participants reported elevated fatigue Post0 HIIE, but fatigue returned to baseline by Post40. While fatigue was elevated Post0 MICE, at Post40 fatigue was reduced relative to Pre. The present study provides evidence that both HIIE and MICE result in immediate increases in fatigue in individuals living with PTS, but such increases are short-lived. Future studies need to assess chronic exercise effects on fatigue, as fatigue is a disabling symptom of PTS.

2725 Board #8 May 31 1:00 PM - 3:00 PM Feasibility of Resistance Exercise Training in Gulf War Veterans with Widespread Pain

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(No relevant relationships reported)

Roughly 25-33% of US Veterans of Operations Desert Shield or Desert Storm report a constellation of chronic symptoms including fatigue, confusion and widespread pain. Although exercise is routinely prescribed, and found to be efficacious, for many chronic pain conditions; Veterans' reports of post-exertional exacerbation of symptoms complicates the question of whether exercise should be used as an adjunct treatment to standard care.

Purpose: To determine the safety and efficacy of a resistance exercise training (RET) program in Gulf War Veterans (GV) with chronic widespread musculoskeletal pain (CMP).

Methods: Gulf Veterans suffering medically unexplained CMP lasting at least 3 months ($N=50$) were randomized to either 16 weeks of twice weekly RET or wait-list control (WLC). Training was supervised by exercise specialists and consisted of 10 exercises targeting major muscle groups. The program started at a very low intensity [25-35% of estimated 1-repetition maximum (1-RM)] and progressed in small ($\leq 5\%$) increments. Thus, training was both individualized and standardized. Testing of 1-RM was completed at baseline and reevaluated at 16 weeks. The McGill Pain Questionnaire (MPQ) and Profile of Mood States (POMS) were completed at weeks 1, 6, 12 and 16. Exercisers not completing $>50\%$ of training were excluded from statistical analyses ($n=4$). Average 1-RM values were compared using dependent t-tests, and MPQ and POMS data were evaluated using repeated-measures ANOVAs.

Results: The final sample consisted of 22 GV in the RET group, with $>90\%$ adherence, and 20 WLC Veterans. No drop outs were due to negative complications with exercise. Following RET, participants on average lifted 67 kg/kg of body weight and significant ($p < 0.05$) 1-RM increases were observed in all 8 lifts. Estimated 1-RM increased by at least 20% for 7 of 8 lifts. Mood scores significantly improved in both groups over the course of the trial with no significant difference between groups. No time or group effects ($p > 0.05$) were observed in MPQ scores.

CONCLUSIONS: RET significantly increased strength in GV with CMP. It resulted in no exacerbation of pain symptoms and did not increase mood disturbance. Resistance exercise appears safe and efficacious for Gulf Veterans with widespread pain. Supported by Dept. of Veterans Affairs grant: IO1-CX000383.

F-08 Thematic Poster - Physiological Responses in Firefighters

Friday, May 31, 2019, 1:00 PM - 3:00 PM
Room: CC-102A

2726 Chair: Emiel DenHartog. North Carolina State University, Raleigh, NC.

(No relevant relationships reported)

2727 Board #1 May 31 1:00 PM - 3:00 PM Exploring Factors Related To Blood Pressure Increase After A 12-hour Shift-work In Firefighters

Rosenkranz M. Nogueira¹, Edgard Soares¹, Eugênio Cesar Nogueira¹, Janssen Gomes¹, Guilherme E. Molina¹, Keila E. Fontana¹, Maria Korre², Denise Smith³, Stefanos N. Kales⁴, Luiz Fernando Junqueira Jr¹, Luiz Guilherme G Porto¹. ¹UNB, BRASILIA, Brazil. ²HAVARD, SARATOGA SPRINGS, NY. ³Skidmore College, Saratoga Springs, New York, SARATOGA SPRINGS, NY. ⁴Harvard T. H. Chan School of Public Health, Boston, MA, BOSTON, MA, MA.

(No relevant relationships reported)

Firefighters' job-related activities may expose firefighters (FF) to an elevated cardiac strain. **Purpose:** To evaluate the effect of a routine 12-hour shift work on blood pressure (BP) among career FF. **Methods:** We evaluated 30 male FF, aged 40 ± 3.2 yrs, BMI = 26.3 ± 3.1 kg/m². BP was measured in a basal condition on an off-duty day (Eva1) and before (Eva2) and after (Eva3) a 12-h shift work, in resting supine (SUP) and orthostatic (ORT) postures. A 3-way repeated measures ANOVA (BP, body position, time) with Bonferroni post-hoc was performed. A BP increase ≥ 4 mmHg was considered meaningful. To understand BP responsiveness we use independent T-tests between subgroups (overweight, obese, cardiorespiratory fitness (CRF) ≥ 12 METs and by age). On-duty task effect on BP was performed with a sub analysis on those who increased diastolic BP. **Results:** ANOVA showed a significant effect of time, BP and position with significant mean BP increase of 3.5 mmHg from Eva 2 to 3. FF >40 yrs had a larger mean systolic BP increase than younger (12 vs 1 mmHg; $p < 0.01$ -Table 1). No differences were observed for those who had CRF ≥ 12 METs, were overweight or obese. 5 FF (17%) had their systolic and diastolic BP meaningfully increased in SUP and ORT conditions: 12.2, 14.8, 10.2, 14.4 respectively. 4 of them (80%) participated in firefighting or emergency medical service (EMS). 16 FF showed a mean meaningful increase of 10.1 mmHg in diastolic BP during ORT condition, 14(88%) of them participated in EMS or firefighting. FF who performed fire fighting or a EMS had a 3.9 (95%CI 0.7-21.7) higher odds of having their diastolic BP meaningfully increased. **Conclusion:** There was an important relationship between FF on duty emergency tasks and cardiovascular strain. Older FF seemed more susceptible to present a negative cardiovascular response after 12-h shift work. The increase on BP was meaningful in most cases, especially diastolic BP, which could be associate to non-fatal cardiovascular events in susceptible firefighters.

		EVA 1	EVA 2	EVA 3
Age > 40	SBP SUP	125.4 \pm 10.9	125.4 \pm 11.6	129.0 \pm 10.7
	SBP ORT	125.9 \pm 14.1	120.7 \pm 11.7	132.7 \pm 18.5
	DBP SUP	79.0 \pm 11.2	78.5 \pm 6.0	78.8 \pm 8.1
AGE \leq 40	DBP ORT	83.5 \pm 10.3	80.7 \pm 8.2	85.3 \pm 10.7
	SBP SUP	120.3 \pm 9.6	119.1 \pm 8.2	120.1 \pm 11.6
	SBP ORT	116.6 \pm 11.6	119.0 \pm 12.2	117.8 \pm 15.6
	DBP SUP	72.4 \pm 8.7	69.5 \pm 6.1	74.0 \pm 7.1
	DBP ORT	76.4 \pm 11.3	77.6 \pm 12.7	80.7 \pm 10.9

2728 Board #2 May 31 1:00 PM - 3:00 PM
Heart Rate Response Relative to Body Weight/Body Fat and Fire Gear During Walking Protocol

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 (No relevant relationships reported)

INTRODUCTION: Fire gear serves a specific purpose in protecting individuals from the harsh environments around them when combating fires. Little research has been done on how gear weight relative to an individual's lean body mass (LBM) and body fat (BF) affects heart rate (HR). Being conscious of how the encumbrance of gear affects one's HR is important because over-exertion from load carriage could possibly cause a decrease in performance and increase the risk of a cardiac event. **PURPOSE:** To assess HR response among individuals based on LBM and BF relative to the weight of different combinations of fire gear during a walking protocol.

METHODS: 22 recreationally trained college students (age 22 ± 3 y/o, wt. 81 ± 17 kg, ht. 177 ± 10 cm) performed a walking protocol in personal protective equipment (PPE 9.1 kg.), oxygen pack and mask (PM 11.3 kg.), and full gear (FG, combination of PM and PPE 20.4 kg.). Each subject completed 3 sessions total. Gear was determined using a randomized cross-over design. Subjects were tested for BF via air displacement plethysmography and weighed before the protocol. The original Bruce protocol was adjusted to (stage 1) 3 minutes (min) at 0.8 m/s and 0% grade (GR), (stage 2) 3 min at 0.76 m/s and 10% GR, (stage 3) 3 min at 1.1 m/s and 12% GR, (stage 4) 3 min at 1.5 m/s and 14% GR, and (stage 5) 4 min cool down at 0.8 m/s and 0% GR. HR was recorded during each minute of the protocol until completion. Results were analyzed using Linear Regression to identify the effect of BF and LBM on HR. Stage 4 HR's were selected because the intensity is most comparable to actual situations.

RESULTS: R^2 of change reported 0.47 for both LBM and BF in FG, .065 in PM, and 0.52 in PPE. For LBM only, R^2 of change reported 0.36 ($P=0.003$) for FG, 0.60 ($P < 0.001$) for PM, and 0.52 ($P < 0.001$) for PPE. BF only, reported 0.08 ($P = 0.216$) for FG, 0.02 ($P = 0.529$) in PM, and less than 0.01 ($P = 0.908$) for PPE.

CONCLUSIONS: The data suggests that more LBM and less BF can be advantageous in relation to HR during encumbered walking. Firefighters should focus on increasing their LBM to increase their overall performance during training or in real life high stress situations.

2729 Board #3 May 31 1:00 PM - 3:00 PM
Physiologic Strain of SCBA (Maze) Training Compared to Circuit Training and Live Fire Training

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 (No relevant relationships reported)

Firefighting is a dangerous occupation and even training carries substantial risk. In fact, about 10-12% of firefighter line of duty deaths occur in training—most due to sudden cardiac death. Self-contained breathing apparatus (SCBA) maze training (also known as SCBA confidence courses) are a common training exercise, and it is often assumed that this type of drill is less physically taxing because there is no “live-fire”. However, little is known about the physiologic strain associated with SCBA maze training.

Purpose: To compare the physiological strain of SCBA maze training to live fire training and circuit training among cadets at a training academy.

Methods: Cadets ($N=40$) wore physiologic status monitors to assess heart rate (HR) and estimated core temperature (ECT) during circuit training, live fire training and SCBA maze training. SCBA maze training occurred in full personal protective equipment (PPE) and took place in an air conditioned building. Live fire training occurred in a specialized training structure, and the circuit training workout occurred in a large equipment bay. Age-predicted maximum (APM) HR was calculated using the 220-age formula. Data were analyzed using repeated measures ANOVA and Bonferroni post-hoc.

Results: Data from 40 cadet firefighters (31 ± 3 yrs. old) were analyzed. No significant difference ($p > 0.05$) was observed between SCBA maze training and live fire training for HR or ECT (see Table 1). However, HR and ECT differed significantly between circuit training and both SCBA maze training and live fire training.

Conclusions: Even though SCBA maze training was performed under controlled environment it involved a physiological strain above circuit training and as high as live fire training, reaching age predicted maximum HR. SCBA maze training should be considered as physiologically stressful as live fire training of similar duration.

	Circuit Training	SCBA Maze	Live Fire Training
Duration (minutes)	33	38	36
Peak HR (bpm)	$182 \pm 9^*$	193 ± 10	194 ± 17
APMHR	$82.6 \pm 5.2^*$	103.0 ± 4.1	104.4 ± 12.1
Peak ECT (°C)	$38.6 \pm 0.4^*$	39.3 ± 0.7	39.3 ± 0.6

* $p < .05$ vs SCBA and Live Fire Training

Supported by FEMA AFG Grant EMW-1015-FP-00731

2730 Board #4 May 31 1:00 PM - 3:00 PM
Effects of Wearing a Self-Contained Breathing Apparatus on Blood Oxygen Saturation During Exercise in Firefighters

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PURPOSE: Firefighters face a number of risks as part of their occupation. The self-contained breathing apparatus (SCBA) protects from smoke inhalation; however, the effects of the SCBA on blood oxygen saturation during exercise are unclear.

The purpose of this study was to look at the effects of the SCBA on blood oxygen saturation during exercise.

METHODS: Nine healthy male firefighters (35 ± 5 years, 180.2 ± 24.9 pounds, 69.8 ± 3.8 inches) completed a physical activity readiness questionnaire (PARQ+) to determine eligibility for the study. Participants performed an incremental treadmill test to estimate their $\dot{V}O_2$ max. One week later, participants exercised at 50% of their $\dot{V}O_2$ max wearing their SCBA (SCBA). One week later, participants exercised at 50% of their $\dot{V}O_2$ max not wearing their SCBA for the same duration (CON). Blood oxygen saturation was recorded at the lowest point (SO_2 Low) and at the end of each exercise session (SO_2 End). Heart rate (HR), blood lactate (LA) and rating of perceived exertion (RPE) were also measured and the end of each exercise session. For all variables, paired samples t-tests were used to compare differences between exercise sessions.

RESULTS: There was a significant difference in SO_2 Low between the exercise sessions ($p = 0.006$; SCBA: $90.6 \pm 3.5\%$; CON: $94.1 \pm 1.4\%$). There was no significant difference in SO_2 End between the exercise sessions ($p = 0.01$; SCBA: $94.3 \pm 2.3\%$; CON: $95.7 \pm 1.1\%$). Although not significant, there was a large difference in LA between the exercise sessions ($p = 0.06$; SCBA: 4.0 ± 3.0 mmol/L; CON: 1.9 ± 1.0 mmol/L). There were no significant differences in HR ($p = 0.82$; SCBA: 165 ± 21 bpm; CON: 164 ± 22 bpm) and RPE ($p = 0.8$; SCBA: 13 ± 1 ; CON: 13 ± 1) between the exercise sessions.

CONCLUSIONS: During exercise blood oxygen saturation was significantly reduced while wearing SCBA compared to CON. It is possible that while wearing SCBA the partial pressure of respired oxygen is reduced, resulting in oxygen not being diffused as efficiently.

2731 Board #5 May 31 1:00 PM - 3:00 PM
Exertional Strain and Task Performance Consequences of a Reduction in Protection in Structural Fire Fighter PPE - A Pilot Study

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 (No relevant relationships reported)

PURPOSE: A major concern for working in structural firefighter PPE is the heat strain that is caused by the heat protection it provides. This is a multi-faceted challenge that requires studying heat protection, firefighter strain and task performance. To initialize this a pilot study on the consequences of reducing firefighter heat and flame protection on thermal strain, task performance and overall experiences of user safety was conducted at a firefighter training facility in The Netherlands.

METHODS: Ten experienced firefighters between the ages of 25 and 50 participated in a protocol approved by the local ethical committee. They performed a simulated rescue of two dummies in a small kitchen fire in a current structural firefighters garment (S) and in a one layer FR coverall with Reduced protection (R), both with

full safety gear, including SCBA. Measurements were conducted on heart rate, skin temperatures (4 sites), core temperature, task performance (speed, rescue result), mood and comfort sensations.

RESULTS: In all conditions all firefighters were able to execute the rescue in the R-gear as well as in the S-gear with no differences in time, on average 8.5 min. There were significant reductions in heart rate in the R-gear versus the S-gear ($p=0.02$) and in core temperature increase: 1.69 (0.80 °C/hr) in R-gear versus 2.52 (1.20) °C/hr in S-gear ($p=0.04$). Mean skin temperature was slightly higher in the R-gear, possibly due to the reduction in protection (35.1 °C (R) versus 34.3 °C (S), $p=0.009$). But it did not reach dangerous levels, none of the maximum skin temperatures was higher than 37 °C. Comfort and strain ratings were lower in the R-gear, but there was an increase in the R-gear just prior to entering the room with the fire.

CONCLUSIONS: This pilot study addressed multiple aspects of the balance strain, protection and performance, all crucial to ensure safety and health for structural firefighters. The results showed that a small fire scenario could be addressed by the gear as effectively as the current gear, which was unexpected. The R-gear is expected to further reduce strain in most of the firefighter day-to-day work activities. The results also indicated that experienced firefighters would need to build confidence in the activities that can be executed safely in this clothing.

2732 Board #6 May 31 1:00 PM - 3:00 PM
Firefighters Do Not Exhibit Postexercise Hypotension Following a Bout of Vigorous Exercise

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(No relevant relationships reported)

Firefighters have a higher than normal prevalence of cardiovascular disease (CVD) and accompanying risk factors such as hypertension. These CVD risk factors may increase the risk of sudden cardiac death (SCD), which accounts for 45% of all on-duty firefighter deaths. Exercise confers protection against CVD risk, in part due to the immediate blood pressure (BP) reductions of 5-7 mmHg following exercise, termed *postexercise hypotension* (PEH). PEH in firefighters has not been studied. **PURPOSE:** To examine PEH after sudden vigorous physical exertion simulated by a maximal cardiopulmonary stress test (GEST) among career firefighters. **METHODS:** Firefighters ($n=19$ men) performed non-exercise control (CONTROL) and GEST on separate days followed by attachment to an ambulatory blood pressure (ABP) monitor for 19hr. Ambulatory systolic BP (ASBP) and diastolic BP (ADBP) were recorded at hourly intervals over awake (11hr), sleep (8hr), and 19hr. Additionally, other CVD risk factors and SCD biomarkers were measured as possible correlates of PEH. **RESULTS:** Firefighters were middle-aged (39.5 ± 8.9 yr) and overweight (29.2 ± 4.0 kg·m⁻²) men with high resting BP ($123.1 \pm 9.6/79.8 \pm 10.4$ mmHg). Compared to CONTROL, ASBP after the GEST increased over awake (18.2 ± 12.9 mmHg, $p<0.01$), sleep (14.6 ± 10.3 mmHg, $p<0.01$), and 19hr (16.5 ± 11.7 mmHg, $p<0.01$). Compared to CONTROL, ADBP increased after the GEST over awake (4.4 ± 3.1 mmHg, $p=0.02$), sleep (7.6 ± 5.4 mmHg, $p<0.01$), and 19hr (5.9 ± 4.1 mmHg, $p<0.01$). Resting SBP explained up to 25.6% of variance in the ASBP response over awake ($r=0.51$, $p=0.03$) and up to 30.0% over 19hr ($r=0.55$, $p=0.02$), while blood glucose levels explained up to 72.8% of variance over sleep ($r=0.85$, $p<0.01$). Resting DBP explained up to 52.9% of variance in the ADBP response over sleep ($r=0.73$, $p<0.01$), while resting DBP and medication use explained up to 76.1% of variance over awake ($r=0.87$, $p<0.01$) and up to 76.5% over 19hr ($r=0.88$, $p=0.02$). **CONCLUSIONS:** Sudden vigorous exertion evoked *postexercise hypertension* as opposed to PEH among firefighters with elevated resting BP, which was largely explained by the positive relationship between resting BP and the increase in ABP following exercise. These unexpected findings indicate that reducing hypertension is critically important to the CVD health of career firefighters.

2733 Board #7 May 31 1:00 PM - 3:00 PM
The Effect of Rapid and Slow Heat Acquisition on Heart Rate Variability

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(No relevant relationships reported)

Autonomic tone (AT), measured by heart rate variability (HRV), has shown to be linked to the risk of cardiovascular and other diseases. Firefighters are chronically exposed to environments and tasks that put them under acute bouts of thermal and cardiovascular stress, acutely affecting AT. HRV has been shown to respond to both heat stress and heavy exercise though it is not known if rapid heat acquisition caused by the microclimate of personal protective equipment (PPE) affects tonal response magnitude during exercise. **PURPOSE:** The aim of this study was to determine if PPE-induced rapid heat acquisition affected HRV differently than standard heat acquisition. **METHODS:** 15 healthy male subjects (mean age, 31.3 ± 11.7 years)

completed an incremental graded treadmill walking test until a core temperature of 39.5 °C, volitional maximum, or a 2-hour time limit was obtained in both an experimental (PPE) and a control (CON) test in a random crossover design. Pre- and post-exercise, participants completed a 10-minute supine rest period, during which heart rate and R-R intervals were continuously collected. HRV data was filtered and analyzed in the frequency domain. Low (LF) and high frequencies (HF) were reported in normalized units (nu) along with the VLF (very-low frequency), LF, HF, and LF/HF ratio as a unit of power (ms²). **RESULTS:** Post-exercise LFnu was significantly increased in both CON (pre= 73.3 ± 3.5 , post= 80.7 ± 3.6 , $p<0.05$) and PPE (pre= 7.4 ± 230.1 , post= 84.2 ± 2.4 , $p<0.01$) conditions while HFnu was significantly lower (CON; pre= 26.7 ± 3.5 , post= 19.2 ± 3.6 , $p<0.05$ and PPE; pre= 31.6 ± 4.5 , post= 15.7 ± 2.4 , $p<0.01$). LF/HF ratios were also significantly different pre- to post-exercise in both conditions (CON; pre= 3.9 ± 0.7 ms², post= 7.3 ± 1.2 ms², $p<0.05$; PPE: pre= 3.9 ± 0.6 ms², post= 7.7 ± 1.0 ms² $p<0.01$). There was no difference between the two conditions either pre- or post-exercise for any of the variables measured in ms² except for post-exercise VLF which was significantly higher in PPE compared to CON.

CONCLUSION: Results from the current study suggest that regardless of the rate of thermal acquisition, HRV response is similar, however the shift of HRV into the VLF domain during the PPE condition may have masked the magnitude of sympathetic response by lowering the LF frequency domain.

F-09 Thematic Poster - Pregnancy, Hormones and Gender

Friday, May 31, 2019, 1:00 PM - 3:00 PM
 Room: CC-102B

2734 Chair: Linda E. May, FACSM. East Carolina University, Greenville, NC.

(No relevant relationships reported)

2735 Board #1 May 31 1:00 PM - 3:00 PM
Validity of the Pregnancy Physical Activity Questionnaire for Maternal Physical Activity Recall

Michelle R. Conway¹, Mallory R. Marshall², Rebecca A. Schlaff³, Nicole M. Talge⁴, Karin A. Pfeiffer, FACSM⁴, James M. Pivarnik, FACSM⁴. ¹Western State Colorado University, Gunnison, CO. ²Samford University, Birmingham, AL. ³Saginaw Valley State University, University Center, MI. ⁴Michigan State University, East Lansing, MI.

(No relevant relationships reported)

The Pregnancy Physical Activity Questionnaire (PPAQ) is a commonly utilized self-report assessment of physical activity (PA) during pregnancy, but its validity when evaluating women's PA historically after the pregnancy ends is unknown. **PURPOSE:** To evaluate the validity of the PPAQ for long-term recall of PA at two time points during pregnancy and once postpartum. **METHODS:** Between 2010 and 2018, 48 women completed the PPAQ at 21 and 32 weeks gestation and 12 weeks postpartum about their previous week's PA. These same women were emailed three separate PPAQs between two months and eight years after originally completing the questionnaires to recall their PA during those same time periods. Of these 48 women, 40 completed the follow up recall questionnaires (83%). Total number of metabolic (MET) minutes per week and percent time spent in light, moderate, and vigorous activity were compared between the original and long-term recall PPAQ values using paired sample t-tests or Wilcoxon Rank tests and Spearman correlation coefficients (SCC). The participants were then separated into two groups via a median split: those who originally completed the PPAQs \geq five years ago and $<$ five years ago. The paired sample t-tests, Wilcoxon Sign Rank tests, and SCC were repeated. **RESULTS:** Total MET-minutes per week and percent time in moderate activity were underestimated by 3000 – 4000 MET-minutes per week and 6%, respectively, and percent time in light activity was overestimated by 4-6%, when comparing long-term recall to original values. Women reported spending little time in vigorous intensity activity at both time points during pregnancy (2-4%). Twenty-one of the 36 comparisons were significantly different (58%). SCC values were lower for women who recalled PA \geq five years postpartum compared to women who recalled their PA $<$ five years postpartum for most time points and intensities. **CONCLUSION:** It is important to continue to assess the long-term validity of self-report methods, such as the PPAQ. On average, participants tend to underestimate total and moderate PA and overestimate light PA, but by relatively small amounts (3561 MET-minutes per week, 6%, 4-6%, respectively) when recalling their activity up to eight years previously.

- 2736** Board #2 May 31 1:00 PM - 3:00 PM
Morphometric Response of Overweight and Obese Women to Resistance Training during Pregnancy
 Olga Roldan-Reoyo¹, Christy Isler², Kelley Haven², Edward Newton², Linda E. May². ¹Swansea University, Swansea, United Kingdom. ²East Carolina University, Greenville, NC.
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 (No relevant relationships reported)

Resistance exercise (RE) has increased in popularity among pregnant women being the third most popular activity in previously active women. However, most of the RE interventions have been focused on birth outcomes from normal weight (NW) pregnant women or in overweight or obese (OWOB) pregnant women with pregnancy-related disease. Currently, we do not know how RE can influence morphometric measures in healthy OWOB pregnant women. **PURPOSE:** To determine the effect of RE during pregnancy of OWOB women on maternal morphometric measures. **METHODS:** 33 OWOB (25-Control group (CG) vs 8-RE group (REG)) healthy, low-risk, women with a singleton pregnancy have been analyzed for this study. All women signed an informed consent and agreed to participate in the study, which involves 3-exercise protocols (aerobics, resistance and aerobics+resistance) and a CG. Participants in the REG trained 3x/week, 50min, moderate intensity for ~20 weeks using machines, free weights and swiss balls. Maternal skinfolds and anthropometric measures were collected at 16 and 36 weeks of gestation. Student t test was performed to determine differences between groups. **RESULTS:** Analysis does not show significant differences in most variables measured at 16 and 36weeks ($p>0.05$): weight16 (CG=86,9kg vs REG=85kg), weight36 (CG=96,7kg vs REG=94,1kg), percentage of body fat16 (%BF) (CG=36,2 vs REG=36,3), %BF36 (CG=37,1 vs REG=39,2), gestational weight gain (GWG) (CG=10kg vs REG=9,2kg), waist to hip ratio (WHR) at 16 (CG=0,79 vs REG=0,82). Significant differences were found in WHR36 weeks (CG=0,84 vs REG=0,77). 40% percent of the women in the CG exceeded their GWG recommendation vs 37,5% of REG women ($p>0.05$). Birth weight was not significantly different between groups ($p>0.05$): (CG=3,6kg vs REG=3,5kg). **CONCLUSION:** RE was not effective to prevent excessive GWG or to decrease %BF for OWOB pregnant women. The data suggest that, another exercise protocols should be evaluated between this population to test for the best efficacy. American Heart Association #15GRNT24470029

- 2737** Board #3 May 31 1:00 PM - 3:00 PM
Oxygen Uptake Kinetics During the Different Phases of the Menstrual and Oral Contraceptive Cycles
 Anmol T. Mattu, Danilo Iannetta, Patricia K. Doyle-Baker, Juan M. Murias. University of Calgary, Calgary, AB, Canada.
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 (No relevant relationships reported)

PURPOSE: To examine whether oxygen uptake ($\dot{V}O_2$) kinetics changes across the phases of the menstrual and oral contraceptive cycles. **METHODS:** Fourteen highly active women who were either non-oral contraceptive users ($n=7$, 28 ± 6 yrs.) or monophasic oral contraceptive users ($n=7$, 22 ± 3 yrs.) participated in the study. The time-constant of the $\dot{V}O_2$ kinetics response ($\tau\dot{V}O_2$) was determined by ensemble-averaging the $\dot{V}O_2$ response measured during three consecutive step-transitions in work rate, from 20 Watts (W) to a moderate-intensity work rate of 80 W. Each step was six minutes in duration. The test was completed during the menstruation phase of the cycles (follicular phase for non-oral contraceptive users or "inactive pill" phase for oral contraceptive users) and repeated during the respective non-menstruating phase (luteal phase or "active pill" phase). An ovulation test was used to validate the menstrual cycle phase. A metabolic cart was used to continuously measure expired gas concentrations and ventilatory rates. A one-way repeated-measures ANOVA was used to compare the differences in $\dot{V}O_2$ kinetics across cycle phases between non-oral contraceptive and oral contraceptive users. Statistical significance was set at $p<0.05$. **RESULTS:** The time constant for the adjustment of $\dot{V}O_2$ was affected by cycle phases, regardless of contraception use, whereby $\tau\dot{V}O_2$ was greater in the menstruation phases of the non-oral contraceptive and oral contraceptive cycles (24 ± 7 s) compared to the non-menstruating phases (19 ± 5 s) ($p<0.05$). **CONCLUSION:** The speed of the $\dot{V}O_2$ kinetics response is affected by the phases of the menstrual and oral contraceptive cycles, such that a greater $\tau\dot{V}O_2$ is observed during the menstruation phase. Anmol T. Mattu was supported by the NSERC Alexander Graham Bell Canada Graduate Scholarship.

- 2738** Board #4 May 31 1:00 PM - 3:00 PM
The Impact Of Pms And Pmdd On Physical Performance In Female Track And Field Athletes
 Reiko Momma¹, Yuriko Tochigi¹, Ai Hamasaki¹, Koichiro Tanahashi¹, Akari Takahashi², Tomohito Sato¹, Atsumu Yokota¹, Noboru Mesaki¹, Seiji Maeda¹. ¹University of Tsukuba, Tsukuba, Japan. ²Japan Sport Council, Kita-ku, Japan.
 (No relevant relationships reported)

Previous studies showed that menstrual cycle is associated with physical performance and subjective condition in female athletes. It is also known that premenstrual syndrome (PMS) and premenstrual dysphoric disorder (PMDD) affect subjective condition in female athletes. However, the relationships among PMS, PMDD and physical performance in female athletes are not clarified yet. **Purpose** To investigate the impact of PMS and PMDD on physical performance in female track and field athletes. **Methods** Sixteen female track and field athletes with regular menstrual cycles participated in this study. Participants were measured body composition and physical performance test in follicular phase (no PMS and PMDD phase) and luteal phase (PMS and PMDD phase). As a physical performance test, Counter Movement Jump: CMJ, Rebound Jump: RJ, and Wingate test were performed. PMS and PMDD were evaluated by questionnaire survey of premenstrual syndrome (ACOG practice bulletin, 2000) and premenstrual dysphoric disorder (DSM-5, APA, 2013). **Results** In all subjects, there were no significant differences in body composition and physical performance between follicular phase and luteal phase. However, subjects who had breast tenderness of PMS decreased more greatly than non-symptom subjects in jump height of CMJ ($p=0.038$) and RJ index ($p=0.015$). Also, subjects who had anxiety of PMS decreased more greatly than non-symptom subjects in jump height of CMJ ($p=0.05$). Moreover, subjects who had overeating of PMDD increased more greatly than non-symptom subjects in HR max during Wingate test ($p=0.042$). **Conclusions** In this study, we showed that some symptoms of PMS and PMDD were associated with suppressed physical performance in female track and field athletes. Thus, PMS and PMDD may lead to decrease the physical performance in female track and field athletes.

- 2739** Board #5 May 31 1:00 PM - 3:00 PM
Physical Activity Influences the Relationship between BMI and Adiposity Differently in College Males and Females
 Ginny M. Frederick¹, Bhibha M. Das², Michael V. Fedewa³, Rachelle M. Reed¹, Rachel E. Salyer¹, Michael D. Schmidt¹, Ellen M. Evans, FACSM¹. ¹University of Georgia, Athens, GA. ²East Carolina University, Greenville, NC. ³University of Alabama, Tuscaloosa, AL. (Sponsor: Ellen M. Evans, FACSM)
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 (No relevant relationships reported)

G.M. Frederick¹, B.M. Das², M.V. Fedewa³, R.M. Reed¹, R.E. Salyer¹, M.D. Schmidt¹, E.M. Evans¹, FACSM. ¹University of Georgia, Athens, GA 30602. ²East Carolina University, Greenville, NC 27858. ³University of Alabama, Tuscaloosa, AL 35487. **PURPOSE:** Body mass index (BMI) is often used as a surrogate measure of adiposity (%Fat). It is well-established that physical activity (PA) influences body composition. In addition to the well-established sex differences in body composition, college-age males also typically engage in more PA than their female counterparts. This difference in PA could potentially impact the relationship between BMI and %Fat. Therefore, the aim of this study was to determine if PA differentially influences the relationship between BMI and %Fat in college-age males compared to females. **METHODS:** BMI was calculated from weight and height measured using standard clinical protocols. PA was measured in steps/day using the NL-1000 accelerometer. %Fat was measured via DEXA. **RESULTS:** Males ($N = 124$; 18.4 ± 0.5 yrs, 23.2 kg/m²) and females ($N = 282$; 18.3 ± 0.5 yrs, 23.0 kg/m²) were nearly identical in age and BMI (both $p > 0.05$). As expected, males were leaner (18.4 ± 5.1 %Fat vs. 32.2 ± 5.7 %Fat, $p < 0.001$) and accumulated more PA ($11,625 \pm 2930$ vs. $10,866 \pm 3467$ steps/day, $p = 0.03$) compared to females. Because of the known sex difference in %Fat, separate linear regression models were evaluated to explore the prediction of %Fat from BMI, PA, and BMI x PA. BMI explained 50.2% of the variance in %Fat among females and only 18.3% of the variance in males ($p < 0.001$ for both). Adding PA to the model significantly increased the variance in %Fat explained in both females and males ($\Delta R^2 = 3.4\%$ and 3.5% , respectively, both $p < 0.05$). The addition of the BMI x PA interaction term improved the model in females ($\Delta R^2 = 1.3\%$, $p = 0.005$), but not males ($\Delta R^2 = 0.0\%$, $p = 0.933$). **CONCLUSION:** Weight management is of high public health importance, especially for young adults who have an increasing risk for obesity during this stage of life. While many health promotion efforts focus on weight management with BMI as a primary outcome, it is important to account for sex differences with respect to the relationships among BMI, PA, and %Fat when using BMI for program evaluation in the young adult population.

Character Count (1,741/2000)

2740 Board #6 May 31 1:00 PM - 3:00 PM
Percentage Body Fat Predicted by Body Mass Index, Waist Circumference & Age in Different Racial & Gender Groups

Yaozong He, Yan Yang, Weimo Zhu, FACSM. *University of Illinois at Urbana-Champaign, Urbana, IL.*

(No relevant relationships reported)

Percentage Body Fat Predicted by Body Mass Index, Waist Circumference and Age in Different Racial and Gender Groups

Studies have shown that percentage body fat (%BF) is highly correlated with the body-mass index (BMI) and waist circumferences (WC) in different age, race, and gender. However, taking ethnicity factor into account to predict %BF has not been established. **PURPOSE:** We explored the equations of %BF predicted by BMI, WC, and age in different racial and gender groups. **METHODS:** We use National Health and Nutrition Examination Survey (NHANES 2003-2004) data with sample weighing 488058396 in five race groups including Mexican American (MA), other Hispanic (OH), Non-Hispanic White (NHW), Non-Hispanic Black (NHB), and other Race - including Multi-Racial (OR). %BF was measured by dual-energy X-ray absorptiometry (DXA). Prediction equation of %BF was developed based on different race and gender groups with predictors of WC, BMI, and age (20 and older). **RESULTS:** There was a statistically significant interaction between groups. The results of the regression equation in different race and gender groups are as the following table:

Race		MA	OH	NHW	NHB	OR
Gender		Male				
%BF (Mean, SD)		28.276, 4.848	27.280, 5.602	28.640, 5.942	26.152, 6.663	27.726, 5.485
R-square		0.675	0.766	0.704	0.717	0.585
Standardized CoefficientsBeta	WC	0.766	0.845	0.855	0.812	1.146
	BMI	0.061	-0.042	-0.054	0.022	-0.442
	Age	-0.004	0.139	0.109	0.057	0.074
Gender		Female				
%BF (Mean, SD)		41.362, 5.738	39.991, 5.302	40.006, 6.849	40.872, 6.765	38.182, 6.193
R-square		0.633	0.566	0.689	0.678	0.709
Standardized CoefficientsBeta	WC	0.187	0.113	0.199	0.165	0.239
	BMI	0.586	0.569	0.594	0.644	0.600
	Age	0.159	0.326	0.207	0.160	0.082

For all, $p = 0.000$

CONCLUSION: Formulating prediction equations in different gender and race groups does not improve the prediction of %BF. Further analyses such as cross-validation based on split training and testing datasets are needed.

2741 Board #7 May 31 1:00 PM - 3:00 PM
Differences in Determining Exercise Intensity in Males and Females

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(No relevant relationships reported)

Even though there are physiological differences between males and females, heart rate (HR), rate of perceived exertion (RPE), power output (PO), oxygen consumption (VO₂), and blood lactate (BL) levels have been used as measures of exercise intensity independently of the sex.

PURPOSE: To determine if there are differences between sexes in different exercise intensity models.

METHODS: Thirty (15 females) young, healthy individuals (age range 19-33 y) were scheduled for two testing visits 48-72 hours apart. During the first testing visit, a graded exercise test (GXT) was administered on a stationary bicycle. HR, RPE, PO, VO₂, and BL were obtained at the end of each exercise step and peak PO and VO₂max were recorded at the end of the test. BL during the GXT was used to determine 3 5-min steady-state workloads (low: 0-2 mmol/l; medium: 2-4 mmol/l; and high: >4 mmol/l) for the second test. HR, %HRmax (HR/(220-age)), RPE, PO, %POmax, VO₂, %VO₂max, and BL were also obtained at the end of each steady-state workload. A two-way repeated measures ANOVA was performed to compare all exercise intensity variables obtained during the second test between males and females ($\alpha=0.05$).

RESULTS: Only RPE, %PO, and BL did not differ between sexes on all 3 exercise intensities (Table). HR, %HR, and PO differ between sexes on at least 2 exercise intensities. VO₂ and %VO₂max differ between sexes on at least 1 exercise intensity.

Workload	Variable	Females (n=15)	Males (n=15)	p
Low (0-2 mmol/l)	HR (bpm)	115.9 ± 14.4	96.8 ± 14.2	0.004
	%HR (%)	68.7 ± 7.5	59.4 ± 8.8	0.002
	RPE	7.7 ± 2.0	7.5 ± 1.6	0.796
	PO (Watts)	61.3 ± 20.3	67.3 ± 15.3	0.440
	%PO (%)	44.1 ± 11.2	36.4 ± 9.7	0.051
	VO ₂ (ml/Kg/min)	15.1 ± 3.7	15.7 ± 3.6	0.731
	%VO ₂ max (%)	54.0 ± 9.8	45.6 ± 8.4	0.010
Medium (2-4 mmol/l)	BL (mmol/l)	1.5 ± 0.4	1.3 ± 0.4	0.439
	HR (bpm)	143.4 ± 15.8	127.9 ± 19.9	0.053
	%HR (%)	84.9 ± 6.2	75.4 ± 6.7	0.000
	RPE	10.5 ± 2.4	10.8 ± 2.4	0.711
	PO (Watts)	93.3 ± 22.0	116.7 ± 19.5	0.017
	%PO (%)	67.6 ± 10.3	62.1 ± 8.3	0.086
	VO ₂ (ml/Kg/min)	20.1 ± 4.2	24.7 ± 5.1	0.034
High (>4 mmol/l)	%VO ₂ max (%)	71.9 ± 10.0	71.3 ± 6.7	0.760
	BL (mmol/l)	2.6 ± 0.6	2.8 ± 0.7	0.367
	HR (bpm)	164.0 ± 15.6	149.0 ± 17.0	0.016
	%HR (%)	97.0 ± 3.7	91.1 ± 7.3	0.017
	RPE	13.7 ± 2.4	14.1 ± 2.4	0.594
	PO (Watts)	123.7 ± 23.0	156.0 ± 29.2	0.001
	%PO (%)	89.9 ± 8.6	87.8 ± 8.2	0.414
	VO ₂ (ml/Kg/min)	26.3 ± 5.5	31.0 ± 5.6	0.074
	%VO ₂ max (%)	93.3 ± 7.4	89.6 ± 5.5	0.212
	BL (mmol/l)	4.7 ± 0.7	4.8 ± 1.1	0.657

CONCLUSIONS: As previously reported, females have higher HR and %HR than males for similar %PO. However, and contradicting previous reports, RPE was similar between males and females for similar %PO. Based on the current results, traditional exercise intensity models are different between males and females. BL and %PO appear to be the models that might be used independently of sex.

2742 Board #8 May 31 1:00 PM - 3:00 PM
The Relationship Between Maternal Physical Activity during Late Pregnancy and Infant Motor Development

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(No relevant relationships reported)

BACKGROUND: Physical activity is beneficial for pregnant women and their offspring. Exercise during pregnancy may elicit improvements in the brain/neurodevelopment of offspring; however, it is unknown whether or not physical activity during pregnancy is connected to infant motor development. The purpose of this study was to determine the relationship between maternal physical activity during late pregnancy and infant motor development at four months of age. **METHODS:** Physical activity was objectively assessed during late pregnancy (32-39 weeks gestation) via a wrist worn accelerometer. The amount of time spent sedentary and participating in light and moderate exercises were calculated for one week. Within 48 hours of birth, surveys were given to participants to complete prospectively with information on time their infant spends in different positions (supine, prone, supported sitting and standing), infant feeding practices (breastfed vs. formula-fed), and other factors that could contribute to infant motor development during the first 4 months of life. Between 4 and 4.5 months of age, the motor development of the child was assessed by a board-certified pediatric physical therapist using the well-validated Alberta Infant Motor Scale (AIMS). **RESULTS:** Thirty women-infant pairs participated in the study (n=30). Infant motor development percentiles were not correlated to time spent sedentary ($r=-.02$, $p=.94$), time spent participating in light activity ($r=-.03$, $p=.88$), or time spent participating in moderate activity during late pregnancy ($r=.04$, $p=.85$). In addition, there was not a significant relationship between infant motor scores and the total time an infant spent in prone ("tummy time") ($r=.06$, $p=.81$). Interestingly, infants who were exclusively breastfed at 4 months had a significantly higher mean motor score percentiles compared to those who were on formula (19.0 vs. 15.8, $p=0.003$). **CONCLUSIONS:** There was no relationship between maternal physical activity levels during late pregnancy and infant motor development at four months of age. However, infants who were still breastfed at 4 months of age had higher motor development percentiles. The long-term implications of these data are substantial as motor performance in infancy is linked to an improved-cognitive function in school-age children.

F-10 Thematic Poster - Sports Injury: New Epidemiological Insights

Friday, May 31, 2019, 1:00 PM - 3:00 PM
Room: CC-104B

2743 Chair: Alpa V. Patel, FACSM. *American Cancer Society, Atlanta, GA.*

(No relevant relationships reported)

2744 Board #1 May 31 1:00 PM - 3:00 PM
Sport-Specific Associations of Sport Specialization and Sport Volume with Overuse Injury in Youth Athletes

Eric G. Post¹, Kevin M. Biese², Daniel A. Schaefer², Andrew M. Watson², Timothy A. McGuine², M. Alison Brooks², David R. Bell². ¹San Diego State University, San Diego, CA. ²University of Wisconsin-Madison, Madison, WI.
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(No relevant relationships reported)

Year-round participation in a single sport at the exclusion of other sports, also known as sport specialization, is associated with increased risk of overuse injury in youth athletes. To reduce this risk, several recommendations for participation volume have been developed. However, risk of overuse injuries may be dependent on specific movement profiles required by a given sport.

PURPOSE: To examine sport-specific associations of sport specialization and exceeding sport volume recommendations with overuse injuries in adolescent basketball, soccer, and volleyball athletes.

METHODS: 716 youth athletes (70.8% female, age 14.21.5 years old, 43.2% basketball, 19.4% soccer, 37.4% volleyball) were recruited to complete an anonymous questionnaire regarding their sport participation patterns and previous injury history. Sport specialization status was classified as low, moderate, or high using a widely utilized 3-point scale. Self-reported sport volume was used to classify athletes as either meeting or exceeding sport volume recommendations (playing their primary sport >8 months/year, hours/week of organized sport > age, days of sport participation per week >5). Multivariable logistic regression analyses were utilized to examine associations between variables of interest and overuse injury in the previous year.

RESULTS: Highly specialized volleyball athletes were more likely to report an overuse injury compared to low specialization volleyball athletes (OR [95% CI]: 2.3 [1.1-4.8], $p<.01$). Volleyball athletes who trained: more than 8 months per year (OR [95% CI]: 2.0 [1.1-3.5], $p<.05$), more hours per week than their age (OR [95% CI]: 2.0 [1.2-3.4], $p<.01$), or more than 5 days per week (OR [95% CI]: 2.1 [1.2-3.9], $p<.05$) were more likely to report an overuse injury compared to volleyball athletes who did not violate these recommendations. No significant associations were observed in soccer or basketball athletes ($P>.05$).

CONCLUSIONS: The association between sport specialization, excessive sport volume, and overuse injuries may be specific to sports that are more repetitive or technical in nature, such as volleyball. Dissemination of sport-volume recommendations should be focused towards athletes, parents, and coaches in these sports.

2745 Board #2 May 31 1:00 PM - 3:00 PM
A Seven-year Epidemiological Analysis Of Ankle Injuries In U.S. Rugby-7s

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Reported Relationships: V. Lopez Jr: Salary; Officer Salary. Industry contracted research; Grant National Operating Committee on Standards for Athletic Equipment (ID 44-16), Chapel Hill, NC, USA., Grant USA Rugby's Empire and New England Geographic Union Rugby Football

Unions.

PURPOSE: There is a lack of injury data on the collision sport of U.S. Rugby-7s, the aim was to determine match ankle injury-incidence and risk-factors in U.S. Rugby-7s.

METHODS: This was a prospective epidemiology study of players at USA Rugby Club 7-a-side competitive regional circuits and USA Rugby-7s Championships (2011-2016). Injury data were captured via the Rugby Injury Survey & Evaluation (RISE) Report. **RESULTS:** Overall injuries were found at 9.9/1000ph (n=313) (time-loss 2.5/1000ph, n=78; medical attention 7.4/1000ph, n=235; $P<.001$). Females (3.5/1000ph; 12.3%; n=112) encountered fewer overall ankle injuries than males (7.6/1000ph; 10.8%; n=239; $P=0.477$). Backs (59%) more frequently than forwards (35%). Ankle injury severity, days absent was found at 41.5 days mean severity (CI: 24.4-58.6) with 68% follow-up. Overall injuries acutely (95%), occurred during the tackle (61%, 5.2/1000ph) and open play (29%, 2.5/1000ph). Lateral ligament sprains (3.7/1000ph) occurred more frequently than medial (0.9/1000ph). Risk factors among time-loss injuries and impact were frequent (direct-contact=1.7/1000ph, 68%; n=53; non-contact=0.8/1000ph; 32%; n=25; $p=0.002$). Contact injuries were higher among women (64%). New time-loss injuries (71.8%) occurred more often than recurrent-time-loss ankle injuries (28.2%). Recurrent ankle injuries occurred more frequently at greater-than-12-months (delayed-recurrence=12.8%) followed by a 2-month (early-recurrence=10.3%). Recurrent injuries occurred most frequently among elite players at a late-recurrence rate (2-12-months=28.6%) as compared to non-elite players at a delayed-recurrence (>12-months=14.1%). **CONCLUSIONS:** Ankle injuries are a frequent concern in collision sports. This is compounded when return-to-sport protocols are not adhered to and may be a risk-factor for subsequent injury. U.S. Rugby-7s community ankle injury rates were lower compared to International elite Rugby-7s play at 7.1-25/1000ph (time-loss). Appropriate proprioception and agility training awareness, would benefit all levels of play. This emerging population may benefit from education on return-to-sport protocols and post-tournament injury care which would decrease recurrent injury rates seen in this U.S. amateur population.

2746 Board #3 May 31 1:00 PM - 3:00 PM
Prospective Injury Surveillance during the Wheelchair Basketball World Championships 2018

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(No relevant relationships reported)

Standardized injury surveillance projects have been conducted in several Olympic sports, and the information has been used to develop preventive strategies to reduce injury risk. In contrast, injury surveillance in Paralympic sports has been executed rarely, and in depth information on injury epidemiology of specific elite Paralympic sports are scarce. **PURPOSE:** To investigate the rate and characteristics of injuries prospectively during the 2018 Wheelchair Basketball World Championships in Hamburg (Germany). **METHODS:** The physicians or physiotherapists of all participating female and male teams were asked to report daily all newly incurred injuries on a standardized injury report form during the 11 days of the tournament. Incidence rates were calculated, and injury characteristics compared using chi-squared tests. **RESULTS:** A total of 100 injuries were reported from 132 players, equivalent to 77.2 injuries per 1000 athlete days (95%CI: 62.1 to 92.3). About two thirds of the injuries occurred during matches, and 32 during training sessions. The rate of match injuries was 76.6 (95%CI 61.6 to 91.6) per 1000 athlete-days, the rate of training injuries 78.4 (95%CI 63.0 to 93.8) per 1000 athlete-days. Eight time-loss injuries were documented, equivalent to 6.2 (95%CI 5.0 to 7.4) time-loss injuries per 1000 athlete-days, all were classified as minor. Most injuries occurred at the upper limb (shoulder 14%, elbow 11%, hand/fingers 10%) and back (cervical spine 16%; thoracic spine 15%). The predominant injury types were muscle spasms (25%) and contusions (16%). About half of the injuries were classified as overuse injuries (52%). Injury mechanisms differed between training and match ($p\leq.05$), and between female and male players ($p\leq.05$). **CONCLUSIONS:** The injury rates were higher than reported during other major tournaments (Paralympic Games) or during regular wheelchair basketball seasons. Reasons are most probably due to the high number of reported non-time-loss injuries. Possible preventive strategies should focus on shoulder, hand and back. Muscle spasms could be prevented using adequate rehydration and electrolyte substitution, while the special requirements of players' disabilities need to be considered. Future research should include illnesses in the prospective monitoring.

2747 Board #4 May 31 1:00 PM - 3:00 PM
Gender Differences In The Risk Of Head, Neck & Face Injuries In US Rugby-7s

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A high incidence of head injuries, including concussions, has been documented in a growing US rugby playing population. However, few studies have focused on describing common risk factors associated with head injuries. **PURPOSE:** The purpose of this study was to identify risk factors associated with head, neck, and face injuries (HNFI) among amateur U.S. rugby-7s players and investigate risk differences between genders. **METHODS:** Data were used from the Rugby Research and Injury Prevention Group's injury registry (January 2010-2016). Anthropometric data, mechanism of injury, and other injury risk factors were tabulated by HNFI and gender. Logistic regression determined the relation between gender and HNFI. The final multivariable model was used to calculate the probability of HNFI and highlight gender differences. **RESULTS:** The final study sample consisted of 1,307 (68.2% men, 31.8% women) U.S. rugby-7s players and 1,679 (68.1% men, 31.9% women) injuries. From 2010-2016, 474 (28.2%) HNFI were documented. The most commonly injured body part and injury type were the head (47.7%) and concussions (40.3%), respectively. The final model revealed gender, age, position during contact, contact surface, and play legality were significantly associated with HNFI. Controlling for play legality and position during contact, under 18 (U18) boys injured during contact with an opposing player had the highest probability of HNFI (51%) and a higher probability than U18 girls ($p=0.004$). However, women 18-24 ($p=0.019$) and over 30 ($p=0.042$), injured during contact with the ground, had a higher probability of HNFI than men. **CONCLUSIONS:** Identifying gender-specific risk factors of injury will allow for a more effective injury prevention plan that addresses the specific needs of men and women of different levels of competitive play. Our analyses suggest there are differences in risk of HNFI in amateur Rugby-7s as it relates to player age, gender, and play legality. Age group analyses may help identify gender-specific HNFI risk factors within each age group.

2748 Board #5 May 31 1:00 PM - 3:00 PM
Gender Differences In Match Contact Injuries In U.S. Rugby-7s.

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(No relevant relationships reported)

Rugby-7s is a popular collision sport that is played by both sexes in the U.S. Collisions that occurs during Rugby are responsible for the majority of injuries during competition. **PURPOSE:** The objective of this study is to evaluate gender differences in match injuries among men and women amateur U.S. Rugby-7 athletes. **METHODS:** A prospective epidemiology study on Rugby-7s competitions (USA Rugby and USA Sevens tournaments) over 2010-2015 was performed. Injury rate (per 1000 player-hour (ph)) and biomechanism of injuries were recorded using the Rugby Injury Survey & Evaluation (RISE) report. Direct (injury from collision with an opposing player) and indirect mechanism (injury from the body part making contact with another factor such as playing surface) were recorded. Severity of injuries (days (d) absent from play) were determined. Comparative analysis between sexes were performed with statistical significance set a $P<0.05$. **RESULTS:** A total of 1223 contact match injuries were seen during the study period (men: 852 injuries; women: 371 injuries). There was no significant differences in incidence of contact injuries for U.S. men vs. women Rugby-7 athletes (men: 55.4/1000ph; women: 59.0/1000ph; $P=0.31$). Female players however had a higher incidence of indirect injuries than males (women: 23.1/1000ph; men: 17.4/1000 ph, $P=0.007$). Female Rugby-7s players also sustained more severe contact injuries than males (women: 56.7d; men: 40.1d, $P=0.03$). In terms of incidence of injury per body region, female players had a higher incidence of lower extremity injuries than males (women: 24.2/1000ph; men: 18.0/1000 ph, $P=0.004$). Female Rugby-7s athletes also missed a significant more time with contact head/neck (women:

55.1/1000ph; men: 29.4/1000 ph, $P<0.009$) and lower extremity injuries (women: 70.7/1000ph; men: 41.2/1000 ph, $P=0.01$). **CONCLUSIONS:** Significant differences in rate and mechanism of injuries exist between U.S. men and women Rugby-7 athletes in our study population. Female players are more likely to sustain certain types of injuries and missed substantially more time after an injury when compared to their male counterparts. Gender differences in sports are important to consider when evaluating injury risk and formulating population-specific prevention programs.

2749 Board #6 May 31 1:00 PM - 3:00 PM
Evaluation Of The Rate Of Orthopedic Injuries Of Concussed And Non-concussed Players In The NFL

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(No relevant relationships reported)

Evaluation of the Rate of Orthopedic Injuries of Concussed and Non-Concussed Players in the NFL

Concussions may increase the risk of musculoskeletal injury during the 90 day period after return to play. Previous work has evaluated this effect in collegiate players with consistent results. **PURPOSE:** To examine possible increased risk of orthopedic injury among National Football League players 12 weeks (90 days) after return to play from an incident concussion compared to an incident orthopedic injury. **METHODS:** Weekly NFL injury data from 2012 through 2017 was collected from public websites and weeks 3-10 of the regular season were analyzed. Players with upper extremity (UE) and lower extremity (LE) orthopedic injuries were matched to each concussed player on position, team, and week of return to play. Concussed players were excluded if they sustained an orthopedic injury concurrently with a concussion or if there was no matched orthopedic control. Additional players were excluded from the study if they were on the injury logs for any other reason. This study analyzed 194 concussed players, comparing them with 187 LE and 105 UE injuries. An additional 444 non-injured controls with no injuries spanning 3 weeks prior were also evaluated. The rate of orthopedic injury was calculated as the number of orthopedic injuries during the 12 week period following return to play from their initial injury divided by 12 weeks. UE and LE injuries were evaluated separately against the concussion group using a Wilcoxon Rank Sum test. **RESULTS:** In the 12 week period following return to play from injury, players who sustained a concussion had an average of 0.030.06 orthopedic injuries, while players who sustained a LE injury or uninjured controls had a rate of 0.010.04 and 0.002.01 orthopedic injuries respectively. There was a significant difference between the orthopedic injury rate among the concussed and LE injury groups ($Z = 2.22$, $p\text{-value} = 0.03$). In addition, the difference in orthopedic injury rate between the controls and concussed groups was significant ($Z=9.79$, $p\text{-value} = 1.55\text{e-}22$). No relationship between concussed and UE injury was found. **CONCLUSION:** The results of this study suggest a relationship between concussions and subsequent orthopedic injuries in NFL players compared to those with an incident LE injury or no incident injury.

2750 Board #7 May 31 1:00 PM - 3:00 PM
Volleyball-Related Injuries in Adolescent Female Players

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Purpose: This study determined the prevalence and type of musculoskeletal injuries and potential contributing risk factors to injury among adolescent volleyball players.

Methods: Female volleyball players ($n=300$; 10-18 yrs), with any level of volleyball experience were recruited. Participants completed a study-specific survey about their overall sport training type and volume, volleyball experience level (beginner, intermediate, advanced) and position, annual volume of volleyball play and injuries accrued during volleyball.

Results: Over 65% of participants reported sustaining one or more injuries, with ankle (38.8%), knee (19.7%), finger (18.8%), and shoulder (14.5%) injuries being most frequently-reported. Among injured players, 21.1% reported missing more than one month of play. Annual volume of volleyball play increased as skill level progressed from beginner to advanced (179.7 units to 478.1 units $p<0.05$). Also, the prevalence of injuries sustained by players increased as skill level increased from beginner to advanced (7.7% to 72.3%; $p<0.05$). Players who ranked themselves as 'intermediate' experience had higher odds of sustaining an elbow injury compared to other skill levels (OR 6.59; $p=0.02$). Outside hitters, defensive specialists, and those who play multiple positions were more likely to participate in multiple conditioning methods such as weight training, endurance and flexibility (OR 1.81, 1.93, 1.74, respectively; $p<0.05$) with advanced players indicating a trend to higher odds of participating in multiple conditioning methods (OR 1.49, $p=0.085$). Only 46.1% of participants

reported playing other sports, with those participating in basketball indicating a 49% decreased odds of sustaining an injury compared to participating in other sports (OR 0.510, $p < 0.05$)

Conclusion: An interpretation of these data is that adolescent players may incur injuries due to underdeveloped neuromuscular systems capable of sustaining progressively higher volumes of play as experience and competition level increase. Participation in a secondary sport like basketball may protect against injury by conferring cross-sport benefits of jump-landing, cutting and body positioning. Position-specific injuries suggest technique-driven risk factors that should be further investigated biomechanically.

2751 Board #8 May 31 1:00 PM - 3:00 PM

Determinants of Concussion Symptomology and Resolution Time in US High School Soccer Players

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Reported Relationships: A. Chandran: Other (please describe): The National Athletic Treatment, Injury and Outcomes Network (HS NATION) data were provided by the Datalys Center for Sports Injury Research and Prevention., HS NATION was funded by the National Athletic Trainers' Association Research and Education Foundation (NATA REF), and the Central Indiana Corporate Partnership (CICP) Foundation.

Concussions are a concern among soccer players of all ages. However, determinants of concussion symptomology and other sequelae have not been examined in high school soccer players.

Purpose: Examine the impact of sex, injury history, injury mechanism, and setting on concussion symptomology and resolution time among HS soccer players.

Methods: The NATION-SP captured soccer-related injury data collected by athletic trainers (ATs) during the 2011/12-2013/14 academic years. We specifically examined injuries diagnosed as concussions. Outcomes of interest included symptoms reported with concussions as well as resolution time, categorized as resolved in 7 days, 14 days, 28 days and > 28 days. Exposures of interest included sex, injury history, injury mechanism associated with concussion, and setting (competition vs. practice). We used multivariate logistic regression models to assess the odds of reporting specific symptoms as a function of exposures, as well as other observed symptoms. We then used ordinal logistic regression models to assess exposure effects on the odds of reporting a longer symptom resolution time. Odds Ratio (OR) estimates with 95% confidence intervals (CI) excluding 1.00 were deemed significant.

Results: A total of 189 concussions were reported, with most observed in girls (56%). Symptoms resolved within 7 days in 41% of reported concussions. Interestingly, we detected several symptom dependencies, such as higher odds of light sensitivity (OR= 20.71, 95% CI: 8.58, 50.00) with concurrent noise sensitivity, and higher odds of irritability (OR= 9.04, 95% CI: 3.74, 21.85) and drowsiness (OR= 7.46, 95% CI: 3.48, 15.98) with concurrent insomnia. We also observed lower odds of longer symptom resolution time in concussions due to player contact mechanisms than those due to non-player-contact mechanisms (Adj. OR= 0.33, 95% CI: 0.18, 0.59).

Conclusions: Determinants of soccer-related concussions and their sequelae appear to be multifactorial. The observed symptom dependencies may encourage clinicians to evaluate players for specific symptoms in the presence of others while also indicating common neurological pathways affected by trauma in this context. Injury mechanism may also be associated with concussion outcomes, although future investigation is warranted.

F-11 Free Communication/Slide - Carbohydrate Metabolism

Friday, May 31, 2019, 1:00 PM - 3:00 PM

Room: CC-105A

2752 **Chair:** Trent Stellingwerff, FACSM. Canadian Sport Institute Pacific, Victoria, BC, Canada.

(No relevant relationships reported)

2753 May 31 1:00 PM - 1:15 PM Sport Specific Substrate Utilization During a Maximal Oxygen Consumption Test

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Substrate utilization as an indicator of exercise performance is a growing topic of interest for athletes. Athletes and sports science professionals are using substrate utilization to determine appropriate exercise programs and dietary interventions. However, evidence supporting the "typical" sports-specific metabolic profile is lacking.

PURPOSE: To predict time of substrate change using respiratory exchange ratio (RER) >0.85 from heart rate (HR), percent $\dot{V}O_{2\max}$ (% $\dot{V}O_{2\max}$), sex, carbohydrate intake (CHO), fat intake (FAT) and protein intake (PRO). We also explored whether differences in substrate utilization existed among sport types during a $\dot{V}O_{2\max}$ test in Masters Athletes. **METHODS:** This was a crosssectional study where 70 Masters Athletes (35 women; 35 men; 39±11 years of age) were measured for RER during a $\dot{V}O_{2\max}$ treadmill test. A food frequency questionnaire (FFQ) was completed to determine average nutrient intake. Athletes from four sport types were included in our analyses: runners (20), triathletes (20), rowers (19) and CrossFit athletes (11). A multivariate linear regression model of least squares was used to predict time to RER of >0.85 from HR, % $\dot{V}O_{2\max}$, sex, CHO, FAT and PRO. A one-way ANOVA was used to determine whether differences existed among sport types. Bonferroni correction procedures were used to control the familywise error rate and maintain alpha levels at $p < 0.05$. **RESULTS:** Significant correlations were found between time and HR ($r = 0.632$, $p < 0.001$), time and % $\dot{V}O_{2\max}$ ($r = 0.616$, $p < 0.001$), time and sex ($r = 0.257$, $p = 0.021$), time and CHO ($r = -0.290$, $p = 0.010$), time and FAT ($r = -0.272$, $p = 0.015$), time and PRO ($r = -0.270$, $p = 0.016$) and were included in our multivariate model. HR, % $\dot{V}O_{2\max}$, sex, CHO, FAT, PRO significantly predicted time to RER ($R^2 = 0.467$, $p < 0.001$). We also found significant differences in time to RER >0.85 between runners ($4:16 \pm 0:58$) and CrossFit athletes ($2:52 \pm 1:03$) ($p = 0.014$), posthoc. **CONCLUSION:** We found a significant relationship between HR, % $\dot{V}O_{2\max}$, sex, CHO, FAT, PRO and time to RER in Masters Athletes of various sports. We also found that significant differences existed in time to RER >0.85 between runners and CrossFit athletes. Future studies that are prospective and include diverse exercise intensities are needed. This study was not funded

2754 May 31 1:15 PM - 1:30 PM Transcriptional Regulation Of Substrate Metabolism Following Carbohydrate Ingestion During Exercise Initiated With Different Glycogen Concentrations

Stefan M. Pasiakos, FACSM, Marques A. Wilson, Claire C. Whitney, Christopher T. Carrigan, Nancy E. Murphy, Adrienne M. Hatch, Scott J. Montain, Lee M. Margolis. United States Army Research Institute of Environmental Medicine, Natick, MA. Email: stefan.m.pasiakos.civ@mail.mil

(No relevant relationships reported)

BACKGROUND: Starting aerobic exercise with low muscle glycogen content elicits greater fat and less carbohydrate utilization than exercise started with high muscle glycogen content, even when exogenous carbohydrate is ingested during exercise. The mechanisms contributing to greater fat utilization despite ingesting carbohydrate during exercise initiated with low glycogen are not delineated.

PURPOSE: Characterize transcriptional regulation of substrate metabolism in response to carbohydrate ingestion during steady-state exercise initiated with low muscle glycogen.

METHODS: In a randomized, crossover design, 12 men (mean ± SD, age, 21 ± 4 y; body mass, 83 ± 11 kg; $\dot{V}O_{2\text{peak}}$, 44 ± 3 mL/kg/min) completed two cycle ergometry glycogen depletion trials, followed by a 24 h period of either high fat (1.5 g/kg carbohydrate, 3.0 g/kg fat) or high carbohydrate (6.0 g/kg carbohydrate, 1.0 g/kg fat) isocaloric refeeding to elicit low (LOW) or adequate (AD) glycogen content the following morning before initiating 80-min of cycle ergometry ($64 \pm 3\%$ $\dot{V}O_{2\text{peak}}$) while

ingesting 146 g of carbohydrate. Transcriptional regulation of substrate metabolism was assessed using RT-qPCR in vastus lateralis biopsy samples obtained before (PRE) and after (POST) the 80-min exercise bout.

RESULTS: PRE glycogen synthase kinase 3 α expression was 40% lower ($P<0.05$; time-by-treatment interaction) in LOW than AD. GLUT4, hexokinase 2, phosphofructokinase, and pyruvate kinase expression were not different between LOW and AD. PRE fatty acid translocase was 40% higher ($P<0.05$; time-by-treatment interaction) in LOW than AD. Independent of time, fatty acid binding protein, carnitine palmitoyltransferase 1A, and hydroxyacyl-CoA dehydrogenase/3-ketoacyl-CoA expression were each ~40% higher ($P<0.05$; time effect) in LOW than AD. In LOW, POST peroxisome proliferator-activated receptor δ was 177% higher ($P<0.05$ time-by-treatment interaction) than PRE, with no change in AD.

CONCLUSION: Initiating aerobic exercise with low muscle glycogen content upregulates the transcriptional control of fat oxidation without modulating intramuscular regulation of glucose metabolism, even when exogenous glucose is ingested during exercise.

2755 May 31 1:30 PM - 1:45 PM

Effect Of Breaking-up Sedentary Activity On Metabolic Flexibility And Glycemia In Free-living Overweight/obese Adults

Laura Schreck, Nathan DeJong, Andrew Lange, Carlos Mendez, Thomas Glazer, David A. Goldstrohm, Edward L. Melanson, FACSM, Corey Rynders, Josiane Broussard, Daniel Bessesen, Audrey Bergouignan. *University of Colorado, Anschutz Medical Campus, Aurora, CO.* (Sponsor: Edward L. Melanson, FACSM) Email: laura.schreck@colostate.edu

(No relevant relationships reported)

PURPOSE: Sedentary behavior (SB) triggers an inability to adjust substrate use to substrate availability (metabolic flexibility, MF), which may precede glucose intolerance in the pathogenesis of insulin resistance. We and others have shown that frequent interruptions in SB leads to improved glycemic control, however the underlying role of MF in this process is unknown. This study examined the effects of breaking up SB on MF and glucose metabolism in free-living overweight and obese adults. To distinguish effects of breaking up SB from being physically active, we also studied a group where participants performed a single energy matched continuous bout of exercise. **METHODS:** Physically inactive, adults (12F/7M, mean \pm SD; 33 \pm 8 yrs, BMI = 29.5 \pm 3.3 kg/m²) were randomly assigned to a 4 week intervention consisting of brisk walking for 5 min each hour for 10h, 5 d/wk (MICRO), or 4 weeks of an intervention consisting of one continuous 45 min bout of exercise per day, 5d/wk (ONE). Outcomes assessed at baseline and after each intervention included: MF (waking respiratory quotient, RQ, minus sleeping RQ as measured in a whole room calorimeter), insulin sensitivity (SI, IVGTT), 24h glycaemia (continuous glucose monitor), 24h glucose oxidation (U13C glucose tracer), SB, time spent stepping, and performing moderate to vigorous activity (MVPA; ActivPAL and ActiGraph). Groups were similar on all outcome variables at baseline. Linear mixed models evaluated intervention and intervention-by-group effects. **RESULTS:** MICRO and ONE decreased time sitting (-43.5 \pm 93.4 min), increased time stepping (+26.3 \pm 44.0 min) and time spent in MVPA (+9.8 \pm 17.6 min) ($p<0.05$ for all). No significant changes were observed in SI, but both interventions decreased fasting insulin and HOMA IR ($p<0.05$ for both). Compared to ONE, MICRO improved the acute insulin response to glucose (AIRg), lowered 24h glycemic variability, maintained exogenous glucose oxidation, and improved MF (interaction: $p<0.05$ for all). Improvements in MF were positively associated with changes in SI ($r=0.59$, $p=0.02$). **CONCLUSIONS:** Independent of time sitting and stepping, breaking up SB improves glucose homeostasis and MF. The effects of such an intervention in persons with type 2 diabetes warrants further study.

2756 May 31 1:45 PM - 2:00 PM

Low Muscle Glycogen Content Does Not Alter Exogenous Carbohydrate Oxidation During Aerobic Exercise

Lee M. Margolis, Marques A. Wilson, Claire C. Whitney, Christopher T. Carrigan, Nancy E. Murphy, Adrienne M. Hatch, Scott J. Montain, FACSM, Stefan M. Pasiakos, FACSM. *United States Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Stefan M Pasiakos, FACSM) Email: lee.m.margolis.ctr@mail.mil

(No relevant relationships reported)

BACKGROUND: Initiating aerobic exercise with low muscle glycogen content promotes greater fat and less endogenous carbohydrate oxidation during exercise. However, whether oxidation of exogenous carbohydrate increases when exercise is initiated with low muscle glycogen is not well defined.

PURPOSE: Determine if exogenous carbohydrate oxidation during aerobic exercise is affected by the level of muscle glycogen at the onset of exercise.

METHODS: Using a randomized, crossover design, 12 men (mean \pm SD, age: 21 \pm 4 y; body mass: 83 \pm 11 kg; $\dot{V}O_{2peak}$: 44 \pm 3 mL/kg/min) completed 2 cycle ergometry glycogen depletion trials separated by 7-d, followed by a 24-h period of high fat (1.5 g/kg carbohydrate, 3.0 g/kg fat) or high carbohydrate (6.0 g/kg carbohydrate, 1.0 g/kg fat) refeeding to elicit low (LOW) or adequate (AD) glycogen stores. Participants then performed 80-min of steady-state cycle ergometry (64 \pm 3% $\dot{V}O_{2peak}$) while ingesting 146 g of carbohydrate (95 g glucose + 51 g fructose; 1.8 g/min). Substrate oxidation (g/min) during exercise was determined by indirect calorimetry and tracer techniques with ¹³C-glucose and ¹³C-fructose. Muscle glycogen (mmol/kg dry wt) was determined by fluorimetric assays from vastus lateralis biopsies obtained before and after glycogen depletion and before (PRE) and after (POST) steady-state exercise trials.

RESULTS: Muscle glycogen concentrations were the same between treatments before (LOW: 467 \pm 95, AD: 472 \pm 109) and after both depletion exercise bouts (LOW: 207 \pm 99, AD: 210 \pm 145). Following 24-h refeeding, PRE glycogen was lower in LOW (217 \pm 103) compared AD (396 \pm 70; $P<0.05$). POST glycogen in AD (229 \pm 94; $P<0.05$) was lower than PRE but remained higher than LOW (137 \pm 131; $P<0.05$). Glycogen did not change PRE to POST in LOW. Exogenous carbohydrate oxidation rate was not different between LOW (0.84 \pm 0.14) and AD (0.87 \pm 0.16; $P>0.05$). Fat oxidation was higher, and total and endogenous carbohydrate oxidation was lower in LOW (0.55 \pm 0.10, 1.59 \pm 0.40, and 0.75 \pm 0.29) compared to AD (0.38 \pm 0.13, 2.03 \pm 0.36, 1.17 \pm 0.29; all $P<0.05$).

CONCLUSION: These data show that initiating steady-state aerobic exercise with low muscle glycogen content does not cause greater reliance on exogenous carbohydrate for fuel.

2757 May 31 2:00 PM - 2:15 PM

Energy Metabolism With Or Without Slow Or Rapid Absorption Carbohydrate In Trained Endurance Runners

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(No relevant relationships reported)

The ability for carbohydrate (CHO) to provide sustained energy availability and stable blood glucose is important in prolonged endurance. **PURPOSE:** To examine energy metabolism, total and exogenous CHO utilization, blood glucose and performance after consuming different isocaloric glucose beverages before a sustained treadmill run. **METHODS:** 10 male experienced endurance runners (32.4 \pm 1.9 yr; 73.5 \pm 3.1 kg; %bf 15.3 \pm 2.1; $\dot{V}O_{2max}$ = 55.9 \pm 1.5 mL/kg/min) participated in a crossover-designed study, on 3 occasions: Slow digestion CHO (S), Fast digestion (F), and Water (C). Participants consumed a single 50g dose of either S or F prior to running 3hrs at 58% $\dot{V}O_{2max}$. Pulmonary gas exchange and plasma glucose were assessed at -15, 0 (run-start), 30, 60, 90, 135, 180 min for glucose, metabolic rate, and CHOox. Breath CO₂ was analyzed for exogenous C13 rate of appearance. Immediately post-run participants completed a time-to-fatigue test at 110% $\dot{V}O_{2max}$. **RESULTS:** There were no significant differences in $\dot{V}O_2$ between groups during the run ($p=0.46$). There was a significant difference in CHOox for C vs. S and F (C 1.0; S 1.33; F 1.45 \pm 0.1 g/min) ($p=0.12$). There was a significant difference in breath 13CO₂ appearance for C vs. S and F, as well as S vs. F (C 0.0002; S 0.0012; F 0.0009 \pm 0.0001 mmol/min) ($p<0.001$), in addition to a significant time x trial for C and S vs. F ($p<0.001$). There was a significant difference in AUC CHO dose oxidized to CO₂ for S vs. F (S 1.09; F 1.41 \pm 0.2 mmol) ($p=0.03$). There was a significant difference in plasma glucose for C vs. S, but not for F (C 89.1; S 95.9; F 93.5 \pm 1.9 mg/dL) ($p=0.001$), in addition to a significant time x trial difference for C and S vs. F ($p<0.001$). There was no significant time-to-fatigue between any trial (C 161.1; S 223.7; F 156.1 \pm 34.4 sec) ($p=0.18$). **CONCLUSION:** The consumption of a single bolus of CHO beverage prior to a 3hr run elicits significant alterations in energy metabolism compared to just water, with S CHO burning significantly less total carbohydrate and more fat than a rapidly digested carbohydrate. The S CHO provided a more stable and consistent energy metabolism profile, in addition to the most stable glucose concentration during the run. These findings provide evidence that S CHO provides a consistent blood glucose and sustained exogenous energy supply during a sustained endurance run.

2758 May 31 2:15 PM - 2:30 PM

The Addition Of A Sodium Alginate-pectin Hydrogel To A Carbohydrate Beverage Significantly Enhances gastric Emptying In Humans

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(No relevant relationships reported)

PURPOSE: To investigate the effect of CHO encapsulation and osmolarity on the rate of gastric emptying while at rest

METHODS: Eight healthy males were recruited to take part in this randomised, double blind, cross-over study. A 500 mL bolus of an experimental drink was installed while seated, and gastric emptying measured using the double aspiration method every 10 min for 90 min. The three drinks consisted of 180 g L⁻¹ maltodextrin and fructose (POLY, ~700 mOsm kg⁻¹), 180 g L⁻¹ glucose and fructose (MON, ~1300 mOsm kg⁻¹) and 180 g L⁻¹ maltodextrin, fructose, sodium alginate and pectin (ENCAP, ~700 mOsm kg⁻¹). All drinks also contained 1.5 g L⁻¹ of sodium and had a CHO ratio of 1:0.8 (maltodextrin:glucose:fructose). Arterialised venous blood samples were collected prior to drink instillation and at regular intervals thereafter and analysed for glucose and non-esterified fatty acid (NEFA) concentration.

RESULTS: Time to empty half of the ingested bolus was faster for ENCAP (21.2 ± 8.5 min) than for POLY (36.3 ± 8.0 min, $P < 0.003$), which was faster than for MON (52.4 ± 16.5 min, $P < 0.03$). During the first 10 min, ENCAP emptied more than MON (ENCAP: 157 ± 50 vs MON: 41 ± 50 mL, $P < 0.05$) but not more than POLY (108 ± 58 mL, $P = 0.28$). Thereafter, ENCAP emptied more than POLY and MON, reaching significance at 20 min (ENCAP: 258 ± 68, POLY: 182 ± 44 and MON: 141 ± 42 mL, $P < 0.05$) and 30 min (ENCAP: 307 ± 58, POLY: 196 ± 37, MON: 177 ± 50 mL, $P < 0.01$) after instillation. After 40 minutes, there were no longer significant differences between ENCAP and POLY. ENCAP and MON remained significantly different until 70 min but were not significantly different thereafter (458 ± 34 vs 406 ± 51 mL, respectively, $P = 0.07$). After 60 min, POLY had emptied significantly more than MON (380 ± 39 vs 290 ± 82, respectively, $P < 0.05$). Serum glucose concentration increased to a similar level on all trials, while serum NEFA concentration continually decreased over the 90 min to a similar extent on all trials.

CONCLUSIONS: These findings suggest that encapsulating CHO in alginate hydrogel is an effective method to enhance gastric emptying.

2759 May 31 2:30 PM - 2:45 PM

Acute Carbohydrate Consumption On The Iron-regulatory Response To Exercise In Elite Keto-adapted Endurance Athletes

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(No relevant relationships reported)

It has been demonstrated adherence to a low carbohydrate (CHO) high fat (LCHF) diet can alter markers of iron metabolism in endurance athletes. **PURPOSE:** To investigate the impact of CHO re-introduction in athletes previously adapted to a LCHF diet on subsequent inflammatory and hepcidin responses to exercise. **METHODS:** In the three weeks prior to the exercise trials, twenty-three elite race walkers adhered to either a CHO-rich (n=14) or LCHF diet (n=9). A 19-25 km race walking protocol was performed while the race walkers were still adhering to their allocated dietary intervention (Adapt). A second exercise test was performed three days later, where the LCHF consumed CHO 2 h prior to, and during the exercise protocol (in line with sports nutrition guidelines) for the first time in 3.5 weeks (CHO Restoration). Venous blood samples were collected pre-, post- and 3 h post-exercise and analysed for serum ferritin, interleukin-6 (IL-6) and hepcidin-25. **RESULTS:** Serum ferritin concentration was similar between trials ($p = 0.48$) and dietary groups ($p = 0.93$). The post-exercise IL-6 increase was greater in LCHF ($p < 0.001$) during both Adapt (LCHF: 13.1-fold increase; CHO: 8.0-fold increase) and CHO Restoration (LCHF: 18.5-fold increase, CHO: 6.3-fold increase); outcomes were not different between trials ($p = 0.84$). Hepcidin-25 levels increased 3 h post-exercise ($p < 0.001$), however, they

did not differ between trials ($p = 0.46$) or diets ($p = 0.84$). **CONCLUSIONS:** Strenuous exercise undertaken following chronic adaptation to a LCHF diet is associated with a greater post-exercise IL-6 response than when exercise is undertaken with high CHO availability. The elevated IL-6 response in athletes adapted to a LCHF diet is not attenuated by an acute increase in exogenous CHO availability. Despite diet-induced differences in IL-6 responses, no differences in hepcidin levels were evident, suggesting IL-6 is likely not the primary factor determining the magnitude of post-exercise hepcidin levels. Baseline iron status may be a more dominant factor regulating this response. Increased IL-6 levels may negatively influence other body processes, and the long-term impact of adhering to LCHF on other health outcomes warrants further investigation. Funded by the ACU Research Fund and the AIS High Performance Sport Research Fund.

2760 May 31 2:45 PM - 3:00 PM

No Correlations Between Gastrointestinal Complaints, Gut Injury Markers, And Carbohydrate Ingestion During a 60 Km Ultramarathon

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PURPOSE: It has been speculated that exercise-induced GI injury is associated with gastro-intestinal complaints. Ingesting carbohydrates (CHO) have been shown to blunt GI injury, although high CHO intakes also have been associated with GI complaints. The aim of this study was to investigate the relation between GI injury, -complaints and CHO intake.

METHODS: As part of a cross-sectional observation study 33 runners (28 males, 5 females) participating in a 60 km ultramarathon (4 April 2017, Texel, the Netherlands) provided a pre- and a post-race blood sample, and nutritional intake and (GI) complaints were assessed using a questionnaire after the race. Plasma intestinal fatty acid binding protein (I-FABP) levels, as a marker for GI injury, and inflammatory markers (CRP, IL-6, IL-8 and TNFα) were compared between pre- and post-race blood samples. GI complaints were scored on a 10-point scale and categorized as serious if scored ≥ 5. CHO intake (g/h) was calculated using predefined product ingredient declarations. Data were analyzed (SPSS 24.0) using Wilcoxon signed-rank tests and Spearman correlations tests and were presented as median [IQR]. Statistical significance was set at $P < 0.05$.

RESULTS: Plasma I-FABP levels did not significantly change pre- to post-race (1375 [1264-2073] to 1726 [985-3287] pg/mL; $P = 0.33$). CRP, IL-6, IL-8 and TNFα all increased from pre- to post-race ($P < 0.001$). GI complaints were reported by 73% of the runners, of which 20% reported serious complaints. CHO intake was 60 [37-90] g/h. There were no significant correlations between ΔI-FABP levels and the sum of GI complaints ($r_{sp} = -0.05$; $P = 0.79$), or between GI complaints and CHO intake ($r_{sp} = 0.21$; $P = 0.26$). No correlation was found between ΔI-FABP and CHO intake ($r = -0.32$; $P = 0.080$), but dividing subjects into terciles for ΔI-FABP levels revealed a significant difference in CHO intake between groups ($P = 0.027$).

CONCLUSION: Despite substantial GI complaints during the ultramarathon, there were no evident signs of GI injury indicated by a minimal change in plasma IFABP levels. Prevalence of GI complaints were not correlated with change in I-FABP levels or CHO ingestion during exercise, but higher CHO intakes may potentially attenuate the degree of GI injury.

The project was supported by Eat2Move and Friesland Campina.

F-12 Free Communication/Slide - Changing Physical Activity Behaviors Across the Life-Course

Friday, May 31, 2019, 1:00 PM - 3:00 PM
Room: CC-105B

2761 Chair: Eric C. Conchola. *Oklahoma State University, Stillwater, OK.*

(No relevant relationships reported)

2762 May 31 1:00 PM - 1:15 PM Are Lower-leg and Thigh Muscle Resistance Training Methods Equally Effective to Dynamic Balance for Community-Dwelling Elderly Females?

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(No relevant relationships reported)

PURPOSE: To compare the magnitude of lower-leg training program and thigh muscle training program to dynamic balance ability changes for community-dwelling elderly Japanese women.

METHODS: After giving written informed consent, the subjects, unable to stand on one leg for more than 25 seconds with their eyes open, were divided into a lower-leg training group (LLG; 10 females, 72.9±4.2 yrs, BMI 22.1±1.8) and a thigh muscle training group (TMG; 10 females, 70.6±2.5 yrs, BMI 22.1±1.2). The program was 60min. two times per week for 16 weeks. Each training program consisted of three parts. At first, participants learned about management skills for their physical stiffness. Secondly, they learned each resistance program. LLG participated in the program using unstable disk and elastic band. TMG learned program was to strengthen their thigh muscles with elastic band. Finally, both groups learned a three-minute arm and leg combined exercise program with music. Participants were asked to follow their learned management skill program and resistance program every day and check it on the card. Dynamic balance ability was measured by one-leg standing time with their eyes open, the area covering and total length of the center of gravity sway(COP) with eyes open or close by stabilometer. Knee extension strength was evaluated. Each measurement items were assessed before and after the intervention period. Student's t-test and two-way repeated measures ANOVA were used to test the effectiveness.

RESULTS: The class participation rates were 82±4% and 81±8% and home participation rates were 76±10% and 72±15% respectively. One-leg standing time with their eyes open (LLG: 14.0±3.0 to 19.9±2.2 sec., TMG: 12.4±2.5 to 15.9±2.2sec, F=5.01, P=0.038), area covering of COP with eyes open (LLG: 14.1±4.1 to 8.2±6.5 cm², TMG: 15.1±3.3 to 18.8±9.0cm², F=8.54, P=0.009), total length of COP (LLG: 143.1±33.1 to 95.6±18.9 cm., TMG: 144.9±26.4 to 135.7±37.2cm, F=3.92, P=0.046) improved significantly in LLG. TMG knee extension strength improved significantly (P=0.029).

CONCLUSIONS: Lower-leg muscle training was found more effective to improve dynamic balance ability than thigh muscle training for community-dwelling females.

2763 May 31 1:15 PM - 1:30 PM Using Gamification to Enhance Student Participation in Classroom Activity Breaks

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(No relevant relationships reported)

PURPOSE: Classroom-based interventions implemented in elementary schools have the potential to establish life-long physical activity habits in children. However, lower rates of participation have been observed among children in socioeconomically disadvantaged schools. The purpose of this study was to test the effectiveness of gamifying activity breaks (AB) to enhance student participation, enjoyment, and confidence during AB in low-income schools. **METHODS:** Nine, 3rd through 6th-grade classrooms (approximately 300 students) in one elementary-middle school in Detroit, Michigan (79% Hispanic; 80% qualified for free/reduced lunch) participated in this 20-week intervention where teachers implemented 5, 4-minute AB/day (100 minutes/week). Gamification of AB occurred during weeks 13-20 of the intervention and included the use of game design elements and classroom goals for the percentage of students engaging in moderate-to-vigorous physical activity (MVPA). Students had the opportunity to win daily, weekly, and post-intervention prizes for meeting

their classroom goal. Student AB participation was measured via direct observation. Student AB enjoyment was measured via the Physical Activity Enjoyment Scale questionnaire. Student AB confidence was measured via a single-item question from the Physical Activity Self-Efficacy Scale. **RESULTS:** Compared to the standard intervention (weeks 6-12), the gamified intervention resulted in a significant increase in student MVPA (standard: 38±2.3% vs. gamified: 60±2.1%, p=0.01) and student enjoyment (standard: 3.6±0.1 vs. gamified: 3.8±0.1, p=0.01) during an AB, with no change in student confidence (standard: 7.1±0.2 vs. gamified: 7.2±0.2, p=0.90). **CONCLUSIONS:** Gamification increased student MVPA participation by 86% and enjoyment of AB by 6%. This equated to students accumulating approximately 21 minutes of classroom activity per day, 13 of which were MVPA. These findings suggest gamification may be a key tool to increasing classroom activity and physical activity enjoyment in children attending low-income schools.

2764 May 31 1:30 PM - 1:45 PM Comparing Health Improvements Achieved Through Different Pathways Of A Community-based Motivational Interviewing Physical Activity Programme

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(No relevant relationships reported)

Benefits of regular physical activity (PA) are well documented, however physical inactivity remains a global public health challenge. The National Institute for Health and Care Excellence recommend brief advice to elicit positive PA behaviour change.

PURPOSE: Assess PA and mental wellbeing impact of signposting [SP] and Social Action [SA] group pathways of a motivational interviewing (MI) community-based PA intervention. **METHODS:** Participants (18-74 years, BMI of 28-35 kg/m²) from Essex, UK, were invited to take part in a community-based, primary care PA programme which uses MI techniques. Self-reported PA (IPAQ) and mental wellbeing (Short Warwick Edinburgh Mental Wellbeing Scale) data were collected at baseline (following an initial 30 minute MI appointment), 12 weeks, 6 months, and 12 months. Participants were assigned to receive activity SP after the initial MI appointment or attend a SA group (weekly healthy lifestyle support for 12 weeks) depending on their GP surgery. Multilevel modelling were used to derive point estimates and 95% CIs for each time point and change scores (i.e. time x - time y). **RESULTS:** 2084 participants attended a baseline appointment (61% women, mean age 61 years (SD 12), 95% White or White British, 68% disabled). Mean total PA (MET-min/week) was significantly greater at baseline for the SP group (SP: 1439, 95%CI [1323-1556]; SA: 1126, 95%CI [1045-1207]). Both pathways significantly increased the amount of total PA at 12 weeks, 6 months, and 12 months. However, there were no significant differences in the changes between pathways. No significant differences in mental wellbeing between pathways at any of the four time points. Mental wellbeing significantly increased for both pathways from baseline to 12 weeks, remaining constant at 6 months. Non-significant reduction in mental wellbeing from 6 months to 12 months for the SP pathway (-1.1, 95%CI [-2.5-0.4]), but a significant increase for the SA pathway (1.3, 95%CI [0.1-2.4]). No significant differences in the changes between pathways. **CONCLUSION:** Both pathways produced similar improvements in PA and mental wellbeing suggesting MI based PA interventions with SP or SA are both effective in improving health outcomes. However, no difference in the results indicate SP should be recommended, especially as the SA group requires more resource.

2765 May 31 1:45 PM - 2:00 PM Effects Of A Teacher-led Movement-training Program On Physical Fitness, Motor Skills, And Physical Activity In Third And Fourth Grade Students

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(No relevant relationships reported)

PURPOSE: Fundamental Integrative Training (FIT) is a circuit-style strength training approach designed to be implemented in conjunction with a physical education program. The purpose of this study was to evaluate the effects of a 12-week, FIT program on physical fitness, fundamental movement skills, physical activity, and psychosocial mediators among children in third and fourth grade classrooms.

METHODS: A total of seven classrooms in one school were randomly assigned to the intervention (INT, n=4) or control (CON, n=3) group. The INT classrooms received a 12-week, teacher-led FIT intervention. The CON group continued participation in regular physical education. At baseline, mid-point, and immediately post intervention, physical fitness (curl-up, push-up, sit & reach), motor skills (hop, jump, throw, catch), objectively measured weekly physical activity and sedentary time, and psychosocial factors (self-efficacy, enjoyment, social support) were measured for all participants.

Kruskal-Wallis rank-sum tests were used to compare pre-post changes between the INT and CON groups for all variables. **RESULTS:** Sedentary time decreased for the INT group (-19 minutes) and increased slightly for the CON group ($p=0.04$). No significant differences were observed between groups for any of the physical fitness, motor skill, or physical activity variables. **CONCLUSIONS:** The current study adds valuable insight into the efficacy of delivering a FIT intervention into an existing PE curriculum. Future studies should continue to explore the relationships between physical activity, fitness, and motor skills in children to identify causal pathways and intervene appropriately.

2766 May 31 2:00 PM - 2:15 PM

Changes On Non-exercise Physical Activity Are Related To Improvements In Mitochondrial Function Independently Of Structured Intentional Exercise

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(No relevant relationships reported)

Whether exercise interventions increase or reduce non-exercise physical activity (NEPA) is controversial. Few studies have examined this potential effect on relevant physiological outcomes, particularly in the context of randomized controlled trials. **PURPOSE:** To determine the effects of a structured exercise program on NEPA, and the independent association between NEPA and both cardiorespiratory fitness (VO_{2max}) and mitochondrial capacity within skeletal muscle. **METHODS:** Thirty-seven older (age=69±5yrs) obese ($BMI=35\pm3kg/m^2$) adults were randomized to one of the following 6-month interventions: Health education (CON: n=12), diet induced weight-loss (DIWL: n=12, or Weight-loss and exercise (WLEX: n=15). CRWL and WLEX participants had a goal of 10% weight-loss through calorie restriction. Subjects in the WLEX group completed a supervised combined aerobic and resistance exercise program. We quantified components of PA by a multisensory device. VO_{2max} was determined by cycle ergometry. Maximal oxidative phosphorylation (OXPHOS) and maximal uncoupled respiration (ETS) of permeabilized myofibers from biopsies was evaluated by high-resolution respirometry. Repeated measures analysis was performed to compare differences between the three groups pre and post intervention. Adjusted correlations to weight loss (WL) between NEPA and VO_{2max} , ETS and OXPHOS were performed. **RESULTS:** After the intervention WLEX increased significantly NEPA compared with the other groups (NEPA: WLEX= 89.6 ± 84.5 min/day; DIWL= 3.7 ± 42.4 min/day; CON= -10.5 ± 63.6 min/day; $F=8.87$ for time x group interaction, $P<0.001$). Change in NEPA was positively correlated with change in mitochondrial capacity (OXPHOS, $r=0.453$ and $r=0.468$; $P<0.05$ for both) and absolute VO_{2max} ($r=0.453$, $P<0.05$). Both DIWL and WLEX experienced a significant WL (WLEX= -10.1 ± 5.0 min/day and DIWL= -7.2 ± 5.5 min/day; $P<0.05$). **CONCLUSIONS:** In addition to the beneficial effects of structured intentional exercise on cardiorespiratory fitness and mitochondrial capacity within muscle, exercise programs in older obese adults may also increase non-exercise physical activity, which in turn appears to independently correlate with improved aerobic capacity. These results highlight the concurrent effect of exercise and NEPA to improve health outcomes.

2767 May 31 2:15 PM - 2:30 PM

Intervention Effects Of A Kindergarten-based Health-promotion Programme On Physical Activity, Bmi Percentiles And Endurance Capacity

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(No relevant relationships reported)

PURPOSE: In recent decades, the prevalence of childhood overweight has increased worldwide and became a public health concern. One reason for this is children's insufficient engagement in physical activity (PA) which may lead to deficient motor skills, which are interdependent. Therefore, early health promotion such as the kindergarten-based health promotion programme "Join the Healthy Boat" is necessary. **METHODS:** In order to evaluate the programme's effectiveness on children's BMI percentiles (BMIPCT), PA and endurance capacity, a randomised controlled trial including intervention (IG) and control group (CG) was conducted. 973 kindergarten children (3.6 ± 0.6 years; 47.1% male) in 57 kindergartens were assessed at baseline and 558 of them at follow-up. Anthropometrics and endurance capability (3-minute-run) were assessed on site. PA behaviour and socio-economic data were assessed using parental report. Linear regression models were used to determine intervention effects for all health outcomes, adjusting for baseline values, age, gender, BMIPCT and socio-economic variables. **RESULTS:** After one year, a significant positive intervention effect on children's BMIPCT was found ($p<0.04$). Further, children in the IG spent significantly more

days in sufficient PA than children in the CG (3.1 ± 2.1 days vs. 2.5 ± 1.9 days; $p<0.005$). Children in the IG also performed significantly better in the three minute endurance run than their counterparts in the CG ($305.8\pm46.2m$ vs. $286.9\pm43.2m$; $p<0.001$). **CONCLUSIONS:** This teacher-centred health promotion using a low-dose bottom-up approach with action alternatives achieved significant positive effects in the reduction of BMIPCT and significant increases in endurance capacity and daily PA. The programme is therefore ideal for integrating health promotion more intensively into the everyday life of children.

2768 May 31 2:30 PM - 2:45 PM

Comparing Physical Activity Levels across Differing Physical Education Class Modules in Middle Schools using SOFIT

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(No relevant relationships reported)

Over 1/3rd of school-age children are overweight or obese. To address this problem, school-age children are recommended to take part in 60 minutes of daily moderate-to-vigorous physical activity (MVPA), with 30 minutes of this daily MVPA being in-school. Physical education (PE) classes offer ideal opportunities for physical activity (PA) as they utilize varying modules including team sports, general fitness, and social (e.g. dance). Yet, how much overall PA and MVPA occurs over these differing PE class modules remains unclear. The System for Observing Fitness Instruction Time (SOFIT) is a simple observational tool that PE instructors can use to calculate PA.

PURPOSE: To observe student PA levels across multiple PE modules using SOFIT.

METHODS: A modified SOFIT was used to assess PA over 15, 90-minute PE classes ($N=124$) across 3 modules: team sports (8 sessions), general fitness (3 sessions), and dance (4 sessions) in a single middle school. PA was coded from 1-5 corresponding to lying down, sitting, standing, walking, and vigorous, respectively. The same observer recorded PA in the last minute of a 5-minute interval based on activity in the prior 4 minutes. Separate 1-way ANOVA examined differences in MVPA (i.e. scores 4) and overall PA across modules with Tukey-Kramer post hoc analyses as appropriate.

RESULTS: Overall PA differed significantly across modules ($p=.02$), with team sports producing higher PA ($3.80\pm.36$) than dance ($3.19\pm.39$; $p=.04$). MVPA was similar across all modules (team sports: $4.29\pm.43$, general fitness: $4.06\pm.28$, dance: $3.70\pm.41$; $F_{2,12}=2.83$; $p=.09$).

CONCLUSION: Although team sports produced greater overall PA, all modules (team sports, fitness, and dance) produced similar MVPA. As MVPA is suggested to be the preferred component of overall PA for improving overall health, all these modules are viable options for producing MVPA during PE classes in this population. To improve adherence to these different activities, future researchers should compare enjoyment levels for students across these activities. Overall, as PE classes are the greatest contribution to in-school PA for students, PE instructors and school health administrators can use our findings to choose appropriate modules to teach children PE and, concurrently, positively address the childhood obesity epidemic.

2769 May 31 2:45 PM - 3:00 PM

Cardiovascular, Metabolic, And Perceived Effort In A Simulated Commute On A Regular And Electric Bicycle

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(No relevant relationships reported)

Use of electric bicycles (e-bikes) with battery powered assist when pedaling, may incentivize active transport for people who may not be fit enough to ride several miles to school, work, or for leisure. E-bikes may enhance one's daily physical activity levels, possibly create a cardiovascular and metabolic health benefit and be an environmentally friendly transportation option. **PURPOSE:** To compare metabolic, cardiovascular, and ratings of perceived effort (RPE) when riding an e-bike for 3 miles at two different assist levels (boosts that vary in intensity), in comparison with a regular bicycle. **METHODS:** Male ($n=16$) and female ($n=14$) subjects, aged 19-61 yr, completed a YMCA submaximal test and three outdoor 3-mile bike rides, simulating a typical commute, at their own pace on a standard bicycle and on an e-bike at both E-2 assist, and E-3 assist levels. Participants wore a heart rate (HR) monitor and COSMED that recorded HR and oxygen consumption (VO_2). RPE on a 6-20 Borg scale was reported at the end of each 3-mile ride. A linear mixed effects model estimated the differences within subjects and between bicycle types on variables of interest at the 95% confidence level. **RESULTS:** In every model, for every variable, a significant difference ($p<0.05$) existed between riding a regular bicycle compared with an e-bike at both assist levels: HR (Reg=133 vs E-2=124 and E-3=114 beats•min⁻¹), % of VO_2

max (Reg=56 vs E-2=48 and E-3=40%, RPE (Reg=12.3 vs E-2=9.8 and E-3=8.4, respiratory quotient (Reg=.89 vs E-2=.85 and E-3=.85), METS (Reg=6.7 vs E-2=5.8 and E-3=4.8), caloric expenditure (Reg=519 vs E-2=436 and E-3=359 kcal•hr⁻¹), time (Reg=13.7 vs E-2=11.8 and E-3=10.3 min) and VO₂ (Reg=23.6 vs E-2=20.3 and E-3=16.8 ml•kg⁻¹•min⁻¹). **CONCLUSIONS:** Compared with regular bicycles, riding e-bikes at assist levels 2 and 3 resulted in 2.5 - 3.9 min faster 3-mile times and lower perceived efforts from somewhat hard for regular bicycle to very light for either e-bike assist levels. Speed and lower RPE may incentivize people to ride e-bikes which may contribute to environmentally friendly active transport. Compared with regular bicycling, 10-20% lower metabolic and cardiovascular responses associated with e-bikes, if performed regularly, may still benefit fitness and health.

F-13 Free Communication/Slide - Foot and Ankle

Friday, May 31, 2019, 1:00 PM - 3:00 PM
Room: CC-202C

2770 **Chair:** Robert Gregory. *Southern Connecticut State University, New Haven, CT.*

(No relevant relationships reported)

2771 May 31 1:00 PM - 1:15 PM **Differences In Foot Kinematics Between Forefoot Strikers In Minimalist And Conventional Running Shoes**

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(No relevant relationships reported)

Forefoot strike (FFS) runners in conventional shoes exhibit higher posterior and medial ground reaction force loadrates than FFS runners in minimalist shoes. This results in higher resultant loadrates when forefoot striking in conventional shoes. The elevated cushioned heel and lateral outsole flare of a conventional shoe may predispose the foot to greater plantarflexion (PF) and inversion (INV) at footstrike. This position may result in the increase in posterior and medial loading. **PURPOSE:** To determine the foot kinematic differences in the sagittal and frontal planes of FFS runners who are habituated to either conventional shoes (FFS-C) or minimalist shoes (FFS-M). **METHODS:** This is an ongoing study of which 9 FFS-M and 15 FFS-C have been recruited to date. Kinematic and kinetic data were collected as runners traversed a 30-m runway at 3.31 (±5%) m/s, while wearing their habitual type of shoe. Foot and ankle kinematics at footstrike as well as ground reaction force loadrates were compared between groups, using Mann-Whitney U tests. Pearson correlations between kinematics and instantaneous load rates (ILR) in posterior and medial directions were calculated. **RESULTS:** FFS-C exhibited more plantarflexion at footstrike in the foot and ankle compared to FFS-M (Table 1). There were moderate correlations between the posterior ILR and the amount plantarflexion at footstrike in the foot and ankle ($r=-0.511$, $p=0.011$ and $r=-0.582$, $p=0.003$ respectively), where more PF resulted in a higher posterior ILR. There were no differences between FFS-C and FFS-M in the frontal plane at footstrike. Additionally, inversion at footstrike was not correlated with medial ILR ($r=0.220$, $p=0.301$). **CONCLUSION:** Based upon these preliminary results, running with a FFS pattern in conventional shoes promotes greater PF at footstrike, which is associated with greater posterior load rates. While greater INV at footstrike was not noted, medial load rates were greater.

	FFS-M (n=9)	FFS-C (n=15)	p value
Foot PF at initial contact (°)	-3.41 (2.4)	-8.94 (3.4)	<0.001
Ankle PF at initial contact (°)	-6.05 (4.1)	-15.3 (5.5)	<0.001
Peak ankle DF velocity (°/s)	444 (90.0)	579 (87.1)	0.004
Foot INV at initial contact (°)	16.7 (4.6)	16.0 (5.7)	0.861
Ankle INV at initial contact (°)	12.5 (4.5)	12.9 (5.5)	0.976
Peak ankle EV velocity (°/s)	-333 (86.7)	-465 (124.0)	0.012
Peak posterior load rate (BW/s)	15.5 (5.7)	26.5 (10.8)	0.022
Peak medial load rate (BW/s)	7.12 (2.5)	9.51 (2.7)	0.055
Peak resultant load rate (BW/s)	55.7 (12.0)	66.4 (17.8)	0.114

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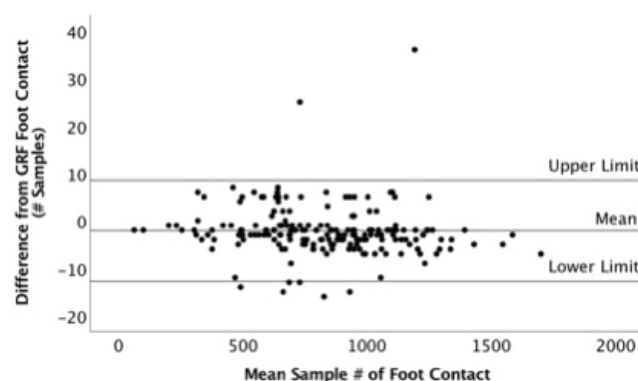
Foot Contact Identification Using A Tibial Mounted Accelerometer During Running

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(No relevant relationships reported)

It is often necessary to identify foot contact when analyzing running biomechanics data, but most techniques are restricted to use in the laboratory. The accurate identification of foot contact from a single triaxial accelerometer mounted on the tibia may be useful for in-field measurements of gait. **PURPOSE:** To determine criterion-related validity of a new technique for determining foot contact from the resultant acceleration of the distal tibia compared to foot contact determined from vertical ground reaction force. **METHODS:** As part of a larger study, 19 runners (10 female, 9 male; 31 ± 6 years; 1.70 ± 0.08 m; 68.6 ± 11.6 kg) participated. Synchronous tibial acceleration and ground reaction force data were recorded at 1000 Hz using a triaxial accelerometer mounted to the skin over the distal antero-medial tibia and a force plate embedded in the floor. Participants completed 10 running trials at 3.0 m/s. Resultant acceleration was calculated and foot contact was determined using a custom algorithm that identified a minimum prior to peak resultant acceleration. Foot contact was also determined as the time at which vertical ground reaction force exceeded a threshold of 20 N. 95% limits of agreement between the two methods were calculated. **RESULTS:** On average the resultant acceleration identified foot contact 2.1 ± 5.4 ms earlier than ground reaction force. The 95% limits of agreement were -8.5 to 12.8 ms. With this approach 95% of foot contacts identified from resultant acceleration were within 10 ms of foot contact identified from ground reaction force. **CONCLUSION:** Identifying foot strike from resultant tibial acceleration measured using a single triaxial accelerometer is a valid technique for foot contact identification in the field. Study funded by College of Nursing and Health Professions Research Award



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Impact Of Reduced Plantar Sensation On Balance Control

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(No relevant relationships reported)

PURPOSE: Balance control has often been used to examine neural function. Given the robustness of balance control, perturbation is often needed to allow for more sensitive measurement. Our previous work has shown that balance is perturbed when a participant is placed in a moving virtual reality environment (VR). This situation creates a sensory mismatch between plantar sensation and visual feedback. The purpose of this study was to examine balance control when plantar sensation was reduced by cooling the plantar sole. We hypothesized that reducing plantar sensation would increase sway displacement, velocity and approximate entropy in a moving VR. **METHODS:** Six healthy young adults completed baseline balance tests: quiet standing (QS) and challenged by an anterior-posterior sinusoidal movement of a 360° projected picture of the lab within the VR headset. After the baseline balance test, participants placed the bottom of their feet in an ice bath until the plantar sole reached a temperature of 10-15°C. Reduced plantar sensation (RPS) was confirmed using a monofilament test. Balance tests were then repeated with participants standing on a cold steel plate with a temperature below 15°C to ensure consistent temperature of the plantar sole. Statistical analysis was performed on anterior-posterior center of pressure displacement, velocity and approximate entropy to determine differences between baseline and RPS balance tests within each balance condition ($\alpha=0.05$). **RESULTS:** Displacement increased when plantar sensation was reduced during the VR condition ($p = 0.04$, Baseline = 1.8 ± 0.8 cm, RPS = 2.4 ± 0.9 cm). There were similar trends that velocity ($p = 0.08$, Baseline = 5.1 ± 2.0 cm/s, RPS = 6.5 ± 2.6 cm/s) and approximate entropy ($p = 0.1$, Baseline = 0.13 ± 0.06 , RPS = 0.10 ± 0.03) were greater when plantar sensation was reduced during the VR condition. There was no difference between reduced plantar sensation and baseline balance during QS. **CONCLUSIONS:** Reducing plantar sensation elicited increased sway with a more consistent pattern (increased approximate entropy) when balance was perturbed by a moving visual environment, suggesting that participants had reduced balance control capabilities due to the sensory mismatch. Funding provided by the Office of Naval Research (N00014-17-1-272).

2774 May 31 1:45 PM - 2:00 PM

The Effects of Ankle Taping on Double Leg Balance after Plyometric Exercises

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(No relevant relationships reported)

Ankle taping (AT) is a common preventative method to decrease the likelihood of ankle ligament injuries. Many athletic trainers use AT for athletes involved in high volume jumping sports to increase ankle stability. Ankle proprioception and postural control can be altered due to the restriction caused by AT and therefore, athletes need to be aware of the potential changes. **PURPOSE:** To compare AT center of pressure displacement (COPDsp) vs no ankle taping (NT) COPDsp, in the X- and Y- direction, before and after a fatiguing plyometric protocol. **METHODS:** Descriptive data (Ht. = 178.67 ± 8.88 , Wt. = 79.69 ± 9.55 , BF% = 12.20 ± 4.38 , age = 22.81 ± 2.56) was measured for 16 averagely fit college-age males. AT and NT sessions were prescribed in a counterbalanced order. Both sessions were separated by no less than 72 hours and no more than 96 hours of recovery. Each subject completed the same plyometric protocol and balance testing on a force plate pre- and post- fatigue with eyes closed (EC) and open (EO) trials. Significant differences for COPDsp between pre- and post- fatigue and both taping sessions were measured using a 2x2x2 repeated-measures ANOVA. Statistical significance was set at $p \leq 0.05$ for all analyses. **RESULTS:** The interaction between AT PRE EC (.137 cm) and AT POST EC (.166 cm) trials in the X direction were significant, $p = .041$. Significant differences also occurred between AT PRE EO (.133 cm) and AT POST EO (.175 cm) trials in the X direction, $p = .039$. No significant differences occurred in the Y direction for AT PRE-POST EC trials ($p = .507$) or AT PRE-POST EO trials ($p = .196$). No significant differences occurred in all NT PRE-POST EC and EO trials, $p > .05$. **CONCLUSIONS:** The current results suggest AT caused an increase in the COPDsp X direction, while there was no difference in the Y direction. Future studies may seek to evaluate collegiate athletes with experience wearing AT and the resulting effects during a dynamic balance test.

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Effects of Shock Pad and Synthetic Turf on Ankle Biomechanics in a 90° Cutting Movement

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(No relevant relationships reported)

Shock pad (PAD) is a popular choice underlayment installed under a synthetic turf (TURF) field. The effects of PAD on impact attenuation and injury risks of human movements are still relatively unknown.

PURPOSE: To examine impact attenuation related ankle biomechanical characteristics of a 90° cutting movement on synthetic turf with shock pad compared to synthetic turf only.

METHODS: Twelve recreational football and soccer players performed five successful trials of 90° cutting movement in each of two approaching speed conditions: 3.0 ± 0.3 (SLOW) and 4.0 ± 0.4 (FAST) m/s on each of TURF and PAD surface conditions. Three-dimensional kinematic and ground reaction force (GRF) data were collected simultaneously. A 2" monofilament synthetic turf with 1/2" stitch gauge was used in TURF and PAD conditions. A foam-based shock pad was used in PAD condition.

RESULTS: No significant surface main effect or surface by speed interactions were found for any ankle kinematic and kinetic variables and peak GRFs ($p > 0.05$). Increased peak ankle eversion moment (0.65 vs. 0.84 Nm/kg, $p < 0.001$) and inversion loading range of motion (ROM, 13.7 vs. 18.6 deg, $p = 0.001$) were seen in FAST compared to SLOW. Increases for peak ankle sagittal-plane concentric pushoff power, and frontal-plane eccentric and concentric power were also observed in FAST compared to SLOW. Peak vertical (2.04 vs. 2.31 BW, $p = 0.023$) and medial loading (0.79 vs. 1.11 BW, $p = 0.002$) GRFs were higher in FAST than SLOW. Additionally, peak pushoff medial GRFs were increased from SLOW to FAST (0.91 vs. 1.20 BW, $p = 0.025$), but pushoff vertical GRFs were decreased slightly (2.24 vs. 2.11 BW, $p = 0.011$).

CONCLUSIONS: The lack of significant differences between TURF and PAD and their interactions for examined ankle and GRF variables suggest that adding a form-based shock pad does not impede cutting performance. These results also seem to indicate there is a neuromuscular accommodation in cutting mechanics on PAD surface, which cannot be reflected loading variables using inverse dynamics. As cutting speed increased, greater increases in medial peak GRFs, and frontal-plane peak ankle moment and ROM were observed compared to those in sagittal-plane, suggesting increased mediolateral loading to ankle complex in fast cut movement. Supported in part by Brock International.

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Gluteus Medius Activation During Gait Is Altered With Chronic Ankle Instability: An Ultrasound Imaging Study

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(No relevant relationships reported)

Altered gait mechanics are frequently reported in individuals with chronic ankle instability (CAI), and increasing information suggests proximal muscle adaptations occur in this population. Ultrasound imaging (USI) offers a visual means to evaluate muscle activation during movement, and overcomes limitations of electromyography to detect hip muscle activity.

PURPOSE: To identify gluteus maximus (GMAX) and medius (GMED) muscle activation using USI throughout walking gait in individuals with and without CAI.

METHODS: A descriptive laboratory study was conducted to evaluate gluteal muscle activation throughout walking on 40 total participants during a single session. Twenty young adults with CAI (21.6 ± 2.4 years, 10 males) and 20 healthy participants (21.2 ± 2.8 years, 10 males) walked on a treadmill at 1.35 m/s while researchers obtained 10-second clips of bilateral USI of the GMAX and GMED. USI clips were reduced to 55 frames consisting of 11-points over five full gait cycles. Muscle thickness values during walking were normalized to quiet bipedal standing USI images to obtain functional activation ratios (FARs). FARs with 90% confidence intervals (CI) were plotted at 10% interludes from 0-100% of the gait cycle to compare groups and limbs. Group mean differences and Cohen's d effect sizes were used to assess the extent of differences.

RESULTS: The CAI group had decreased GMED activation bilaterally from 0-40% of walking gait compared to healthy counterparts with large effect sizes ($d: 0.62-0.95$). CAI group FARs were below quiet stance levels (FARs < 1.0) throughout the entire gait cycle. There were no differences noted between groups or limbs for GMAX measures.

CONCLUSIONS: Proximal stabilizing musculature was altered bilaterally in CAI individuals compared to healthy counterparts, which may contribute to movement

dysfunction through centrally mediated adaptations. Previous studies using electromyography have not detected gluteal muscle alterations in CAI groups during stance phases of gait, however these findings suggest USI was able to detect proximal alterations during walking in this population.

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The Effect Of Persistent Pain Following Ankle Sprain On Lower Extremity Kinematics During Walking

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(No relevant relationships reported)

Persistent pain is the most common complaint reported by those with chronic symptoms following ankle sprain with its prevalence peaking in middle-aged adults. Despite the high prevalence rate and associated adverse effects on mobility, quality of life, and physical activity, the influence of persistent ankle pain on lower extremity function during gait in middle-aged adults has not been examined. **PURPOSE:** To identify the modifiable lower extremity kinematic dysfunction during walking gait associated with persistent ankle pain in middle-aged adults. **METHODS:** Ten individuals with persistent ankle pain (9F, 1M; 55.4 ± 6.52 years; 166.80 ± 6.73 cm; 78.24 ± 25.05 kg) and nine matched uninjured controls (8F, 1M; 53.0 ± 5.79 years; 168.2 ± 6.06 cm; 75.81 ± 24.46 kg) volunteered for the study. Three-dimensional lower extremity kinematics and kinetics were collected during five barefoot walking trials at a self-selected speed. Lower extremity sagittal and frontal joint positions were used to calculate joint ROM and maximum joint position during 1st double-limb support, single-limb support, and 2nd double-limb support. Position at initial contact in the sagittal and frontal plane was also calculated. MANOVA tests assessed group differences with an alpha level of $p < 0.05$. Significant tests were followed by independent t-tests with Bonferroni corrections. **RESULTS:** Rearfoot ankle inversion is significantly increased in those with persistent ankle pain compared to controls during overground walking ($p < 0.05$). Persistent ankle pain subjects were in an inverted position at initial contact ($2.91 \pm 4.32^\circ$), while controls were in an everted position at initial contact ($-3.75 \pm 3.25^\circ$). No other group differences were noted. **CONCLUSIONS:** Persistent ankle pain subjects demonstrate significant increases in rearfoot inversion at initial contact compared to controls. This altered movement pattern may result in further stress of the ankle joint structures, which may contribute to their persistent ankle pain. Additional research with a larger sample size and greater male representation is needed to further explore the effects of ankle pain on gait. This project was supported by the College of Health Sciences Student Research Grant Award at University of Wisconsin-Milwaukee.

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Subjects with Chronic Ankle Instability Exhibit Less Loading Absorption After Drop Jump and Drop Landing

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(No relevant relationships reported)

Chronic Ankle Instability (CAI) is a condition characterized by neuromuscular, range of motion, and postural control deficits that predispose subjects to reinjure. Different kinematic landing strategies have been identified in people with CAI when compared to healthy controls. Whether these adaptations result in similar loading patterns than those without CAI, has not been documented. This knowledge would be of much use for programming physical rehabilitation protocols to prevent the progression of CAI. **PURPOSE:** To compare ground reaction force (GRF) parameters between subjects with and without CAI, after a drop jump (DJ) and a drop landing (DL). **METHODS:** After informed consent was obtained, 19 young participants (height 164.8 ± 7.4 cm; body mass 68.1 ± 12.0 Kg) were assessed, classified in a group of subjects with CAI (CAI, $n = 14$) and a control group (CON, $n = 5$), according to the recommendations of the International Ankle Consortium. Groups were similar in height, body mass and gender distribution. Each participant performed 5 DJ and 5 DL from a platform of 40 cm height, landing on a force plate recording GRF at a frequency of 100 Hz. The order of all 10 jumps for each subject was determined by an online random generator. The signal corresponding to the vertical GRF was low pass filtered (4th order Butterworth, 20 Hz), normalized to body weight, and then processed to calculate the maximal GRF (F_{Max}) and the loading rate (LR) from the time of initial contact to when F_{Max} was achieved. Comparisons among groups were performed using unpaired t test with normal distributed data; otherwise Mann-Whitney test was used. A p value < 0.05 was considered as significant.

RESULTS: F_{Max} was larger for CAI after DJ (CAI: 3.35 ± 0.57 N* N^{-1} v/s CON: 3.03 ± 0.29 N* N^{-1} ; $p < 0.01$), but was not different from CON after DL (CAI: $3.50 \pm$

0.59 N* N^{-1} v/s CON: 3.39 ± 0.39 N* N^{-1} ; $p = 0.57$). LR was larger for CAI after both DJ (CAI: 35.74 ± 13.26 N* N^{-1} * s^{-1} v/s CON: 24.54 ± 10.01 N* N^{-1} * s^{-1} ; $p < 0.01$) and DL (CAI: 41.33 ± 10.43 N* N^{-1} * s^{-1} v/s CON: 35.03 ± 5.94 N* N^{-1} * s^{-1} ; $p < 0.01$)

CONCLUSION: According to our preliminary results, subjects with CAI exhibit less GRF absorption after dropping from a medium altitude, which might contribute as a risk factor for ankle reinjury. Patients with CAI might benefit from including loading absorption strategies in their rehabilitation protocols.

F-14 Rapid Fire Platform - Mental Health & Athletic Performance

Friday, May 31, 2019, 1:00 PM - 2:20 PM

Room: CC-Hall WA2

2779 Chair: Aaron J. Stegner. Univ. of Wisconsin, Madison, WI.

(No relevant relationships reported)

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Changing the Tide: Psychological Outcomes Among Active Duty Service Members Following a Surf Therapy Program

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(No relevant relationships reported)

Surf programs for individuals with psychological conditions exist; however, data evaluating such programs are limited. **PURPOSE:** This study examined psychological outcomes among active duty service members participating in a surf therapy program at Naval Medical Center San Diego. **METHODS:** Seventy-four active duty service members completed self-report questionnaires before and after the 6-week program and before and after each surf therapy session. **RESULTS:** Multilevel modeling results demonstrated that total scores for symptoms of depression ($\beta = -2.31$, $p < .01$), anxiety ($\beta = -3.55$, $p < .001$), posttraumatic stress disorder (probable PTSD subgroup only; $\beta = -14.55$, $p < .001$), and negative affect ($\beta = -6.40$, $p < .001$) significantly decreased from pre- to post-program, while positive affect significantly increased ($\beta = 9.46$, $p < .001$). Within each session, depression/anxiety symptoms significantly lessened ($\beta = -3.35$, $p < .001$) and positive affect significantly improved ($\beta = 8.97$, $p < .001$). Within-session changes did not differ across sessions ($p > .05$). Results for subgroups with probable PTSD or major depressive disorder were comparable to those of the full sample. **CONCLUSION:** Immediate benefits of surf therapy included significantly reduced depression/anxiety and increased positive affect. As a complementary intervention, surf therapy may improve depression, anxiety, and PTSD symptoms, with potentially unique benefits on affect.

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Resilience and Mental Health Screening in Collegiate Athletes

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(No relevant relationships reported)

Screening for mental health disorders common in collegiate athletes can be challenging due to time constraints and concerns about the willingness of athletes to report given the need for multiple screening tools to cover the broad spectrum and concerning stigma surrounding mental health. **PURPOSE:** This study evaluates the Brief Resilience Scale (BRS) as a tool to identify mental health conditions in collegiate athletes. The BRS is a 6-question screening tool assessing one's ability to recover from stress.

METHODS: Collegiate athletes were anonymously surveyed completing BRS and mental health screening tools including the Patient Health Questionnaire-2 (PHQ-2) for depression, Generalized Anxiety Disorder Assessment (GAD-7), Adult ADHD Self-Report Scale (ASRS), SCOFF eating disorders questionnaire and Pittsburgh Sleep Quality Index (PSQI). Correlations between BRS and the screening tools were determined using Pearson's correlation. Mean BRS scores among athletes screening positive or negative with the screening tools were compared by t-test.

RESULTS: 468 athletes (67.1% male, 34.6% division I, 37.4% division II, 39.3% division III) participated in the survey with 392 (84%) completing all 6 screening tools. Significant differences in the mean BRS were seen among athletes screening negative vs. positive on 4/5 mental health screening instruments (PHQ-2: 3.08 ± 0.70 v

3.56 ± 0.65, $p=0.01$; GAD-7: 3.20 ± 0.57 v 3.57 ± 0.66, $p=0.0002$; ASRS: 3.05 ± 0.54 v 3.56 ± 0.66, $p=0.00004$; PSQI: 3.27 ± 0.63 v 3.81 ± 0.60, $p=5.2 \times 10^{-16}$). A significant difference was not seen with the SCOFF tool (3.30 ± 0.63 v 3.55 ± 0.66, $p=0.06$). Significant correlations were seen between BRS and all 5 screening instruments (GAD-7 $r=-.303$, $p=1.02 \times 10^{-9}$; PHQ-2 $r=-.221$, $p=1 \times 10^{-4}$; ASRS $r=-.244$, $p=1 \times 10^{-6}$; SCOFF $r=-.157$, $p=0.002$; PSQI $r=-.400$, $p=1 \times 10^{-15}$). Overall, the BRS had a sensitivity of 26% and specificity of 98% for individuals that screened positive on at least 1 screening instrument.

CONCLUSIONS: Resilience (BRS) shows significant correlation with mental health screening instruments in athletes. As a short survey that avoids the stigma of many mental health questions, BRS may provide an efficient and effective alternative screening instrument to identify those athletes most at risk and in need of further specific screening.

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Examination of Anger Prevalence In Ncaa Division I Student-athletes

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(No relevant relationships reported)

Anger may have an impact on performance. Once anger is triggered, it may not allow an athlete to move beyond whatever prompted the anger and in turn may decrease their concentration and focus on continued performance. Research is limited in the collegiate athletic population. **Purpose:** To examine the prevalence of anger in collegiate NCAA Division I athletes; and to investigate differences between sex, academic status (i.e., freshman, senior) and sport type (e.g., football, soccer, cheerleading). **Methods:** As part of a larger study, collegiate athletes (N=616, age: 19.5±1.3 years; males: n=234, height: 183.5±14.3 cm, weight: 91.2±19.5 kg; females: n=382, height: 168.6±7.4 cm, weight: 63.4±9.8 kg) were recruited over a 3-year period from a NCAA Division I institution. Demographic information (e.g., age, self-reported height and weight, sex, academic status, sport type) and the Anger Index Self-Test were collected via SurveyMonkey. **Results:** Chi-squared analysis revealed a significant difference between the anger index and sex [$\chi^2(2, N=613) = 20.3, P \leq 0.01$]. Overall 37.7% (N=232/616) reported high risk for anger with males 47.9% (n=112/234) and females 31.4% (n=120/382). Chi-squared analysis revealed a significant difference between the anger index and sport type [$\chi^2(42, N=616) = 61.3, P \leq 0.03$], with the highest percentages reporting high risk for anger within football 55.2% (n= 64/116) and baseball 50% (n= 19/38). Overall, 54.7% (N=337/616) revealed moderate risk for anger and sport type. No significant differences were found for anger risk and academic status [$\chi^2(10, N=616) = 5.220, P > 0.88$]. **Conclusions:** Male collegiate athletes demonstrated a higher risk for anger than female collegiate athletes; however, most athletes displayed moderate risk for anger across different sports. Anger across academic status was not significant, therefore, this may imply anger management and/or coping skills were not learned or taught throughout college. Further examination is necessary to investigate the prevalence of risky behaviors in combination with anger among this population. Considering the high prevalence of anger among collegiate athletes; institutions should work to establish a screening for all student-athletes and direct those at risk to a qualified mental health professional for intervention.

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Examination of Mental Health Risks and Injury Prevalence in NCAA Division I Collegiate Athletes

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(No relevant relationships reported)

Research in mental health for student-athletes is a growing topic among healthcare professionals. Studies examining pre-existing mental illness risk (e.g., depression (DEP), anxiety, attention deficit hyperactivity disorder (ADHD)) and injuries are limited. **Purpose:** To examine the effects of psychoaffective (PA) disorders (DEP, anxiety) and neurodevelopmental (ND) disorder (ADHD) risks and injury status (yes/no), injury type (acute/chronic), and multiple injury status (yes/no) in NCAA Division I student-athletes. **Methods:** A retrospective analysis of student-athlete medical records from 2013-2014 (n=218) and 2015-2016 (n=174) academic years was used from a NCAA Division I institution. Mental health screening medical records from pre-participation exams (e.g., Center for Epidemiologic Studies Depression Scale, State-Trait Anxiety Inventory, Behavioral and Emotional Screening System) identified mental health risks. Athena electronic medical records identified injury data. Descriptive statistics and chi-square analysis were used to identify the distribution of "at risk" and injury status, multiple injuries and injury type. **Results:** Student-athletes (34.7%) were at risk for at least 1 neuropsychiatric disorder (PA disorders: 17.6%, n=69; ND disorders: 8.9%, n=35; comorbid disorders: 7.9%, n=31). Student-athletes (34.4%) reported at least 1 injury throughout the respective academic year. Of those at risk for PA disorders (46.4%), ND disorders (25.7%) and comorbid disorders (29%)

also reported sustaining an injury. Those at risk for PA disorders (14.5%) and ND disorders (8.6%) had a higher prevalence of sustaining multiple injuries than those not at risk (7.8%). Acute injuries were sustained more commonly across all groups regardless of mental health status. PA risk group sustained 29.0% (n=20) acute and 17.4% (n=12) chronic injuries, the ND group sustained 14.3% (n=5) acute and 11.4% (n=4) chronic injuries, and the comorbid group sustained 19.4% (n=6) acute and 9.7% (n=3) chronic injuries. **Conclusions:** Neuropsychiatric disorder risks may affect injuries in NCAA Division I student-athletes, especially those with a PA disorder risk. Student-athletes at risk for neuropsychiatric disorders during preseason should be referred to a mental health professional for further evaluation.

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Examination of Eating Disorder Risk among Recreational Athletes

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(No relevant relationships reported)

With fitness becoming a new trend (e.g., Pure Barre, Zumba, CrossFit, Mudrun, marathons, etc.) the general adult recreational athlete may be engaging in the same physical demands and mental stressors associated with organized sport. In turn, this may predispose the recreational athlete to being at risk for disordered eating (DE)/ eating disorders (ED).

Purpose: To examine the prevalence of Eating Disorder (ED) risk across gender in male and female recreational athletes.

Methods: Data from a larger cross sectional study was used. A convenience sample of male and female recreational athletes (n=58; age: 26.4±6.1 years; males: n=34; height: 179.1±6.2 cm; weight: 78.3±10.4 kg; females: n=24, height: 164.9±6.6 cm, weight: 65.4±9.0 kg) from the southeastern region of the United States participated in the study. Participants completed a basic demographic survey, the Eating Disorder Inventory-3 (EDI-3), and the EDI-3 Symptoms Checklist (SC). Basic descriptive statistics were used for demographic information. Cross-tabulations were used to examine the proportion of participants classified as "at risk for EDI-3 and EDI-3 SC" across gender.

Results: Significant differences were found between ED risk and gender [$\chi^2(3, N=58) = 11.8, P=0.008$]: within gender groups for EDI-3 (males: 17.6%, n=6; females: 4.2%, n=1), EDI-3 SC (males: 17.6%, n=6; females: 45.8%, n=11), and both EDI-3 and EDI-3 SC (males: 26.5%, n=9; females: 41.7%, n=10). Overall, significant differences were found between pathogenic behaviors and gender for dieting (males: 20.7%, n=12; females: 29.3%, n=17, $P=0.008$) and purging (males: 0.0%, n=0; females: 5.2%, n=3, $P=0.034$). No significant differences were found for exercise 50-100% of the time to lose weight (males: 3.4%, n=2; females: 5.2%, n=3); binge eating (males: 15.5%, n=9; females: 15.5%, n=9), laxatives (males: 3.4%, n=2; females: 0.0%, n=0), diet pill use (males: 5.2%, n=3; females: 8.6%, n=5), and use of diuretics (males: 1.7%, n=1; females: 1.7%, n=1).

Conclusion: ED risk was prevalent for both male and female recreational athletes; however females displayed an overall higher risk for EDs and pathogenic behaviors such as dieting and purging. In this new and growing population education, prevention, and clinical interventions from qualified healthcare professionals should be accessible.

2785 May 31 1:50 PM - 2:00 PM

Sport Differences In Resiliency Development Of Men's NCAA Football And Basketball Athletes

Justin R. Geijer, Connie A. Mettelle. *Winona State University, Winona, MN.*

(No relevant relationships reported)

The National Collegiate Athletic Association (NCAA) has recently identified mental health as a primary health concern for student-athletes. Each sport contains its own unique stressors, which may require sport-specific stress reduction and resiliency-building techniques.

PURPOSE: The purpose of this investigation was to identify the differences in stress impacts and resiliency in men's NCAA football and basketball athletes.

METHODS: Thirteen NCAA Division II men's basketball athletes 32 NCAA Division II men's football athletes were surveyed before and after the 2016-2017 competition season. The survey contained 35 questions, which were selected from the College Student Health Survey (Boynnton Health, University of Minnesota, Minneapolis, MN). The survey addressed aspects of physical health, drug and alcohol use, screen time, relationships, sleep, stress management, and resiliency. Post-season surveys were analyzed to determine differences between sports in stress management and resiliency. Independent t-tests were used to determine differences between survey question responses. Alpha levels were set at 0.05.

RESULTS: Football athletes reported significantly better ability to respond to adversity ($p < 0.001$), and withstand difficult situations ($p < 0.001$). No significant difference existed between the sports in regards to the number of days their physical health ($p = 0.58$) or mental health ($p = 0.95$) was negatively impacted in the past 30 days. **CONCLUSIONS:** While no significant differences existed in the number of days in which mental or physical health was negatively impacted, significant differences were found in the football and basketball athletes' perceived abilities to respond to stressful situations. Future research should investigate the development and efficacy of sport-specific resiliency-building techniques.

2786 May 31 2:00 PM - 2:10 PM

A Comparison Of Depression, Anxiety, And Stress Levels Of Basketball Athletes In Different Collegiate Divisions

Jessica E. Jochum, Lauren Blyly, Kendall Beckstein, Mallory Meyers. *University of Indianapolis, Indianapolis, IN.* (Sponsor: Amy Jo Sutterluety, FACSM)
Email: jochumj@uindy.edu
(No relevant relationships reported)

Participating in sports helps to promote a healthy lifestyle. However, as competition level increases so do physical, emotional, and mental demands placed on the athletes. These increased demands could also increase susceptibility to depression, anxiety, and stress. **PURPOSE:** To investigate differences in self-reported in-season levels of stress, anxiety and depression in collegiate men's and women's basketball players from collegiate levels of NCAA Division I, II, III and the NAIA. **METHODS:** 102 collegiate basketball players completed the Depression Anxiety and Stress Scale 42 (DASS-42) and demographic information questionnaire including variables measuring hours of sleep, credit hours enrolled and history of injury. The DASS-42 is a self-reported questionnaire that uses three scales to measure an individual's emotional state of depression, anxiety, and stress; each scale has fourteen items. Of the 102 athletes, 26 were from a NCAA Division I, 31 from Division II, 23 from Division III, and 22 from the NAIA, ($n_{male} = 54$ (52.9%), $n_{female} = 48$ (47.1%)). An alpha level of $p \leq .05$ was set for statistical significance. The Kruskal-Wallis test was used to compare by division level and the Mann-Whitney U test was used to compare gender and credit hours. The Pearson chi-square test was used to compare gender and hours of sleep. **RESULTS:** There was not a statistically significant difference in stress, anxiety and depression scores by division levels (DI, DII, DIII and NAIA), $p = .965$, $p = .383$, $p = .729$, respectively. However, differences were found between males and females, with females reporting higher levels of stress compared to males (median score 4.0 and 13.0, respectively; $p < .001$), anxiety (median score 3.0 and 6.0, respectively; $p < .001$) and depression (2.0 and 5.0, respectively; $p = .003$). A comparison of hours of sleep by gender revealed males were likely to get more sleep, however the difference was not statistically significant ($p = .182$). Similarly there was also not a statistically significant difference between males and females for the number of credit hours currently taken ($p = .221$), but females were more likely to take more credit hours. **CONCLUSION:** Comparison revealed no statistical difference between collegiate settings. However, female athletes are at greater risk of depression, anxiety, and stress than males.

2787 May 31 2:10 PM - 2:20 PM

Screening Athletes For Disordered Eating: Are We Asking The Right Questions?

Franklin Sease, FACSM, Vicki Nelson. *Greenville Health System, Greenville, SC.*
(No relevant relationships reported)

PURPOSE: Little data is available to evaluate the performance of preparticipation screening questions in practice. The performance of consensus PPE questions was examined in comparison to the validated 5-question SCOFF screening tool to detect eating disorders. **METHODS:** 230 collegiate athletes (194 male) completed an anonymous survey including 3 consensus PPE questions regarding eating habits (prior history of eating disorder, adherence to a special diet, and current attempts to gain or lose weight) and the SCOFF screening tool. **RESULTS:** 10 athletes (4.3%, 3.6% of males, 8.3% of females) screened positive for an eating disorder using the SCOFF tool. The standard PPE questions combined to identify 43% of athletes as having concerning dietary habits (sensitivity 50%, specificity 59%, positive predictive value 5%, negative predictive value 98%). One athlete self-reported a diagnosed eating disorder. This individual was detected using the SCOFF tool and was not detected using the PPE questions. An analysis of the component questions identified the single question "Do you worry that you have lost control over how much you eat?" from the SCOFF tool to be the most sensitive and specific (70%, 100%) to detect disordered eating in collegiate athletes. **CONCLUSIONS:** Our results suggest that the current consensus PPE screening questions are neither sensitive nor specific to detect eating disorders in collegiate athletes. Further studies are needed to determine the appropriate questions for screening in the collegiate athlete population.

F-31 Thematic Poster - Baseball

Friday, May 31, 2019, 3:15 PM - 5:15 PM
Room: CC-101A

2843 **Chair:** Ajit Mohan Worthen Chaudhari, FACSM. *The Ohio State University, Columbus, OH.*

(No relevant relationships reported)

2844 Board #1 May 31 3:15 PM - 5:15 PM
Quantification of Ground Reaction Forces for Skilled Versus Recreational Baseball Hitting

Ethan Stewart¹, Megan Smidebush¹, Jeffrey Simpson², Adam Knight¹, Harish Chander¹, Robert Shapiro³. ¹Mississippi State University, Mississippi State, MS. ²University of West Florida, Pensacola, FL. ³University of Kentucky, Lexington, KY.
Email: ems664@msstate.edu

(No relevant relationships reported)

PURPOSE: Successfully hitting a baseball requires the hitter to properly use ground reaction forces (GRFs) in all three directions. The normal pattern of the GRFs during the baseball swing and the importance of the timing of those GRFs have been identified, but have not been compared among hitters across various competition levels. Therefore, the purpose of this study was to investigate how the peak GRFs in the medial-lateral direction (GRFx), anterior-posterior direction (GRFy), and vertical direction (GRFz), as well as time to reach peak GRFs for the lead and trail legs may vary between athletes who play at the collegiate level and those who have not. **METHODS:** Active baseball players were recruited and separated into two groups, recreational ($n = 6$) and skilled ($n = 6$), with the skilled players competing at the NCAA level. Each athlete performed three swing trials while standing in their normal hitting stance on two force platforms sampling at 1000 Hz. The dependent variables included the peak GRFx, GRFy, and GRFz normalized to bodyweight, and the time to peak GRFx, GRFy, and GRFz in milliseconds before ball contact for the lead and trail legs, as determined by Visual3D software. Values were averaged for each respective group and compared using independent sample t-tests ($p = 0.05$). **RESULTS:** The skilled group demonstrated a significantly lower posterior peak GRF (Recreational = -0.26 ± 0.03 BW, Skilled = -0.23 ± 0.03 BW, $p = 0.02$), a significantly higher vertical peak GRF (Recreational = 0.97 ± 0.03 BW, Skilled = 1.03 ± 0.02 BW, $p = 0.005$) and a reduction in time to vertical peak GRF in the trail leg (Recreational = -0.40 ± 0.06 ms, Skilled = -0.54 ± 0.11 ms, $p = 0.028$) in comparison to the recreational group. **CONCLUSION:** The ability of the skilled athletes to control their trail leg peak GRFy, while creating a significantly higher peak GRFz and reaching the peak GRFz faster helps to both facilitate velocity of the swing and control their body movement. Combining these three distinct kinetic differences in the swing could lead to differences in bat velocity and skill level between these two groups.

2845 Board #2 May 31 3:15 PM - 5:15 PM
Performance and Injury Correlates of X-Factor Among Baseball Hitters

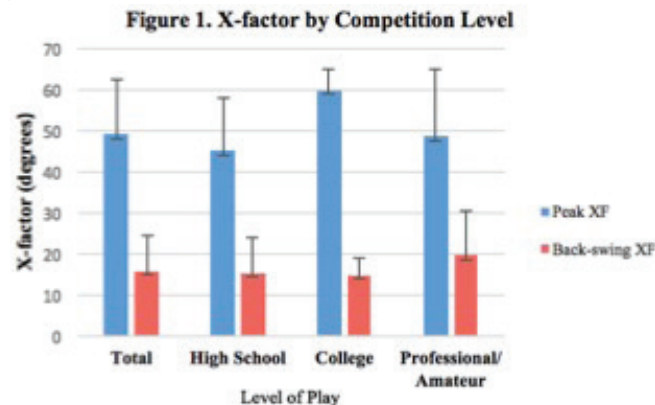
Eric M. Berkson, James Michaud, Shannon Linderman, Robert C. McCunney, Donna M. Scarborough. *Massachusetts General Hospital, Boston, MA.*
Email: eberkson@mgh.harvard.edu

(No relevant relationships reported)

PURPOSE: Abdominal strains related to trunk torsional forces commonly occur during baseball batting. A large degree of trunk rotation, or X factor (XF), is proposed to increase bat speed. However, baseball swing initiation is driven by pelvis rotation, which requires adequate hip joint mobility. This study investigates the correlations between XF, bat speed, passive hip range of motion, and dynamic hip rotation during the baseball swing. **METHODS:** 22 players (3 professional, 1 amateur, 5 college, 13 high school), mean age 18.09 ± 3.90 years, underwent 3D biomechanical baseball swing analysis. XF (resultant transverse angle of the intersecting rays through both shoulder joints and the pelvis midpoint) and lead and trail hip rotation angles were measured for 1 swing. Passive, prone hip rotation was assessed via goniometer. Spearman rho correlations and one-way ANOVA were performed. **RESULTS:** Peak XF and XF at the top of the back swing did not correlate with peak bat speed ($p = 0.088$ and $p = 0.832$). There was no significant difference in peak XF across level of play [$F(2,19) = 2.637$, $p = 0.098$] (Figure 1). Passive internal trail hip rotation differed between college and high school players ($p = 0.049$) and was inversely correlated with bat speed at ball contact ($r_s = -0.526$, 0.029). Peak bat speed positively

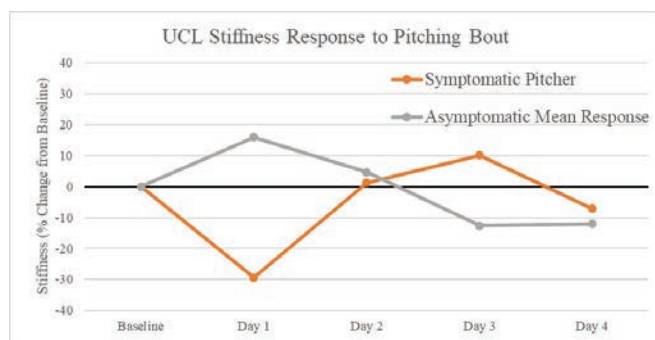
correlated with max trail hip rotation angle during the swing ($r_s=0.570$, $p=0.006$). No correlation of peak XF and passive hip rotation measures or hip rotation angles during the swing reached significance set at $p < 0.05$.

CONCLUSIONS: Findings do not support the use of XF as an indicator of bat speed. The variation in XF values may result from coaching differences or joint mobility compensation patterns. Athletes with limited hip rotation may attempt to compensate through generation of a large XF, possibly increasing the risk of back and oblique abdominus injuries. Clinicians caring for baseball players should screen for trail hip joint rotational mobility limitations.



- 2846 Board #3 May 31 3:15 PM - 5:15 PM**
UCL Stiffness Response to a Moderate Pitching Bout
 Christopher J. Curran, Henry W. Zale, Patrick M. Rider, Anthony S. Kulas, Zachary J. Domire. *East Carolina University, Greenville, NC.*
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 (No relevant relationships reported)

Purpose: The effect of a single pitching bout on the material stiffness of the ulnar collateral ligament (UCL) was investigated in five competitive baseball pitchers (age: 20.0 ± 2.6 years). Differences in the response were compared between one pitcher with arm trouble and four asymptomatic pitchers. **Methods:** Shearwave ultrasound elastography was used to measure the material stiffness of the UCL prior to, and on the four days following, a moderately-intense pitching bout. The pitching bout consisted of a minimum of 50 full-effort pitches in either a practice or game situation. Pitch velocity was measured and maintained within 10% of expected maximum velocity to ensure full effort was given. Participant arm health was measured using the Kerlan-Jobe Orthopaedic Clinic Shoulder and Elbow Score (KJOC) prior to the first imaging session. **Results:** Four pitchers reported "playing without any arm trouble" with a mean KJOC score of 90.4 out of 100.0. One pitcher reported "playing, but with arm trouble" and had a KJOC score of 60.2. Each of the asymptomatic pitchers showed an immediate increase in UCL stiffness (mean increase = $+15.99\%$) compared to baseline followed by a marked decrease and trend towards returning to baseline values on days 2-4. The UCL stiffness of the symptomatic pitcher showed a different immediate response (-29.47%) before returning towards baseline values on days 2-4. **Conclusions:** UCL material stiffness in a pitcher with arm trouble responded differently to a moderate pitching bout compared to a small sample of asymptomatic pitchers. A decrease in material stiffness of the UCL immediately following a pitching bout may be evidence of elbow distress and be useful in the identification of pitchers with increased injury risk.



- 2847 Board #4 May 31 3:15 PM - 5:15 PM**
Does The Kinematic Sequence Of A Curveball Pitch Vary Within Baseball Pitchers?
 Donna M. Scarborough, Shannon Linderman, Pablo Colon, Eric M. Berkson. *Massachusetts General Hospital, Boston, MA.*
 Email: dscarborough@mgh.harvard.edu
 Reported Relationships: D.M. Scarborough: Salary; figur8.

PURPOSE: The performance of a proximal-to-distal transfer of segmental angular velocity (or kinematic sequence) is reported to reduce stress on musculoskeletal structures of the overhand baseball pitcher's throwing arm and maximize ball velocity. The commonly asserted risk for injury of curveball pitching has not been demonstrated biomechanically. This study evaluates the kinematic sequence (KS), and their variability, of a curveball pitch in an effort to better characterize the stress on the arm during this pitch.

METHODS: 3D biomechanical pitch analyses using high-speed motion capture cameras (360Hz) were performed on 71 curveball pitches (5-6 pitches per pitchers) from 14 baseball pitchers (4 high school, 8 collegiate and 2 professional) with a mean age 19.21 ± 2.94 years. The peak angular velocity of five body segments: pelvis, trunk, arm, forearm and hand were analyzed to determine the kinematic sequence patterns for each curveball pitch.

RESULTS: None of the 71 pitches demonstrated the proximal-to-distal KS order. Eleven different KS patterns were demonstrated, and the most prevalent order was pelvis-> trunk-> arm and hand segments peaking simultaneously -> forearm. No players performed only 1 KS pattern among the curveball pitches. An average of 3 different KSs were observed per pitcher.

CONCLUSIONS: Deviation from the proximal-to-distal KS during pitch delivery results in an inefficient movement. The KS patterns of the fastball pitch have recently been described. This study evaluated the KS patterns of the curveball pitch. The most frequently performed KS during the curveball is with the forearm segment generating peak velocity simultaneously after the hand and shoulder velocity peaks. It is not known how the stresses across the shoulder and elbow are associated with this KS. Variation in KSs performed throwing curveballs may help prevent injury to the throwing arm, in particular if some KS patterns create more stress on the throwing arm than others.

Table 1. Pitcher characteristics and number of curveball kinematic sequences performed per pitcher. *LOP- Level of Play (P- professional, C- collegiate, HS- high school)

ID	LOP	Throwing hand	Ball speed (MPH)	# pitch trials	# of KS
1	P	Right	68.64	3	5
2	P	Left	71.68	4	5
3	C	Right	59.24	3	5
4	C	Right	63.96	4	5
5	C	Right	72.26	2	5
6	C	Right	62.36	2	5
7	C	Right	63.14	2	5
8	C	Right	70.06	2	5
9	C	Left	65.62	4	6
10	C	Left	66.68	3	5
11	HS	Right	64.62	2	5
12	HS	Left	61.04	2	5
13	HS	Left	57.4	2	5
14	HS	Left	59.4	3	5

- 2848 Board #5 May 31 3:15 PM - 5:15 PM**
Induced Power Analysis Of Sequential Body Motion And Elbow Valgus Load During Baseball Pitching
 Arnel Aguinaldo¹, Rafael Escamilla, FACSM². ¹Point Loma Nazarene University, San Diego, CA. ²California State University Sacramento, Sacramento, CA.
 Email: arnelaguinaldo@pointloma.edu
 (No relevant relationships reported)

The flow of mechanical energy of segmental motion provides a mechanism by which the throwing arm is accelerated during baseball pitching. Muscles can indirectly influence the energy level of distal segments to which they are not attached by way of the interaction torques transferring energy up the kinetic chain. No study to date, however, has addressed these causal components of mechanical power, specifically in relation to valgus loading at the elbow, which is prone to pitching-related injuries.

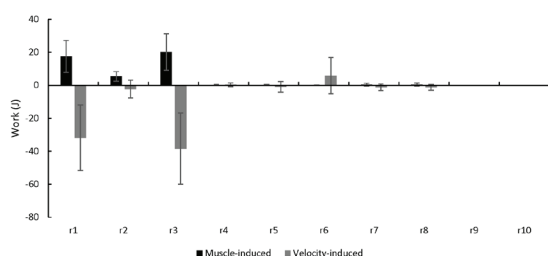
PURPOSE: To determine the components of muscle and velocity-dependent torques that contribute to the power of throwing arm segments when the elbow is under valgus load during pitching.

METHODS: The throwing motions of 10 adult pitchers (age = 22.9 ± 4.1 years, height = 1.87 ± 4.93 m, and mass = 86.5 ± 7.4 kg) were biomechanically measured using 3D motion capture after written informed consents were provided by the participants.

The resulting kinematic and kinetic data were included in a state-space power analysis using a 10-DOF model. The contributions of the torque-induced components to the mechanical work of the forearm were determined by integrating the power curves in time between the instants of front foot contact (FC) and maximum external rotation (MER) of the throwing shoulder.

RESULTS: Pitchers threw with a maximum elbow valgus torque of $70.1 \pm 2.2 \text{ N}\cdot\text{m}$. The trunk flexion (r1) and rotation (r3) components of the muscle-induced torque were the greatest positive contributors to the work of the forearm. Muscle torques contributed a total of $44.5 \pm 23.4 \text{ J}$ while velocity-dependent torques absorbed $69.6 \pm 37.1 \text{ J}$, representing 61% of the total work (114.1 J) of the distal arm segments during the arm-cocking phase (Figure 1).

CONCLUSIONS: Trunk motion in the early part of the arm-cocking phase appears to drive the power of accelerating the throwing elbow in valgus via velocity-dependent torques.



2849 Board #6

May 31 3:15 PM - 5:15 PM

Glenohumeral-Rotation-Deficits In High School, College, And Professional Baseball Pitchers With And Without An MucL Injury

Rafael F. Escamilla, FACSM. *California State University, Sacramento, Sacramento, CA.*
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(No relevant relationships reported)

PURPOSE: To assess if a glenohumeral-internal-rotation-(IR)-Loss (GIRLoss), a glenohumeral-external-rotation-(ER)-gain (GERGain) or a total-rotational-motion-(TRM)-deficit (TRMD) predict medial ulnar-collateral-ligament (MUCL) injury-risk among high-school (HS), college (COLL), and professional (PRO) baseball-pitchers with-and-without-MUCL-injury. It was hypothesized that pitchers with MUCL injury would have >GIRLoss and TRMD compared to pitchers without MUCL injury, with no differences in IR, ER, TRM, GIRLoss, GERGain, and TRMD. **METHODS:** Two-hundred-sixteen-male HS, COLL, and PRO pitchers were equally divided into MUCL-injury-group (n=108) and control-group (n=108) without MUCL injury. Control-group was matched with the MUCL-injury-group according to number, level & age. Bilateral shoulder passive IR/ER were measured and GIRLoss, GERGain, TRM, and TRMD calculated. A two-way-analysis-of-variance ($p < 0.05$) was employed to assess shoulder-rotational-differences among the two-groups and three-pitching-levels. **RESULTS:** Compared to control-group, MUCL-injured-group had >GIRLoss ($21^\circ \pm 14^\circ$ -versus- $13^\circ \pm 8^\circ$; $p < 0.001$), GERGain ($14^\circ \pm 9^\circ$ -versus- $10^\circ \pm 9^\circ$; $p = 0.004$), and TRMD ($7^\circ \pm 13^\circ$ -versus- $3^\circ \pm 9^\circ$; $p = 0.008$). For all pitching levels ~60% of subjects in MUCL-injury-group had GIRLoss > 18° , compared to ~30% of subjects in control-group. ~60% of subjects in MUCL-injury-group had TRMD > 5° , compared to 50% of subjects in control group. No differences were observed among HS, COLL, and PRO pitchers for GIRLoss ($16^\circ \pm 12^\circ$, $17^\circ \pm 11^\circ$, $19^\circ \pm 13^\circ$, respectively; $p = 0.131$), GERGain ($11^\circ \pm 9^\circ$, $11^\circ \pm 10^\circ$, $13^\circ \pm 10^\circ$, respectively; $p = 0.171$), TRMD ($5^\circ \pm 11^\circ$, $6^\circ \pm 11^\circ$, $5^\circ \pm 14^\circ$, respectively; $p = 0.711$), throwing shoulder ER ($111^\circ \pm 10^\circ$, $111^\circ \pm 11^\circ$, $113^\circ \pm 9^\circ$, respectively; $p = 0.427$), throwing shoulder IR ($50^\circ \pm 11^\circ$, $49^\circ \pm 11^\circ$, $48^\circ \pm 10^\circ$, respectively; $p = 0.121$), & throwing shoulder TRM ($162^\circ \pm 14^\circ$, $160^\circ \pm 15^\circ$, $161^\circ \pm 14^\circ$, respectively; $p = 0.770$). **CONCLUSIONS:** Greater GIRLoss, GERGain, and TRMD in MUCL-injured-pitchers compared to uninjured-pitchers implies these variables may be related to increased-MUCL-injury-risk, especially since GIRLoss > 18° and TRMD > 5° demonstrate an increased MUCL injury risk. Shoulder rotational motion and deficits do not vary among HS, COLL, and PRO levels of pitchers.

2850

Board #7

May 31 3:15 PM - 5:15 PM

Kinematic Factors that Contribute to Batting Performance in Collegiate Baseball

Alexia E. Amo, William P. Lydon, Nathaniel J. Holmgren, J. Mark VanNess, Courtney D. Jensen. *University of the Pacific, Stockton, CA.*

Email: l_amo@u.pacific.edu

(No relevant relationships reported)

To remain competitive in collegiate athletics, sports teams now employ advanced analytical tools to identify improvable domains. In baseball, technological limitations have precluded comprehensive interpretation of swing mechanics. Recent developments in technology now permit more complex assessments. **PURPOSE:** To test how kinematic factors of bat swing associate with in-season batting performance in college athletes. **METHODS:** We enrolled 13 batters from a D1 baseball team in Northern California and used Proteus (Boston Biomotion, USA) to conduct three-dimensional analyses of swing mechanics. Each athlete performed six five-repetition sets of swings at increasing loads of magnetic resistance: 1lb, 2lb, 3lb, 5lb, 7lb, and 9lb. Proteus software computed explosiveness (rate of power production) and endurance (replication of power production in successive swings). Players were tracked through the 2017 season and all batting statistics were recorded. Linear regressions tested the effects of explosiveness and endurance on in-season batting performance. Significance was set at $p < 0.05$; owing to a small sample and the novel equipment, trends ($p < 0.08$) were considered. **RESULTS:** 11 of 13 players had a base hit during the study season; these 11 constituted the study sample. They played 40.1 ± 13.2 games and batted $.264 \pm .048$. Mean swing explosiveness was 313.7 ± 59.3 and endurance was 97.7 ± 1.4 . Batting average was positively related to swing endurance ($R = 0.638$); an additional point of endurance predicted an 8.7% increase in batting average ($p = 0.047$). Runs ($R = 0.869$), triples ($R = 0.628$), and home runs ($R = 0.585$) per at-bat were positively correlated with swing explosiveness; in each at-bat, an additional point of explosiveness predicted a 0.2% increase in runs ($p = 0.001$), 1.3% increase in triples ($p = 0.052$), and 0.8% increase in homeruns ($p = 0.075$). Neither explosiveness ($p = 0.121$) nor endurance ($p = 0.529$) associated with games played. **CONCLUSIONS:** In three-dimensional analyses of swing mechanics, increased explosiveness and endurance predicted an improved batting average, more extra base hits, and more runs scored per at-bat. Scouts may be wise to consider swing mechanics in their estimations of a player's value. Likewise, players and coaches may choose training programs that optimize mechanics accordingly.

2851

Board #8

May 31 3:15 PM - 5:15 PM

Relationship Between Ground Reaction Force and Wrist Velocity in Skilled and Novice Baseball Pitchers

Kurt Kornatz, Christopher Wendt, Kevin Ritsche. *Winston-Salem State University, Winston-Salem, NC.* (Sponsor: Mike McKenzie, FACSM)

(No relevant relationships reported)

While throwing, skilled performers transmit forces in a precisely coordinated manner from the foot through the kinetic chain ultimately manifesting in a large velocity of the wrist. Accordingly, stride-leg ground reaction forces have been used to predict wrist velocity in skilled baseball pitchers. However, the relationship between ground reaction force and wrist velocity in novice pitchers is less clear. **PURPOSE:** The purpose of this study is to compare the relationship between peak vertical ground reaction forces of the stride leg (Fzpeak) and wrist velocity in skilled and age-matched novice baseball pitchers. **METHODS:** Ten collegiate baseball pitchers and ten recreationally active college-aged novice throwers completed one laboratory testing session in which they were asked to throw a baseball as fast and accurately as possible after a standardized instruction and warmup. Each subject performed a total of 15 throws, collected as part of a larger study in which stride-length was altered (comfortable $\pm 10\%$), on a dimensionally correct pitching mound equipped with a force platform (1200 Hz). Marker trajectory data (32 reflective markers) was tracked from 10 high-speed cameras at 240 frames/sec. Fzpeak was normalized for body weight (N/BW); wrist velocity (m/s) was measured at ball release. **RESULTS:** Skilled pitchers demonstrated larger FzPeak (1.61 ± 0.19 vs. 1.34 ± 0.13 N/BW, 16% difference, $p < 0.01$) and higher wrist velocity (18.11 ± 0.94 vs. 13.96 ± 1.04 m/s, 23% difference, $p < 0.01$) compared to novice participants. Furthermore, Fzpeak and wrist velocity were correlated for skilled pitchers only ($r = 0.47$, $p < 0.01$ vs. $r = 0.18$, $p > 0.1$). **CONCLUSIONS:** Skilled pitchers are more efficient than novice throwers at generating and transmitting ground reaction force through the kinetic chain in order to maximize wrist velocity.

F-32 Thematic Poster - Exercise and Neuroscience

Friday, May 31, 2019, 3:15 PM - 5:15 PM
Room: CC-101B

2852 Chair: J. Carson Smith, FACSM. University of Maryland, College Park, MD.

(No relevant relationships reported)

**2853 Board #1 May 31 3:15 PM - 5:15 PM
The Impact of Varying Exercise Protocols on Neurogenesis and Angiogenesis in the Dentate Gyrus**

Darrin Lenhart. *East Stroudsburg University, Seton Hall University, East Stroudsburg, PA.* (Sponsor: Shala Davis, FACSM)

Email: dlenhart@esu.edu

(No relevant relationships reported)

The Impact of Varying Exercise Protocols on Neurogenesis and Angiogenesis in the Dentate Gyrus

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Exercise is being considered for associations with improved neuronal health and longevity, synaptic plasticity, increased cerebral blood volume and angiogenesis, overall brain volume, and neurogenesis which collectively may have the power to forestall neurodegenerative disease. **PURPOSE:** To investigate the effects of varying exercise protocols on indices of neurogenesis and angiogenesis in the dentate gyrus of the hippocampus to inform efforts to forestall cognitive decline associated with neurodegenerative disease. **METHODS:** The indices of neurogenesis and angiogenesis were assessed using the surrogate measures of maximal oxygen uptake (VO_{2max}), cognitive function as assessed by the Rey auditory verbal learning test (RAVLT), and urinalysis of brain-derived neurotrophic factor (BDNF) concentration taken just prior to and just after a six-week training protocol. Twelve college-aged males were randomized into either high intensity interval training group (HIIT) or a steady-state training group (SS) and were compared to six sedentary controls over the course of a six-week supervised training study. **RESULTS:** Findings reflect an association between exercise and improved cognitive function. Specifically, cognitive function improved significantly with HIIT training ($\Delta RAVLT=3.66$, $p=0.045$) and a significant correlation between cognitive function and improved VO_2 from HIIT training was also shown ($r=0.98$; $p=0.010$). Cognitive function and neurotrophin concentration both increased significantly with steady state training compared to controls ($\Delta RAVLT=4.40$, $p=0.011$; $\Delta BDNF=54.00pg/ml$, $p=0.007$). **CONCLUSION:** Varying exercise protocols have a varying impact on cognitive function as assessed by the RAVLT, urine BDNF, and VO_2 . Findings hold implication for pathologies that involve cognitive decline.

**2854 Board #2 May 31 3:15 PM - 5:15 PM
Not Just for Joints: Physical Activity is Associated with Greater Cortical Thickness among Adults with Osteoarthritis**

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(No relevant relationships reported)

PURPOSE: Preliminary evidence suggests osteoarthritis (OA) is a risk factor for dementia. One potential reason is 87% of adults with OA are inactive, and low moderate-to-vigorous physical activity (MVPA) and high sedentary behaviour (SB) are each risk factors for brain atrophy. While regular MVPA and low SB are thus critical for brain health, it is unclear 1) what aspects of brain structure are associated with these behaviours among adults with OA; and 2) whether the relationships of MVPA and SB with brain structure are independent of each other. Hence, we investigated the independent relationships of MVPA and SB with brain structure in adults with knee OA. **METHODS:** This was a secondary cross-sectional analysis of a six month, proof-of-concept randomized controlled trial (RCT) to promote MVPA and reduce SB among adults with knee OA. At study entry, we objectively measured MVPA and SB for 7 days using the SenseWear Mini. Following this observation period, participants ($N=30$) underwent a 3T magnetic resonance image (MRI) scan, wherein T_1 -weighted structural MRIs were performed to measure cortical thickness. We performed regression analyses using a surface-based cluster size exclusion method for multiple

comparisons within the FreeSurfer neuroimaging software to determine if 1) MVPA was associated with greater cortical thickness independent of SB; and 2) SB was associated with less cortical thickness independent of MVPA.

RESULTS: Participants had a mean age of 61 years ($SD=9$ years), and 80% were female. Higher MVPA was associated with greater cortical thickness in the temporal pole (cluster size = 855 mm²; $p<0.05$) and superior frontal area (cluster size = 1204 mm²; $p<0.05$) of the left hemisphere independent of SB. SB was not associated with greater cortical thickness in any region independent of MVPA.

CONCLUSIONS: Higher MVPA is associated with greater cortical thickness in adults with OA, however SB does not appear to be strongly associated with brain structure. Promoting MVPA among adults with OA may thus be an important strategy for maintaining cognitive health among this population.

**2855 Board #3 May 31 3:15 PM - 5:15 PM
Fitness Trumps Fatness: An Examination of Cognition and Cerebral Volume**

Julian M. Gaitán, Sarah R. Lose, Ryan J. Dougherty, Jennifer M. Oh, Catherine L. Gallagher, Cynthia M. Carlsson, Howard A. Rowley, Yue Ma, Sanjay Asthana, Mark A. Sager, Bruce P. Hermann, Sterling C. Johnson, Barbara B. Bendlin, Dane B. Cook, FACSM, Ozioma C. Okonkwo. *University of Wisconsin - Madison, Madison, WI.*

(No relevant relationships reported)

PURPOSE: To determine whether cardiorespiratory fitness (VO_{2peak}) is related to cognition and cerebral volume in the presence of fatness in a late-middle-aged cohort at risk for Alzheimer's disease (AD). **METHODS:** 127 enrollees in the Wisconsin Registry for Alzheimer's Prevention (age = 64.1 ± 5.8 years, $N=127$, 43 male) underwent a graded maximal exercise test, anthropometric measurement, neuropsychological examination, a structural brain MRI scan, fasting venipuncture to assess insulin resistance (HOMA-IR), and APOE genotyping. Subjects were categorized as high vs low on VO_{2peak} using age- and sex- specific cutoffs from normative data and high vs low on waist-to-height ratio using sex-specific cutoffs. This resulted in four groups: Low fit/High fat (Lofit-Hifat; $n=43$); Low fit/Low fat (Lofit-Lofat; $n=11$); High fit/High fat (Hifit-Hifat; $n=28$); High fit/Low fat (Hifit-Lofat; $n=41$). Four cognitive domains were examined: Verbal Learning & Memory, Immediate Memory, Speed & Flexibility, and Working Memory. Cerebral volume was computed from MRI scans as the ratio of cerebrospinal fluid to the sum of gray and white matter. MANCOVA and follow-up ANCOVAs (adjusted for HOMA-IR, APOE, and in a secondary analysis, sex) were used to test whether fitness/fatness group associated with cognition and cerebral volume. **RESULTS:** There was a significant main effect of group on Verbal Learning & Memory ($p=.003$). Compared to the Lofit-Hifat group, Hifit-Lofat and Hifit-Hifat ($\beta=0.476$, $p=.013$; $\beta=0.719$, $p=.001$) performed better, whereas Lofit-Lofat did not ($\beta=0.023$, $p=.939$). There was a significant main effect of group on cerebral volume ($p=.012$). Relative to the Lofit-Hifat group, Hifit-Hifat had significantly greater cerebral volume ($\beta=-0.052$, $p=.007$) while Hifit-Lofat and Lofit-Lofat were not different ($\beta=-0.027$, $p=.151$; $\beta=0.020$, $p=.451$). When sex was added to the statistical models, there was no longer an effect of group on cognition or cerebral volume. **CONCLUSION:** In a cohort at risk for AD, cardiorespiratory fitness is associated with better cognition in Verbal Learning & Memory and greater cerebral volume even in the presence of high fatness, while sex may impact the relationships. Cardiorespiratory fitness may be more important than achieving a favorable body habitus for preserving cognition and brain health.

**2856 Board #4 May 31 3:15 PM - 5:15 PM
Brain Activity For Food Inhibition In Children With Higher Cardiorespiratory Fitness: An Fmri Study**

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(No relevant relationships reported)

Inhibitory cognitive control in children has been associated with future educational attainment, healthy body composition and eating behavior. Regular practice of aerobic exercise has shown to improve inhibitory cognitive control in children, however the brain areas involved in this cognitive domain, in particular those related to the inhibition of high caloric food, are unclear. **PURPOSE:** To identify the effects of enhanced cardiorespiratory fitness on brain activity involved in food-specific inhibitory control in children. **METHODS:** 22 children (10 ± 1.4 years old) participated in this study by completing general anthropometric assessments, a graded shuttle run test to estimate cardiorespiratory fitness (VO_{2max}) and a food-specific cognitive task while acquiring functional magnetic resonance imaging (fMRI) data by a 1.5 T MRI scanner.

During the scanner children performed a Go/No-go task. Pictures of objects (neutral) were used as Go stimulus and caloric food and toys pictures as No-go stimulus. The entire protocol consisted in three blocks No-go food, and three No-go toy. Each block contained 50 trials (80% Go stimulus). Children were divided in two groups (Lower fitness x Higher Fitness) separated by the median value of $\dot{V}O_{2\max}$. Unpaired Student's t-tests were used to compare cognitive performance between groups. Food specific-inhibitory control was assessed comparing which brain areas were more activated during No-Go conditions (Food) between groups by a two sample t-test. **RESULTS:** No differences were found between groups for the cognitive performance (number of errors) and general anthropometric variables ($p > 0.05$). However, children with higher cardiorespiratory fitness during the food-specific cognitive task had greater activation of areas related to cognition (prefrontal cortex and inferior parietal lobule), motor control (primary motor cortex and primary somatosensory cortex) and homeostatic regulation (insular cortex) ($T = 2.89$; $p < 0.005$). **CONCLUSION:** Cardiorespiratory fitness might influence the brain activity during inhibition control of high caloric food in children. This finding suggests that regularly performed aerobic exercise by children may promote functional adaptations on the brain that could affect future eating behaviors.

2857 Board #5 May 31 3:15 PM - 5:15 PM
Prefrontal Hemodynamics And Affective Responses To Incremental Exercise

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Neuroimaging investigations in non-exercise contexts have shown that the dorsolateral prefrontal cortex (dlPFC), medial PFC and anterior cingulate, are engaged when individuals attempt to cognitively control negative affect. Moreover, there are indications that aversive interoceptive stimuli preferentially activate the right hemisphere. We theorized that affective responses to incremental exercise would be regulated by the same prefrontal network implicated in non-exercise affect regulation. We hypothesized that there would be preferential right-dlPFC activation, among individuals with low tolerance to exercise intensity and, therefore, less positive affective responses to challenging intensities of exercise (i.e., above ventilatory threshold, VT). **PURPOSE:** To investigate dlPFC activation and affective responses during incremental exercise. **METHODS:** Thirty-eight participants (15M, 21F, Age: 23.7 ± 6.9 y; BMI: 24.0 ± 4.8 kg·m⁻²; $\dot{V}O_{2\max}$: 32.8 ± 7.8 ml·kg⁻¹·min⁻¹) completed an incremental cycling test to volitional termination. They were divided into low- and high-Tolerance groups based on a median split of their Tolerance scores (Preference for and Tolerance of the Intensity of Exercise Questionnaire). Near-infrared spectroscopy was used to assess changes from rest in the Tissue Oxygenation Index (ΔTOI) in the left (AF3) and right (AF4) dlPFC. Affective valence ratings (Feeling Scale; FS) were collected each min. **RESULTS:** Tolerance scores were positively correlated with FS ratings above VT ($r = 0.33$, $p = .04$), such that lower-Tolerance individuals reported lower FS ratings. For ΔTOI , a significant interaction was found between Tolerance group (low-high) and Hemisphere (left-right), $p = .02$, $\eta_p^2 = .129$. ΔTOI in the right dlPFC was larger for low- vs high-Tolerance individuals ($p = .03$). **CONCLUSION:** Low self-reported tolerance for exercise intensity is associated with lower ratings of affective valence above VT and larger increases in right-dlPFC oxygenation from rest. These results suggest that the prefrontal regulation of negative affective responses to increasing exercise intensity may exhibit similarities to the regulation of negative affective responses in non-exercise contexts.

2858 Board #6 May 31 3:15 PM - 5:15 PM
Acute Exercise Alters Brain Activation In Older Adults: What Is The Role Of Sleep?

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 (No relevant relationships reported)

Insufficient sleep is associated with altered brain activation and poor cognitive performance. Aerobic exercise training enhances neural efficiency and improves cognition.

Purpose: To examine sleep's role in the effect of acute aerobic exercise on brain functional activation and cognitive performance. **Methods:** We studied healthy, physically active older adults ($n = 31$; mean age = 66.2 ± 7.4 years (range = 55-81); 74.2% women; 93.6% > high school education; body mass index = 25.7 ± 4.2). During two counterbalanced study visits, participants engaged in 30 minutes of moderate-intensity bicycle exercise or seated rest, followed by a functional MRI scan. While in the scanner, participants completed the Erikson Flanker Task. Prior to the first study visit they also completed 7.9 ± 3.3 nights of wrist actigraphy. Actigraphic sleep indices

included total sleep time (TST), sleep efficiency (SE), wake after sleep onset (WASO), and average wake bout length (WBL). **Results:** Compared to rest, acute exercise significantly increased functional activation in the right superior parietal lobule (SPL; beta = 0.14, $p = 0.011$) and decreased activation in the left anterior cingulate cortex (ACC; beta = -0.09, $p = 0.012$). After adjustment for age, sex, race, and education, greater WASO was associated with less exercise-induced change in SPL activation (beta = -0.05, $p = 0.001$). There were no significant associations between TST, SE, or WBL and exercise-induced changes in functional activation. Acute exercise did not significantly affect Flanker Task performance. **Conclusions:** Acute moderate-intensity exercise alters functional activation in brain regions involved in executive function and inhibitory control, which align with previous exercise studies showing a conflict-related shift from ACC to SPL activity. Our findings suggest that the short-term effects of acute exercise may accumulate and promote the cognitive improvements linked to exercise training. Moreover, our findings suggest that greater time awake after initial sleep onset (i.e., sleep fragmentation) may attenuate the benefits of aerobic exercise on functional activation in the aging brain. Randomized controlled trials are necessary to further evaluate the interactive effects of sleep and acute exercise in older adults.

2859 Board #7 May 31 3:15 PM - 5:15 PM
The Effect of Exercise on Neural Activation in Older Adults

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Acute exercise (EX) affects neural activation, assessed with functional magnetic resonance imaging (fMRI), and is a suggested mechanism in the effects of EX on behavioral measures of cognition. **PURPOSE:** We investigated the effect of EX on neural activation during a set switching task (SST). **METHODS:** Six healthy, right-handed older adults ($M = 71.4 \pm 5.1$) completed two separate visits [EX; 30-min of cycling at 55-65% Heart Rate Reserve and rest (RS); 30-min of seated rest]. After EX or RS participants completed a SST during an fMRI. SSTs are a measure of executive function where participants shift attention between sets of rules during the task. Switch cost (cost) is the performance difference between switching (i.e. A, B, A) and repeat trials (i.e. A, A, A). The conditions included rest, a high switching block [70% switching, 30% repeat trials (HS)], and a low switching block [20% switching, 80% repeat trials (LS)]. fMRI analyses using FSL included assessment of main effects of activation during HS and LS blocks during EX and RS and a comparison of activation with reaction time cost. **RESULTS:** Across both HS and LS and EX and RS, participants similarly activated the lateral occipital cortex and frontopolar area. In addition, there was significant activation of the superior and inferior frontal gyri, middle frontal gyrus, cerebellum VIIb, thalamus, caudate, and insula following RS in HS and LS. There were no unique areas of activation in HS following EX, however in LS there was activation in the temporal occipital fusiform gyrus, inferior frontal gyrus, and middle frontal gyrus. In relation to performance, cost during HS was associated with activation of the cerebellum VIIb following EX and activation of the thalamus and occipital pole following RS. Further, cost during LS was associated with activation in the frontopolar area after EX and activation in the thalamus following RS. **CONCLUSION:** Similar activation during HS and LS following rest and EX suggests a common network for SSTs. During the HS blocks, EX did not elicit additional unique activation, as seen following RS or the LS block, suggesting EX-induced efficiency. More research is needed to better understand the implication of differential activation. Results presented at ACSM will include additional participants; findings and conclusions will reflect the final analyses.

2860 Board #8 May 31 3:15 PM - 5:15 PM
Association of Sleep Duration with Exercise-Induced Reductions in Default Mode Network Connectivity in Healthy Older Adults

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Exercise promotes neuroprotective effects in several large-scale brain networks that are vulnerable to dysregulation in aging and disease. Aging-related changes in sleep may also disrupt functional connectivity within these networks, including the default mode network (DMN), in which beta-amyloid aggregates in Alzheimer's disease (AD). **PURPOSE:** To determine the effect of moderate-intensity acute exercise on resting-state DMN functional connectivity (DMN-rSFC) in the brains of healthy older adults, and how this might be altered by poor sleep.

METHODS: On separate days, 32 physically active older adults (24F, 66.3 ± 7.3 years) completed 30 minutes of moderate-intensity cycling (RPE 14-15) or rest in a counterbalanced order prior to resting-state BOLD fMRI data acquisition. Actigraphic sleep indices, including total sleep time (TST) and sleep efficiency (SE; proportion of time in bed spent asleep), were calculated using wrist actigraphy data from 8 ± 3.5 nights prior to the first study visit. We utilized a seed-based correlation analysis (seed: left posterior cingulate cortex [PCC], MNI 2 -54 26) to determine the effect of exercise on DMN-rsFC. We tested the association of TST and SE with residualized exercise-induced change in DMN-rsFC (Δ DMN-rsFC) with multiple linear regression.

RESULTS: A paired-samples *t*-test revealed decreased DMN-rsFC in the left inferior parietal lobule (IPL; MNI -41 -51 45, $k = 108$, 864 mm^3) after exercise compared to rest. TST and SE explained 25% of the variance in exercise-induced Δ DMN-rsFC ($R^2 = .253$, $F(29) = 4.91$, $p = .015$). Every 30-minute increase in TST was associated with a $\beta = 0.019$ -unit decrease in DMN-rsFC between the left PCC and left IPL ($t(29) = -3.13$, $p = .004$).

CONCLUSION: Our findings suggest that acute moderate-intensity cycling exercise reduces functional connectivity between the left PCC and left IPL, two core DMN regions. Shorter sleep duration was associated with attenuated exercise-induced reduction in functional connectivity between these regions. Given the vulnerability of DMN regions to beta-amyloid deposition, our finding that exercise-induced effects on DMN-rsFC are modulated by sleep duration may have implications for optimizing results of exercise-based interventions aimed at preventing AD. Further research is needed to investigate this possibility.

F-33 Thematic Poster - New Findings in Children and Youth

Friday, May 31, 2019, 3:15 PM - 5:15 PM
Room: CC-104B

2861 Chair: Russell R. Pate, FACS. *University of South Carolina, Columbia, SC.*

(No relevant relationships reported)

2862 Board #1 May 31 3:15 PM - 5:15 PM
Neighborhood Resources Supporting Physical Activity: Perceived Access and Weight-Related Health Status in Youth

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(No relevant relationships reported)

Previous authors have demonstrated that the availability of neighborhood parks and greenspace is positively associated with physical activity engagement and health outcomes in youth. Yet, given the documented influence of *perceptions* of neighborhood safety, cleanliness, and traffic calming measures on physical activity participation in youth, further investigation is needed to consider the impact of perceived park access on youth health outcomes. **PURPOSE:** To examine the relationship between perceived access to neighborhood resources supporting physical activity and weight-related health status in youth. **METHODS:** Data from 17 urban public elementary schools, representing 733 students (mean age = 7.32 ± 1.78 years; males = 372, females = 361) was collected from the 2016-2017 Roanoke Valley Community Healthy Living Index. A correlation analysis examined the relationship between perceived access to resources supporting physical activity and BMI-for-age z-scores. **RESULTS:** A significant negative relationship was found between perceived access to resources supporting physical activity and weight-related health status in youth, $r(731) = -0.08$, $p = .01$. **CONCLUSIONS:** As perceptions of access to neighborhood-level resources supporting physical activity increased, weight-related health status in youth improved. These findings contribute to the existing literature on neighborhood-level correlates to health by considering the impact of family perceptions of access to healthy-living resources on youth health outcomes.

2863 Board #2 May 31 3:15 PM - 5:15 PM

The Association Between School Gardens and Physical Activity: A Way to Increase Youth Physical Activity

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(No relevant relationships reported)

The benefits of school garden programs are far-reaching; however, few studies have assessed the impact of school gardens on PA levels in a youth population.

PURPOSE: To assess the impact of school gardens on physical activity (PA) levels in a youth population. **METHODS:** Data were obtained from 62 low-income 4th grade students in a central Texas school participating in TX Sprouts—a large, school-based gardening, nutrition, and cooking randomized controlled trial. A wall-mounted stadiometer and Tanita scale were used to measure students' height, weight, and body fat percentage, respectively. ActiGraph wGT3X+BT accelerometers captured student PA on garden days and non-garden days. Evenson (2008) cut points were used to calculate time spent in sedentary (SED) and in moderate-to-vigorous PA (MVPA). Total step counts (TLSC), and energy expenditure (kcal) were also obtained. Linear mixed modeling was used to determine the effect of TX Sprouts on PA, controlling for age, sex, and BMI. **RESULTS:** Students were 60.3% female, 59.7% Hispanic with a mean age of 9.2 ± 0.4 years, and 45% of students were affected by overweight/obesity. When compared to non-garden days, on garden days students demonstrated greater MVPA ($\beta = 2.96$, $p < 0.001$), TLSC ($\beta = 551.45$, $p < 0.001$), kcal ($\beta = 18.04$, $p < 0.001$), and a reduction in SED ($\beta = -9.21$, $p < 0.0001$). This equates to an increase of approximately 3 minutes MVPA, 549 steps, 17.6 kcal, and a decrease of 9.4 minutes TMESD.

CONCLUSION: Results showed increased PA for students on garden days vs. non-garden days. While findings reflect PA during one hour of a school day, garden lessons could have a substantial and meaningful impact on children's PA if incorporated multiple times throughout the school week.

Supported by NIH Grant R01 HL123865.

2864 Board #3 May 31 3:15 PM - 5:15 PM

Independent And Combined Associations Of Sedentary Time And Physical Activity With Executive Function Among Children

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(No relevant relationships reported)

Previous studies have suggested that sedentary behaviors and physical inactivity might be independent risk factors for executive dysfunction.

PURPOSE: To examine the independent and combined relationships of after-school sedentary time (ST) and daily physical activity (PA) with executive function in children and tentatively explore which these two behaviors had greater impact on children's executive function. **METHODS:** A total of 4,304 children aged 6-12 years were recruited in 2017. ST, PA and executive function were assessed using the International Physical Activity Questionnaire Short Form (IPAQ-SF) and the Behavior Rating Inventory of Executive Function (BRIEF), respectively. Subgroups were identified as: low ST, after-school ST < 2 hours/day; high ST, after-school ST ≥ 2 hours/day; low PA, moderate-to-vigorous physical activity (MVPA) < 60 minutes/day; high PA, MVPA ≥ 60 minutes/day. Participants were categorized into 4 groups: 1) low ST, high PA; 2) low ST, low PA; 3) high ST, high PA; 4) high ST, low PA. **RESULTS:** The mean age of the participants was 9.01 ± 1.72 years. Children in group 4 had the highest T-scores of BRIEF indices (48.23 ± 8.44 , increased symptom), followed by those in group 3 (47.10 ± 8.05), group 2 (45.81 ± 7.78), and group 1 (44.41 ± 7.31), with $P < 0.05$ for each pairwise comparisons except for that between group 1 and 2. Multiple linear regressions showed that ST was positively related to the T-score of all indices, independent of MVPA ($P < 0.05$). However, MVPA was negatively associated with the T-score of metacognition index (MI) and global executive composite (GEC) only in the high ST subgroup ($P < 0.05$). **CONCLUSION:** Children with both low ST and high PA may have beneficial influence on their executive function. Notably, children with high ST and low PA demonstrated more significant deficits on the BRIEF than those with low ST and low PA, which suggested that intervention efforts should be paid more on reducing ST in addition to promoting PA.

2865 Board #4 May 31 3:15 PM - 5:15 PM
Age for Onset of Walking May Predict Physical Activity in Childhood; The Norwegian Mother and Child Cohort Study

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(No relevant relationships reported)

Physical activity (PA) is associated with a wide range of health benefits in children and youth. Identifying factors that might influence activity level is important to aim future public health strategies. Cross-sectional studies have demonstrated an association between motor skills and PA in childhood, however few studies have examined whether early motor development in infancy is associated with PA in childhood. **PURPOSE:** To examine whether age for onset of walking predicts PA in 7 year olds. **METHODS:** We used data from the Norwegian Mother and Child Cohort Study (MoBa), which is an ongoing population-based birth cohort study. The mothers reported age for onset of walking (months) and PA at 7 years (frequency of participation per week in moderate-to- vigorous PA [MVPA]) through questionnaires. The PA-questionnaire's validity is tested against accelerometer assessed MVPA (spearman's rho=0.38). We used multiple regression analyses and adjusted the analyses for gestational age, sex and weight at 1 year and parental education as a marker for socio-economic status. A formal test showed no evidence of an interaction by sex. **RESULTS:** A total of 33013 participants are included in the analysis (49% girls), and the mean age (sd) were 7.1 (0.14) years at follow-up. The average age (sd) for onset of walking were 12.9 (1.86) months, and average participation rate (sd) were 4.3 (2.45) times/week in MVPA. We observed a negative association between age for onset of walking and participation in MVPA in childhood ($B=-0.08$, 95%CI=-0.10, -0.07) independent of confounding factors. **CONCLUSION:** This finding indicate that earlier age for onset of walking may predict PA in childhood. However, while the association may be considered weak, i.e. each month earlier onset of walking is associated with 0.08 higher participation rate in MVPA (frequency per week), self-reported PA is likely prone to random measurement error attenuating the true association.

2866 Board #5 May 31 3:15 PM - 5:15 PM
An 8-week Fundamental Motor Skill Program Improves Skill Proficiency and Reduces Sedentary Time in Pre-schoolers

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(No relevant relationships reported)

PURPOSE: Fundamental motor skills (FMS) are the building blocks for physical activity (PA), with higher FMS proficiency associated with increased PA. Time spent in sedentary behaviours (SB) are increasing, and PA levels declining in children leading to higher rates of adult onset lifestyle diseases. This study aims to assess the effectiveness of an 8-week FMS program on FMS, PA and SB in children. We hypothesised that an 8-week supervised FMS program will improve object control and locomotor skills in children aged 3-5 years, and that improvements will be associated with improvements in PA and/or SB. **METHODS:** Children aged 3-5 years were recruited from a FMS program and child care centres. Children from the FMS program participated in a supervised program aimed at developing FMS through sporting activities and games. This involved one-hour training sessions, once a week for 8 weeks. Children in the control group (CG) continued usual pre-school activities. FMS were assessed using the Test for Gross Motor Skill Development-2 and PA levels using the parent completed Pre-school Physical Activity Questionnaire at baseline, and 8 weeks. An analysis of variance was used to assess between group differences. Simple linear regression was used to identify any relationships between FMS and PA. **RESULTS:** Forty-six children participated in the study with 24 allocated to the CG (mean age 4.2±0.6 yrs) and 22 to the intervention group (IG) (mean age 3.9±0.7 yrs). After 8 weeks of FMS training the children in the IG were significantly better than the CG in the gallop ($p=0.04$) and strike ($p=0.02$), as well as locomotor ($p=0.01$), object control ($p=0.01$) and gross motor quotient ($p=0.007$) percentiles. In addition, children in the IG spent reduced time in SB ($p=0.03$), with the change being inversely and significantly associated with gallop skill performance ($r=-0.34$, $p=0.04$) and gross motor quotient ($r=-0.35$, $p=0.03$). **CONCLUSIONS:** An 8-week supervised FMS program is associated with an improvement in locomotor and object control skill proficiency, and improvements are associated with a reduction in time spent in SB. Further research is needed to explore if the improvements made during the program are maintained over time and whether children who attended the program are more likely to remain physically active throughout childhood.

2867 Board #6 May 31 3:15 PM - 5:15 PM
The Effect Of Exercise In Addition To A Lifestyle-intervention On Hepatic Fat In Overweight Children

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(No relevant relationships reported)

PURPOSE: To compare the prevalence of responders (R) and non-responders (NR) for hepatic fat content and liver enzyme levels between overweight children participating in a family-based lifestyle intervention (LS) or in a family-based lifestyle plus exercise intervention (LS+Ex).

METHODS: This study included 102 overweight children (8-12 y; 55% girls; 57% with obesity according WOF criteria) that completed the 22 weeks of the EFIGRO (ClinicalTrials.gov ID: NCT02258126) two arms parallel intervention trial. The LS group (N=53; 10.6±1.1 y; 55% girls; 55% with obesity) attended a family-based lifestyle-and psycho-educational program composed by 11 sessions of 90 minutes. The LS+Ex group (N=49, 10.5±1.1 y; 55% girls; 59% with obesity) attended the same educational program and additionally participated in an exercise program that included aerobic and strength exercises, 3 days/week, 90 mins/session. Before and after the intervention, hepatic fat content was measured by magnetic resonance imaging, and alanine aminotransferase (ALT), aspartate aminotransferase (AST) and gamma-GT were measured in fasting plasma samples. Children were categorized as R when the effect size (d-cohen) was ≥0.2, and as NR when d-cohen was <0.2.

RESULTS: Regarding hepatic fat content, there was a significantly higher prevalence of R ($P=0.035$) in the LS+Ex group (54%), than in the LS group (34%). Moreover, the difference in the prevalence of R between the two groups was also significant for GGT (69% and 38% of R, for the LS+Ex and LS groups, respectively, $P=0.002$), while there were no significant difference in the prevalence of R in changes in ALT (45% vs. 37% of R, for the LS+Ex and LS groups) and AST/ALT (40% vs. 35% of R, for the LS+Ex and LS groups) between the two groups (all $P>0.05$).

CONCLUSIONS: There was a higher prevalence of responders for hepatic fat content and GTT levels in the group of children with overweight that participated in the family-based multicomponent intervention program that included exercise. These results suggest that lifestyle intervention programs for improving obesity associated comorbidities in children should include exercise training to improve their hepatic comorbidity.

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2868 Board #7 May 31 3:15 PM - 5:15 PM
Parental Perceptions of Their Children's Physical Activity

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(No relevant relationships reported)

Despite known health benefits, most children are not meeting the recommended physical activity (PA) guidelines. Parents play a critical role in supporting and encouraging their children's PA and it is essential to understand parents' perceptions of the factors that may influence their children's PA. **PURPOSE:** To describe, in a representative, statewide sample, South Carolina parents' perceptions of their children's PA behaviors. **METHODS:** Items from the 2013 statewide Children's Health Assessment Survey pertaining to children's PA, sport participation, outdoor activity, screen time, recreational time and coordination were analyzed for a total of 711 parent-reported children (342 males, 369 females) ages 5-17 years. Weighted percentages were calculated for the total sample and population subgroups (age, parent education, race, and weight status) and for the children's health-related PA behaviors items; weighted percentages for reported children's health-related PA behaviors stratified by meeting PA requirements. Age, parent education, race, and weight status were controlled in the analyses. **RESULTS:** Over half of the youth were reported as being active on ≥ 5 d/wk. Males were reported accumulating ≥ 60 min/d of PA as compared to females (80.5% and 72%). The 5-10-year-old age group reportedly had the highest percentage of accumulating ≥ 60 min/d of PA (90%), choosing PA during recreational time (64%), and a higher percentage (80%) spent < 120 min/d engaged in screen time compared to the other age groups. For the total group, those reportedly meeting the guideline were more likely to be active ≥ 5 d/wk (47%), choose PA during recreational time (44%), participate in sports and/or PA classes (52%), spend

≥ 60 min outside on weekdays (70%), and weekend days (64%) than the alternative behaviors. Both the younger (74% vs 16%) and middle age groups (64% vs 11%) who reportedly met the 60 min of PA guideline were more likely to spend ≥ 60 min outside on weekends. **CONCLUSIONS:** Children reportedly meeting the PA guidelines, are more likely to engage in other PA behaviors, as perceived by their parents. Active encouragement of parents and their children to be more physically active, engage in sports and outdoor time, as well as decreasing time using electronics and other sedentary behaviors should be advocated.

2869 Board #8 May 31 3:15 PM - 5:15 PM
Association Between Meeting Physical Activity, Sleep, And Dietary Guidelines And Cardiometabolic Risk Factors And Adiposity In Adolescents

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(No relevant relationships reported)

INTRODUCTION: Obesity is a complex disease that may be influenced by physical activity (PA), sleep, and diet; though little is known if individual behavior guidelines are related to cardiometabolic risk factors. **PURPOSE:** To examine the association between meeting PA, sleep, and dietary guidelines and cardiometabolic risk factors and adiposity in adolescents. **METHODS:** Adolescents, ages 10 to 16 years, wore an accelerometer for 7 days, including overnight to capture PA and sleep. The PA guideline was defined as ≥ 60 minutes of moderate-to-vigorous PA per day. The sleep guideline was 9-11 hours (10-13 years of age) or 8-10 hours (14-16 years of age) per night. The dietary guideline was based on the Healthy Eating Index 2015 score calculated from a self-administered dietary recall. Scores ≥70 were classified as meeting guideline. Cardiometabolic risk factors were assessed in a clinical setting including body mass index percentile (BMIP); waist circumference (WC); DXA for total body fat; abdominal MRI for visceral adipose tissue (VAT); resting blood pressure (BP); and a fasting blood draw for high-density lipoprotein cholesterol, triglycerides, and glucose. Generalized linear regression was used to assess meeting the guidelines and cardiometabolic risk factors, with adjustment for age, sex, race, and other guidelines. **RESULTS:** Of the 342 participants, 239 (69%) provided complete measures. Adolescents were 12.4 ± 1.9 years of age, most were white (61%), had overweight or obesity (47%), and slightly more were girls (53%). Many met the sleep guideline (50%), but few met the PA (11%) or dietary (3%) guidelines. Most met 1 (50%) or no guidelines (43%), and few met 2 or more guidelines (6%). In adjusted models, meeting the PA guideline was associated with a lower BMIP, diastolic BP, WC, VAT, and total body fat; and meeting the sleep guideline was associated with a lower WC ($p < 0.05$ for all). Meeting one guideline was associated with a lower BMIP, WC, VAT, and total body fat; and meeting 2 guidelines was associated with lower diastolic BP ($p < 0.05$ for all). There were no other associations between meeting guidelines and risk factors. **CONCLUSIONS:** Adiposity was lower for those who met the PA or sleep guidelines, and very few met the dietary guideline. Multidisciplinary strategies are needed to ensure healthy behaviors for all adolescents.

F-34 Thematic Poster - Protein Metabolism

Friday, May 31, 2019, 3:15 PM - 5:15 PM
 Room: CC-102A

2870 Chair: Floris Wardenaar. Arizona State University, Phoenix, AZ.

(No relevant relationships reported)

2871 Board #1 May 31 3:15 PM - 5:15 PM
The Association of Protein Intake and Change in Lean Mass During 9-mos. of Resistance Training

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(No relevant relationships reported)

PURPOSE: The purpose of the study was to assess the association of protein intake with change in lean mass (LM) during a 9-mo. resistance training (RT) protocol.

METHODS: Normal/overweight sedentary, previously untrained young adults ($n = 78$, age ~22 yrs. BMI ~ 25 kg/m²) completed a 9-mo., supervised efficacy trial (1 or 3-sets RT, 9 exercises, 3 d/wk.) Participants were required to complete ≥80% scheduled RT sessions and asked maintain usual ad-libitum diets. Body composition (DEXA) and dietary intake (digital photography plus recall) were assessed at baseline, 4.5 and 9 mos. Multiple linear regression models were used to examine the associations between protein intake and changes in LM. Intake variables from the assessment periods were aggregated over the 9-month intervention. Protein intake was examined by using the nutrient residual energy-adjustment method, in which the protein residuals obtained by regressing absolute protein intake on total energy intake are added to mean protein intake and used as the independent variables. Models were adjusted for age, sex, race, randomization group, baseline LM, and height. To allow determination of whether the associations were independent of change in overall mass, models were also adjusted for changes in FM.

RESULTS: Participants completed 92 ± 6% of scheduled RT sessions. LM increased significantly from baseline to 9 mos. (1.2 ± 1.7 kg, $p < 0.0001$) with high inter-individual variability (range = - 2.0 to 6.2 kg). Grams of total protein ($\beta = 0.01$ SE=0.01, $p=0.34$), animal protein ($\beta = 0.02$ SE= 0.02, $p=0.15$), vegetable protein ($\beta = -0.03$ SE=0.04, $p=0.44$), and isoleucine ($\beta = 3.4$ SE=1.97, $p=0.09$), were not associated with changes in total LM per unit of energy-adjusted protein intake. However, leucine ($\beta = 1.8$ SE=1.2, $p=0.03$) and valine ($\beta = 3.7$ SE=1.4, $p=0.01$) were positively associated with changes in total LM per unit of energy-adjusted protein intake.

CONCLUSIONS: There was no association with total protein intake and changes in LM in young adults enrolled in a 9-month RT intervention. However, there was a positive association with two of the branch chain amino acids, leucine and valine. Thus, the type of protein may be more important than total protein intake for increasing LM during a long-term RT intervention.

2872 Board #2 May 31 3:15 PM - 5:15 PM
Why Protein Consumption Before, Rather than Within a Post-Exercise Meal Increases the Postprandial Aminoacidemia

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(No relevant relationships reported)

Rapidly digested and absorbed proteins enhance the muscle protein synthesis response following resistance exercise, with the degree of hyperaminoacidemia suggested to be an important consideration. However, most studies have used supplemental protein sources, with little focus on how consumption of protein within a mixed meal influences postprandial amino acid (AA) responses. **PURPOSE:** To examine the pattern of postprandial AA responses to consuming whey protein isolate before or within a mixed meal after resistance exercise. **METHODS:** Eight resistance trained men (age 21 (1) y; body mass 80.2 (8.4) kg; body fat 13 (6) %) completed two trials in a randomized order. Trials consisted of ~1 h lower-body resistance exercise, a 30 min post-exercise feeding period and a further 150 min supine rest period. Post-exercise nutrition was identical in composition (400 mL water at 0 min; an oat flapjack + 600 mL water at 15-30 min) and included 20 g of whey protein isolate, which was either consumed in the drink at 0 min (SUPP) or mixed into the oat flapjack consumed at 15-30 min (MEAL). Blood samples were taken every 15-30 min post-exercise to determine amino acid, glucose and insulin concentrations. **RESULTS:** Compared to MEAL, leucine and essential AA (EAA) concentrations were higher at 15-50 min and lower at 120-180 min in SUPP ($P < 0.05$), whilst total AA (TAA) concentrations were higher at 30-50 min and lower at 150 min in SUPP. Peak leucine (SUPP 414 (70) mmol/L; MEAL 216 (40) mmol/L; $P < 0.001$), EAA (SUPP 2404 (411) mmol/L; MEAL 1502 (235) mmol/L; $P < 0.001$) and TAA (SUPP 4860 (759) mmol/L; MEAL 3450 (467) mmol/L; $P < 0.01$) concentrations were all greater during SUPP vs MEAL, with peak concentrations also achieved earlier in SUPP. Total postprandial area under the curve for leucine, EAA and TAA concentrations were all greater during SUPP ($P < 0.05$). There were no between-trial differences for glucose or insulin responses ($P > 0.05$). **CONCLUSIONS:** Consumption of protein in supplemental form prior to, rather than within a mixed meal, facilitates a more rapid and pronounced postprandial aminoacidemia following resistance exercise. This might offer some advantage where maximizing the anabolic effect of resistance exercise is desirable.

This project received no funding. The whey protein isolate was provided by Volac International Ltd.

2873 Board #3 May 31 3:15 PM - 5:15 PM
Does Exclusive Consumption of Plant-based Dietary Protein Impair Resistance Training-induced Muscle Adaptations?

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(No relevant relationships reported)

Dietary protein consumption maximizes the anabolic response during resistance training (RT) by triggering muscle protein synthesis and providing the indispensable amino acids for a net positive protein balance. Leucine is considered the key amino acid in this process, suggesting that differences in protein quality may influence RT-induced gains in muscle mass and strength. In this respect, despite acute evidence on lower anabolic properties of plant- vs. animal-based protein, the effects of an exclusive plant-based dietary protein diet on RT-induced adaptations are currently unknown. **PURPOSE:** To investigate the impact of dietary protein source (plant- vs. mixed diet-based protein) on RT-induced changes in muscle mass and strength in total protein-matched young healthy men. **METHODS:** Nineteen vegan (VEG 26±5 y; 72.7±7.1 kg, 1.78±0.05 m) and nineteen omnivorous (OMN 26±4 y; 73.3±7.8 kg, 1.76±0.06 m) physically active young men were enrolled in a 12-week, twice weekly, lower-limb RT program. Daily protein intake was adjusted to 1.6g/kg/day in both groups via supplementing either soy (VEG) or whey (OMN) protein. Leg lean mass (LLM, by DXA) and lower-limb maximal strength (leg-press one-repetition-maximum, 1-RM) were determined PRE and POST intervention. Six 24-hour dietary recalls were performed at baseline (for habitual protein intake determination) and three during the intervention, for monitoring purposes. **RESULTS:** Significant increases in LLM were observed in both VEG (PRE=18.9±2.2 kg and POST=20.1±2.2 kg, Δ%=6.4±5.8 %, p<0.0001) and OMN (PRE=19.1±2.4 kg and POST=20.3±2.7 kg, Δ%=6.1±3.9 %, p<0.0001). Similarly, 1-RM was significantly increased in both VEG (PRE=258±59 kg and POST=354±81 kg, Δ%=38.1±15.9 %, p<0.0001) and OMN (PRE=261±63 kg and POST=381±73 kg, Δ%=49.0±21.6 %, p<0.0001). No group by time interactions were found. Finally, total protein intake was similar between groups (VEG=1.68±0.14g/kg/d and OMN=1.72±0.10g/kg/d, p=0.30). **CONCLUSION:** A higher protein-content (~1.6g/kg/day) exclusive plant-based (including soy) protein diet is similarly effective as a mixed-diet in supporting RT-induced muscle adaptations, suggesting that total protein, rather than protein quality, may be more important for muscle adaptation in young individuals. Supported by FAPESP grant 2016/22083-3.

2874 Board #4 May 31 3:15 PM - 5:15 PM
Leucine Co-Ingestion Augments the Muscle Protein Synthetic Response to the Ingestion of 15 g Protein During Recovery from Resistance Exercise in Older Men

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(No relevant relationships reported)

PURPOSE: Older adults have shown an attenuated post-exercise increase in muscle protein synthesis rates following ingestion of smaller amounts of protein when compared to younger adults. Consequently, more protein may be required to increase post-exercise muscle protein synthesis rates in older as compared to younger men. The present study investigated whether co-ingestion of 1.5 g free leucine with a single, 15 g bolus of protein augments the muscle protein synthetic response during recovery from resistance-type exercise in older men. **METHODS:** Twenty-four healthy older men (67±1 y) were randomly assigned to ingest 15 g milk protein concentrate (MPC80) with (15G+LEU; n=12) or without (15G; n=12) 1.5 g free leucine after performing a single bout of resistance-type exercise. Post-prandial protein digestion and amino acid absorption kinetics, whole body protein metabolism, and post-prandial myofibrillar protein synthesis rates were assessed using primed, continuous infusions with L-[ring-2H5]-phenylalanine, L-[ring-2H2]-tyrosine and L-[1-13C]-leucine combined with the ingestion of intrinsically L-[1-13C]-phenylalanine labeled milk protein. **RESULTS:** A total of 70±1% (10.5±0.2 g) and 75±2% (11.2±0.3 g) of the protein-derived amino acids were released in the circulation during the 6-h post-exercise recovery phase in 15G+LEU and 15G, respectively (P<0.05). Post-exercise myofibrillar protein synthesis rates were 16% (0.058±0.003 vs 0.049±0.002 %·h⁻¹; P<0.05; based upon L-[ring-2H₅]-phenylalanine) and 19% (0.071±0.003 vs 0.060±0.003 %·h⁻¹; P<0.05; based upon L-[1-13C]-leucine) greater in 15G+LEU when compared with 15G. **CONCLUSIONS:** Leucine co-ingestion augments the post-exercise muscle protein synthetic response to the ingestion of a single 15 g bolus of protein in older men.

2875 Board #5 May 31 3:15 PM - 5:15 PM
Pre-Sleep Consumption of Casein Protein on Resting Metabolic Rate and Appetite in Premenopausal Women

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(No relevant relationships reported)

PRE-SLEEP CONSUMPTION OF CASEIN PROTEIN ON RESTING METABOLIC RATE AND APPETITE IN PREMENOPAUSAL WOMEN

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PURPOSE: To determine the acute effects of nighttime pre-sleep consumption of casein protein (CP) and a placebo (PLA) supplement on next-morning measures of resting metabolic rate (RMR) and appetite in sedentary premenopausal women. **METHODS:** This study was a randomized crossover double-blind placebo-controlled trial. Seven premenopausal (age: 19.9±1.2 yrs, BMI= 23.1±2.6 kg/m²) women participated. Subjects had body composition (DXA), RMR (indirect calorimetry), and appetite (visual analog scale; VAS) measured. Subjects consumed either CP (35 g, 130 kcal) or PLA (7.2g, 10 kcal) 30 min prior to bed time on two separate occasions separated by 48-hours. RMR and measures of hunger, desire to eat, and satiety were analyzed using Paired T-tests. Significance was accepted at p<0.05. **RESULTS:** RMR (CP:1383±162; PLA:1340±159 kcal/day) and relative oxygen consumption (CP:3.41±0.44; PLA 3.36±0.38 ml/kg/min) were not different between CP and PLA. There were also no effects of CP and PLA on measures of appetite (Hunger: CP: 3.8±3.0; PLA: 3.1±2.7 cm; Satiety: CP: 4.1±3.4; PLA: 4.7±2.7 cm; Desire to Eat: CP:3.7±3.4; PLA:2.8±2.1 cm). **CONCLUSION:** There were no differences in RMR and measures of appetite between CP and PLA. There is growing evidence that a small snack before sleep (150-200 kcal) is not harmful to metabolism or appetite. This study was supported with product by Dymatize Nutrition.

2876 Board #6 May 31 3:15 PM - 5:15 PM
Protein Supplementation Does Not Further Augment Physiological Adaptations to Prolonged Endurance Exercise Training

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PURPOSE: It has recently been speculated that protein supplementation may further augment the adaptations to prolonged endurance exercise training. We assessed the impact of protein supplementation during prolonged endurance exercise training on whole-body oxidative capacity (VO_{2max}) and endurance exercise performance.

METHODS: Sixty recreationally active males (age: 27±6 y; BMI: 23.8±2.6 kg·m⁻², VO_{2max} 47±6 mL·min⁻¹·kg⁻¹) were subjected to 12 weeks of triweekly endurance exercise training. After each session and each night prior to sleep, participants ingested either a protein supplement (PRO; 29 g casein protein) or an isocaloric carbohydrate placebo (PLA). Before and after the 12 weeks of training, VO_{2max} and endurance exercise performance (~10-km time-trial) were assessed on a cycle ergometer. Muscular endurance (total workload achieved during 30 reciprocal isokinetic contractions) was assessed by isokinetic dynamometry and body composition by DXA. Dietary intake was assessed at baseline and during the intervention period. Repeated measures ANOVA was applied to assess whether training adaptations were different between groups.

RESULTS: Protein intake increased in PRO (1.2±0.4 to 1.6±0.3 g·kg⁻¹), but not in PLA (1.3±0.4 to 1.2±0.3 g·kg⁻¹, time x treatment interaction, P<0.001). Endurance exercise training induced an 11±6% increase in VO_{2max} (time effect, P<0.001), with no differences between groups (PRO: 48±6 to 53±7 mL·min⁻¹·kg⁻¹; PLA: 46±5 to 51±6 mL·min⁻¹·kg⁻¹; time x treatment interaction, P=0.50). Time to complete the time-trial was reduced by 14±7% (time effect, P<0.001), with no differences between groups (time x treatment interaction, P=0.15). Muscular endurance increased by 6±7% (time effect, P<0.001), with no differences between groups (time x treatment interaction, P=0.84). Whole body lean mass was unchanged over time (P=0.097). However, leg lean mass showed an increase following endurance exercise training (P<0.001), which tended to be greater in PRO (PRO: 0.5±0.7 kg; PLA: 0.2±0.6 kg; time x treatment interaction, P=0.073).

CONCLUSION: Protein supplementation after exercise and before sleep does not further augment the gains in whole-body oxidative capacity and endurance exercise performance following prolonged endurance exercise training in healthy, young males.

2877 Board #7 May 31 3:15 PM - 5:15 PM
Higher Protein Intake does Not Potentiate Resistance Training-Induced Muscular Adaptations in Middle-aged Adults

Rafael A. Alamilla, Colleen F. McKenna, Amadeo F. Salvador, Susannah Scaroni, Isabel G. Martinez, Joseph W. Beals, Scott A. Paluska, FACSM, Nicholas A. Burd. *University of Illinois at Urbana/Champaign, Urbana, IL*. (Sponsor: Scott A. Paluska, FACSM)

(No relevant relationships reported)

Maintenance of muscle strength helps preserve functional capacity and independence in aging populations. Protein intake above the current recommended dietary allowance (RDA) is believed to optimally facilitate resistance training adaptations; however, the suitability of consuming these protein amounts for middle-aged adults remains unclear. **PURPOSE:** To determine whether dietary protein ingestion above the RDA modulates muscle strength and body composition to resistance exercise training in middle-aged adults. **METHODS:** 27 participants were randomly assigned to consume either the RDA of protein (0.8-1.0 g/kg/d; 50 ± 2 y, BMI = 27.9 ± 0.1 kg/m²) or twice the RDA (1.6-1.8 g/kg/d; 52 ± 2 y, BMI = 28.1 ± 0.9 kg/m²) during a 10-wk progressive resistance training program. Participants were counseled on equal distribution of protein, and consumed either 15g or 30g protein in the immediate post-exercise period and nightly before sleep, respectively. Body composition was assessed by dual-energy x-ray absorptiometry. One repetition maximum assessments were used to determine muscular strength for both lower and upper body exercises. Strength assessments were performed at baseline and after the 10-wk intervention. **RESULTS:** There was a significant increase ($P < 0.05$) in muscle strength in all exercises for both groups across time (Table 1). However, there was no significant difference in strength between groups ($P > 0.05$) after the intervention. Body fat % was not significantly different from baseline in either group ($P > 0.05$), or after intervention ($P > 0.05$). Lower body lean body mass significantly improved ($P < 0.05$) with resistance training in both groups with no group differences ($P > 0.05$). **CONCLUSION:** Dietary protein intake comparable to the RDA coupled with moderate post-exercise and nightly protein doses is adequate to support training-induced muscle strength and mass gains in middle-aged adults.

Supported by USA National Cattlemen's Beef Association (NCBA)

Table 1

RDA (n = 14) 2x RDA (n = 13)				
	Baseline	Post-intervention	Baseline	Post-intervention
Body Fat (%)	34.9 ± 2.3	34.0 ± 2.3	31.7 ± 2.4	31.9 ± 2.4
Lower Body Lean Body Mass (kg)	16.2 ± 1.4	17.2 ± 1.4*	18.1 ± 1.4	18.8 ± 1.4*
One Repetition Maximum (kg)				
Leg Press	100.8 ± 9.9	151.1 ± 18.8*	100.5 ± 10.1	149.3 ± 17.1*
Leg Curl	57.1 ± 4.5	72.5 ± 6.5*	65.6 ± 6.04	85.8 ± 7.2*
Leg Extension	63.3 ± 5.0	94.4 ± 10.3*	66.1 ± 5.4	97.4 ± 13.2*
Chest Press	39.6 ± 5.4	48.4 ± 6.2*	41.4 ± 5.5	55.2 ± 5.9*
Shoulder Press	16.9 ± 3.17	25.3 ± 3.9*	16.7 ± 2.3	28.6 ± 3.3*
Seated Row	41.5 ± 4.2	53.6 ± 4.3*	46.2 ± 5.1	57.0 ± 4.9*
Bicep Curl	16.4 ± 1.3	22.1 ± 2.2*	19.6 ± 2.1	28.2 ± 2.6*

F-35 Thematic Poster - Running

Friday, May 31, 2019, 3:15 PM - 5:15 PM
 Room: CC-102B

2878 Chair: Christopher J. Lundstrom. *University of Minnesota, Minneapolis, MN.*

(No relevant relationships reported)

2879 Board #1 May 31 3:15 PM - 5:15 PM
Are Changes In Running Economy Associated With Changes In Performance In Runners? A Systematic Review and Meta Analysis

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(No relevant relationships reported)

Improvements in running economy (RE) are thought to lead to improvements in running performance (P). The identification of modifiable factors that affect RE and by association, P has been the focus of a significant body of research in recent years. Modifiable factors affecting RE are broadly classified as, biomechanical, anthropometric, physiological, extrinsic and training related. Interventions have been used to alter one or more of these factors with a view to improving RE. The underlying assumption is that an improvement in RE will also lead to an improvement in P. **PURPOSE:** The aim of this study was to assess the effect of interventions of at least 2-weeks' duration on RE and P and to determine whether there is a relationship between changes in RE (Δ RE) and changes in running performance (Δ P). **METHODS:** A database search was carried out in Web of Science, Scopus and SPORTDiscus. In accordance with a PRISMA checklist 10 studies reporting 12 comparisons between interventions and controls were included in the review. **RESULTS:** There was no correlation between percentage Δ RE and percentage Δ P ($r = 0.46$, $P = 0.936$, 12 comparisons). There was a low risk of reporting bias in relation to incomplete data sets. There was an unclear risk of selection bias associated with random allocation to intervention and control groups and reporting of baseline differences in RE and P between intervention and control groups. There was also an unclear risk of performance bias relating to the monitoring of non-intervention training, detection bias associated with differences in determination of the performance outcome measure and attrition bias associated with reporting of participant dropout. Meta-analyses found no statistically significant differences between interventions and control for RE (SMD (95% CI) = -0.37 (-1.43, 0.69), 204 participants, $p = 0.49$) or for P (SMD (95% CI) = -0.65 (-26.02, 24.72), 204 participants, $p = 0.99$). **CONCLUSIONS:** Methodologies for subject allocation to intervention and control groups and the reporting of differences in baseline characteristics of control and intervention groups and reporting of participant dropout were infrequently applied in the included studies. Studies of greater statistical power, with standardised measures of performance and greater control of non-intervention training are required.

2880 Board #2 May 31 3:15 PM - 5:15 PM
Running Economy Strongly Related to Ground Contact Time Imbalances

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(No relevant relationships reported)

Running economy (RE) can be defined as the oxygen consumption or caloric unit cost required to move at a specific velocity. In addition to a runner's maximal oxygen uptake (VO₂max) and lactate threshold (LT), RE is a key endurance performance determinant. Better RE is advantageous as it represents the ability to run at a lower relative percentage of VO₂max at a given speed and reduces the rate of energy depletion. Ground contact time (GCT) has been associated with RE, however it has not been established how GCT imbalances between feet impact economy. **Purpose:** Determine the relationship between cadence, GCT, and GCT imbalances and RE. **Methods:** 11 NCAA Division I distance runners (7 male: 21±2 years, 15.8±3.4% fat; 4 female: 19±1 years, 22.1±5.2% fat) completed a graded exercise test on a treadmill to determine LT and VO₂max. Subjects ran with a heart rate monitor capable of measuring cadence, GCT, and GCT balance between left and right feet. VO₂ and the respiratory exchange ratio (RER) were monitored continuously, and the average VO₂ and RER over the last minute of the 5 minute stages was used for determining caloric cost. Caloric unit cost (kcal·kg⁻¹·km⁻¹) was calculated for the stage determined to be just below the LT (prior to >4mmol/L), and the relationship between this measure of

RE was correlated with cadence, GCT, and GCT imbalance by Pearson correlations. **Results:** The average $\text{VO}_{2\text{max}}$ among the runners was $68.6 \pm 4.9 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ and $59.3 \pm 1.1 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, and the average LT was $80 \pm 8\%$ and $83 \pm 5\%$ $\text{VO}_{2\text{max}}$ for men and women, respectively. The relationship between RE at the LT and the measured running dynamics is displayed in Table 1. There was a very strong, positive correlation between GCT imbalances and the caloric cost of running. **Conclusion:** GCT imbalances were a stronger determinant of RE than GCT or cadence. Future research should determine how to improve GCT imbalances and if doing so can improve economy and performance.

Table 1. Relationship between running dynamics and running economy				
		Cadence	GCT	GCT Imbalance
Caloric Cost $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{km}^{-1}$	Pearson Correlation	-.454	.492	.874*
	Sig. (2-tailed)	.161	.124	<.001
	N	11	11	11
GCT = Ground Contact Time; * $p < 0.001$				

2881 Board #3 May 31 3:15 PM - 5:15 PM
Reactive Strength And Leg Stiffness Correlates Running Economy In Well-Trained Long Distance Runners

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 (No relevant relationships reported)

Purpose: Neuromuscular factors play critical role in running economy (RE), the present study was to investigate the relationship between leg stiffness, relative maximal strength, Counter movement jump height (CMJ), drop jump height (DJ), reactive strength index (RSI) and RE.

Methods: Twenty-eight male long-distance runners (23.1 ± 3.8 years; BMI: $20.5 \pm 2.6 \text{ kg} \cdot \text{m}^{-2}$; $\text{VO}_{2\text{max}}$: $66.4 \pm 7.0 \text{ mlO}_2 \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$) were participated in this study. Each subject performed two-day test including 12, 14 and 16 km $\cdot \text{h}^{-1}$ RE test, 1RM back squat test, CMJ and DJ test on the first day, and performed leg stiffness measurement using three-dimensional (3D) motion capture experiments on the second day. The data were analyzed using Pearson correlation coefficients.

Results: A statistically significant negative correlation was found between DJ and 16 km $\cdot \text{h}^{-1}$ RE ($r = -0.67$, $p < 0.01$). RSI was related to RE at 14 and 16 km $\cdot \text{h}^{-1}$ speeds ($r = -0.72$ and -0.76 , $p < 0.01$, respectively). In addition, there were a significant negative correlations ($r = -0.81$ and -0.84 , $p < 0.01$, respectively) observed between leg stiffness and RE at 14 and 16 km $\cdot \text{h}^{-1}$ speeds. There were no significant correlations between relative maximal strength, CMJ and RE.

Conclusions: The present data highlight that reactive strength and leg stiffness maybe most important neuromuscular factors related to the better RE. Strength training such as heavy resistance training and plyometric exercises should be considered as a component to neuromuscular function for developing RE in long-distance runners.

2882 Board #4 May 31 3:15 PM - 5:15 PM
Cardiometabolic and Perceptual Responses to Maximal Exercise: Comparing Graded Walking to Ungraded Running

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 (No relevant relationships reported)

Graded exercise testing for determination of aerobic capacity can be conducted in numerous ways with treadmill testing representing the primary modality. Achieving maximal effort on a treadmill can be accomplished by increasing speed and/or grade. Research to date comparing graded walking maximal tests to ungraded running tests is limited. **Purpose:** Compare the cardiometabolic responses to two treadmill-based maximal tests, namely graded walking and ungraded running. **Methods:** 20 healthy participants (11 females, 9 males; mean BMI = 25; mean age = 24) completed two counterbalanced cardiometabolic exercise tests. The WALK trial started with a brisk and comfortable walking speed and increased grade by 2% every minute until exhaustion and the RUN trial started with a comfortable walking speed and increased by 0.5 mph every minute until exhaustion. Expired gases, HR, overall RPE (RPE-O), and legs only RPE (RPE-L) were assessed during the test. **Results:** Data was analyzed using dependent t-tests. The RUN and WALK trials produced similar maximal values for RPE-O, RPE-L, and VO_2 (all p-values > 0.05; all ES values < 0.2), though HR was significantly higher in the RUN trial ($p < 0.05$; ES = 0.4), and RER was significantly higher in the WALK trial ($p < 0.01$; ES = 0.8). **Conclusions:**

Findings indicate that both walk-based and run-based exercise tests produce similar perceptual responses that indicate maximal effort, and similar $\text{VO}_{2\text{max}}$ values despite very different approaches to creating intense work. The observed difference in HR suggests that a run-based maximal exercise test produces a greater cardiovascular response, while the higher RER value within the walk-based maximal exercise test suggests greater metabolic acidosis. Results support treadmill exercise testing as a flexible multiple assessment modality.

2883 Board #5 May 31 3:15 PM - 5:15 PM
Effects of Marathon Training on Maximal Aerobic Capacity and Running Economy in Experienced Marathon Runners

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 (No relevant relationships reported)

Maximal aerobic capacity ($\text{VO}_{2\text{max}}$) and running economy (RE) are markers of running performance. A valid evaluation of RE may occur through allometric scaling of body mass (alloVO_2 ; $\text{ml} \cdot \text{kg}^{-0.66} \cdot \text{min}^{-1}$), energy cost (EC; $\text{kcal} \cdot \text{kg}^{-1} \cdot \text{km}^{-1}$), or percent of $\text{VO}_{2\text{max}}$ ($\%\text{VO}_{2\text{max}}$). Little is known about physiological changes that occur in competitive runners over a marathon training cycle. The VDOT score, incorporating $\text{VO}_{2\text{max}}$ and RE, enables comparison of race performances under different temperature conditions. **Purpose:** To determine whether $\text{VO}_{2\text{max}}$ and measures of RE change with marathon training; to evaluate the relationship between these variables and VDOT. **Methods:** Eight runners (age 34 ± 2 years; marathon <3:00 males, <3:30 females; five females) completed treadmill marathon-intensity-effort (MIE) and $\text{VO}_{2\text{max}}$ tests at 10 and 1-2 weeks pre-marathon. Body composition ($\%\text{BF}$) was determined using hydrostatic weighing. Paired t-tests were used to compare pre- and post-training values. The alpha level for significance was set at 0.05. **Results:** Body fat decreased from $18.7 \pm 1.5\%$ to $16.7 \pm 1.6\%$, $\text{VO}_{2\text{max}}$ increased from 51.6 ± 2.4 to $63.9 \pm 1.1 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, and $\%\text{VO}_{2\text{max}}$ during the MIE decreased from 82.1 ± 2.0 to $72.3 \pm 3.2\%$ ($p < 0.05$ for all). VDOT was significantly associated with alloVO_2 ($r = -0.779$, $p = 0.039$) but not with $\text{VO}_{2\text{max}}$ ($r = 0.071$, $p = 0.867$). **Conclusions:** Experienced competitive runners may increase $\text{VO}_{2\text{max}}$ and decrease $\%\text{BF}$ after a marathon-specific training cycle. The decrease in $\%\text{VO}_{2\text{max}}$ in a MIE is likely due to a higher $\text{VO}_{2\text{max}}$, as other measures of RE did not change significantly. In this cohort, alloVO_2 was negatively related to race performance.

2884 Board #6 May 31 3:15 PM - 5:15 PM
The Influence of AlterG Treadmill Training on Cardiorespiratory Performance in Cross Country Runners

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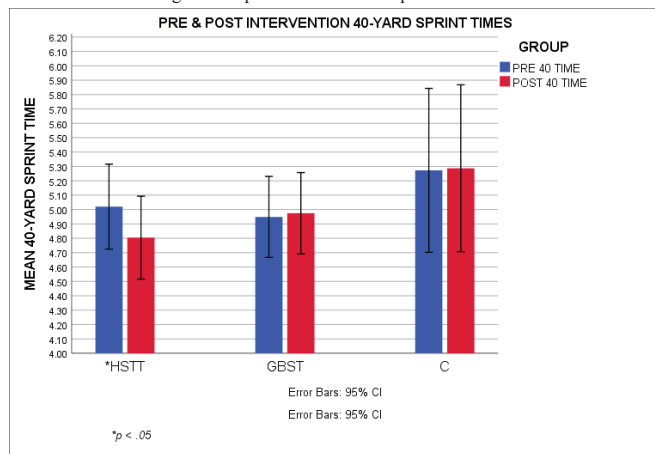
Running on an AlterG® Treadmill (AGT) at reduced bodyweight allows runners to aerobically train with reduced orthopedic stress. However, to maintain the training stimulus, the speed must be increased if heart rate (HR) response is to match overground running. This allows one to run at faster speeds for longer durations, without increasing impact forces or HR intensity beyond typical training. Yet it is unknown how this speed intensity chronically influences cardiorespiratory performance. **Purpose:** Investigate the effect of an AGT training program on cardiorespiratory performance. **Methods:** As an offseason supplement, 19 healthy uninjured high school boy cross country runners replaced 2 overground running sessions/week for 6 weeks with AGT runs at 80-85% of bodyweight. Speed was increased to elicit a HR intensity and distance/time consistent with each runner's mile pace for that day. Pulmonary gas exchange and HR data were collected during treadmill graded exercise tests (GXT) at pre and post AGT training program. Paired t-test were used to assess pre-post changes in cardiorespiratory and HR variables from the GXT ($p < 0.05$). **Results:** The mean speed of AGT runs was $9.0 \pm 0.5 \text{ mph}$ at a mean distance of $4.2 \pm 0.6 \text{ miles}$. The mean of the fastest speed for each runner was $9.8 \pm 0.6 \text{ mph}$ (range 8.6-11.4) at a mean run time of $27.6 \pm 8.4 \text{ min}$. (range 16-40 minutes). HR [$180 \pm 9 \text{ vs. } 167 \pm 10 \text{ bpm}$] significantly decreased while oxygen uptake remained unchanged [$46.6 \pm 3.6 \text{ vs. } 47.0 \pm 3.2 \text{ ml/kg/min}$] at the anaerobic threshold (AT) post AGT training. However, peak oxygen uptake [$60.8 \pm 6.4 \text{ vs. } 62.7 \pm 5.0 \text{ ml/kg/min}$], peak minute ventilation [$124.7 \pm 22.6 \text{ vs. } 132.2 \pm 24.9 \text{ L/min}$], and peak respiratory frequency [$61 \pm 10 \text{ vs. } 64 \pm 11 \text{ breaths/min}$] significantly improved post AGT training, while peak HR remained unchanged [$196 \pm 20 \text{ vs. } 192 \pm 12 \text{ bpm}$]. **Conclusion:** AGT training with reduced bodyweight at faster speeds had little influence on cardiorespiratory performance variables occurring at lower levels of

intensity (AT). However, all peak cardiorespiratory performance variables at higher levels of intensity improved, likely due to training at faster than normal speeds. This would benefit runners by allowing training to occur with reduced orthopedic loading at typical HR intensities, and yet still concurrently improve peak cardiorespiratory performance.

2885 Board #7 May 31 3:15 PM - 5:15 PM
High-Speed Treadmill vs Ground-Based Training for Sprint Speed Among College Athletes

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 (No relevant relationships reported)

Introduction: Practitioners often debate as to which speed-training method is most effective for improving speed. Ground-Based Speed Training (GBST) has been the predominant method, however with technological advances, High Speed Treadmill Training (HSTT) has been implemented and used (Hauschildt, 2010; Jerome-Koral, Herrera, & Millet, 2018; Johnson, Eastman, Feland, Mitchell, Mortensen, & Egget, 2013; Ross et al., 2009). **Purpose:** This study compared HSTT and GBST for improving speed and reducing 40-yard sprint times among collegiate athletes. **Methods:** Twenty-one collegiate football and baseball players were randomly assigned to HSTT ($n = 7$), GBST ($n = 7$) or control group ($n = 7$). Experimental groups completed 8 specialized training sessions 2 times a week for 4 weeks. HSTT group trained using PerformX Tred-X30 high-speed treadmill in each session with inclines of 5% to 30%. GBST group performed sprints that involved resisted and assisted training modalities: tow sled, uphill running, partner runs and downhill running. **Results:** Pre-test 40-yard sprint-time scores indicated no significant difference between groups prior to intervention ($F(2,18) = 1.059, p = .367, \eta^2 = .105$). Post-intervention indicated there was a 19.3% difference in times between the three groups ($F(2,18) = 2.152, p = .145, \eta^2 = .193$). HSTT group exhibited a significant difference among pre-intervention 40-yard sprint time ($M = 5.02, SD = .320$) to post-intervention ($M = 4.80, SD = .312$), $t(6) = 5.418, p = .002$ while GBST group did not; pre-intervention ($M = 4.95, SD = .305$) to post-intervention ($M = 4.97, SD = .306$), $t(6) = -0.488, p = .67$. **Conclusions:** HSTT group increased linear speed and decreased sprint times over GBST and control groups. HSTT may be an effective way to improve sprint speed for times over various distances in a shorter period of training time than GBST and these improvements can be transferred to collegiate and professional athletic performance.



2886 Board #8 May 31 3:15 PM - 5:15 PM
Correction Factor to Improve the Accuracy of Iso-Efficient Treadmill Velocity During Inclined Treadmill Running

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 (No relevant relationships reported)

As inclined treadmill running becomes more popular among trained runners, the ability to maintain a metabolic iso-efficient velocity has gained importance. Treadmill velocity (TMV) for a specific incline and intensity can be determined by solving the ACSM running equation for speed as opposed to relative $\dot{V}O_2$, but this may underestimate iso-efficient TMV in trained runners as they may respond to speed and grade differently from the general population. **Purpose:** The purpose of this study was to identify

an appropriate correction factor to improve iso-efficient TMV identification during inclined running in trained runners. **Methods:** 11 collegiate distance runners (7 male, 4 female; 63.2 ± 9.5 kg; 174.8 ± 7.5 cm; 64.6 ± 6.5 mlO₂/kg/min) completed three 4-min treadmill runs at 0%, 4%, and 8% incline with a 4 min recovery period between runs. Expired gases were collected during the final minute of each run to determine relative $\dot{V}O_2$. Actual TMV at 0% was inserted into the ACSM running equation to determine predicted $\dot{V}O_2$ for the 0% run [$\dot{V}O_{2p} = (S \times 0.2) + (S \times G \times 0.9) + 3.5$]. That value was then divided by the actual $\dot{V}O_2$ measured at 0% to develop a correction factor. TMV for the 4% and 8% trials was determined by inserting the measured 0% $\dot{V}O_2$ value into the ACSM equation [$S = (\dot{V}O_2 - 3.5) / (0.2 + 0.9G)$] and multiplying the resultant velocity by the correction factor to maintain iso-efficiency. Differences within 0%, 4%, and 8% values were assessed using a paired sample t-test, while a one-way ANOVA compared $\dot{V}O_2$ values between grades ($p < 0.05$). **Results:** Actual $\dot{V}O_2$ at 0% grade was 15% lower than predicted by the ACSM equation (55.2 ± 2.7 vs. 46.8 ± 5.0 mlO₂/kg/min; $p < 0.05$), resulting in a correction factor of 1.2 ± 0.1 . Predicted TMV at 4% (183.6 ± 21 m/min) and 8% (159.3 ± 18.3 m/min) was 18% lower ($p < 0.05$) than the corrected velocities for each grade (216.9 ± 2 and 188.2 ± 10.4 m/min). $\dot{V}O_2$ values for each grade were 46.8 ± 5 , 46.6 ± 4.8 , and 48.0 ± 4.9 mlO₂/kg/min, respectively, with the 8% $\dot{V}O_2$ being greater than 4% ($p < 0.05$). **Conclusion:** The ACSM running equation may underestimate TMV when attempting to maintain metabolic iso-efficiency during incline running. These data suggest that application of a correction factor to the TMV derived from the ACSM equation may provide a closer approximation of TMV to maintain iso-efficiency during incline running.

F-36 Free Communication/Slide - Energy Balance-Weight Control

Friday, May 31, 2019, 3:15 PM - 5:15 PM
 Room: CC-105A

2887 Chair: Edward L. Melanson, FACSM. University of Colorado Denver, Denver, CO.

(No relevant relationships reported)

2888 May 31 3:15 PM - 3:30 PM
Randomized Trial Examining the Effect of a 12-week Exercise Program on Eating Behaviors

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Overeating and emotional eating can lead to weight gain. While exercise may help protect against weight gain, the mechanisms through which exercise aids in weight control are poorly understood. **PURPOSE:** This efficacy trial tests the hypothesis that exercise training impacts eating behaviors, specifically through a reduction in overeating and internal disinhibition (the tendency to eat in response to cognitive or emotional cues), in a sample of women who are overweight or obese. **METHODS:** Participants were inactive at baseline and self-identified as 'stress eaters' (eating more than usual when 'moderately' or 'extremely' stressed). They were randomized to 12 weeks of exercise training (EX) or to a no-exercise control (CON). EX participants were given an exercise goal of 200 min/wk of combined supervised and home-based exercise (30% supervised; home-based exercise was confirmed via accelerometry). No dietary instructions were provided to any participants. Assessments occurred at baseline and 12 weeks. Overeating episodes were measured over 14 days at each assessment using ecological momentary assessment (EMA; 5 surveys/day delivered randomly via smartphone). Internal disinhibition was assessed questionnaire. **RESULTS:** 39 participants (EX: $n = 19$, CON: $n = 20$) completed the study (age: 40.8 ± 10.3 years BMI: 31.6 ± 3.9 kg/m²). Adherence to the exercise intervention was high (99.4% of all prescribed exercise was confirmed via accelerometry) and 12-week weight change did not differ by condition (EX: $-1.1 \pm 3.5\%$ vs. $0.4 \pm 2.0\%$, $p = 0.11$). At week 12, the proportion of eating episodes that were characterized as overeating episodes was 18.4% in EX vs. 24.5% in CON ($p = .01$). The odds of an overeating episode were lower in EX relative to CON and became more pronounced over time (condition*time = $-.005$, SE = $.002$, $p = .01$). Specifically at week 12, the odds of having an overeating episode among EX participants was 0.58 times the odds of having an overeating episode within CON's. Internal disinhibition decreased in EX (pre: 4.1 ± 2.2 , post: 2.8 ± 1.8), but not CON (4.3 ± 2.6 to 4.2 ± 2.3 , $p = .02$). **CONCLUSIONS:** Exercise

training reduced the likelihood of overeating, and eating in response to emotional or cognitive cues, in women who self-identified as stress eaters. Thus, this may be one pathway by which exercise impacts body weight.

2889 May 31 3:30 PM - 3:45 PM

Compensatory Reduction in Non-Exercise Energy Expenditure Among Weight-Stable Overweight and Obese Adults

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(No relevant relationships reported)

PURPOSE: Increasing total daily energy expenditure is a critical component of weight management strategy. There is disagreement as to a potential compensatory reduction in non-exercise energy expenditure that could blunt the anticipated increase in total daily energy expenditure (TDEE) resulting from exercise participation. The purpose of the present study was to examine the effect of varying doses of exercise energy expenditure (EE_{ex}) on TDEE and non-exercise energy expenditure when body weight is maintained. **METHODS:** Seventy healthy, but overweight or obese, young adult women and men participated in a 26-week exercise intervention. Based on the individual daily EE_{ex}, participants were stratified into tertiles (T1, T2, T3) of increasing EE_{ex}. Paired sample t-tests determined significant within-tertile differences between pre/post data for each variable. Linear regression models, adjusted for age, sex and race, determined the significance of changes over time in selected variables. **RESULTS:** Average daily EE_{ex} was different among tertiles (39.9±9.7, 175.5±9.8, 282.9±9.8 kcal, respectively; $p<0.001$). No main effect of tertile was found for change in sedentary activity EE (p=0.228), moderate/vigorous EE (p=0.698), or TDEE (p=0.762). A negative main effect of tertile was found for a change in light activity EE (p=0.016) and for non-exercise energy expenditure (p=0.012), with a greater decrease in non-exercise energy expenditure in T3 (p=.009). **CONCLUSION:** These data indicate that, when body weight is maintained, participation in the exercise program resulted in a compensatory reduction in light and non-exercise moderate/vigorous energy expenditure, as well as a less-than-expected increase in TDEE. These findings suggest that maintenance of non-exercise energy expenditure is critical for correctly estimating the caloric deficit anticipated from participation in exercise as part of a weight loss program. Supported by an unrestricted grant from the Coca Cola Company.

2890 May 31 3:45 PM - 4:00 PM

The Effects of Steady State and High Intensity Exercise on Compensatory Eating Behaviors and Appetite

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Exercise is often prescribed for weight control; however, it is not uncommon that weight loss is less than expected. Unexpected results may be influenced by compensatory eating behaviors following exercise. **PURPOSE:** The aim of this study was to examine differences in eating behaviors after steady state (SS) and high intensity (HI) active females. **METHODS:** Nine, recreationally active college-aged females participated in this study. Prior to testing, subjects completed a VO_{2max} test to individualize exercise. Subjects completed three trials in a randomized order: control (CON), HI exercise, or SS exercise. Each trial took place during the first week of the luteal phase of their menstrual cycle. During the CON trial, subjects remained seated for 30 minutes. During SS, subjects ran on a treadmill at 70% VO_{2max} for 33 minutes. During the HI, trial subjects ran on a treadmill at 90% VO_{2max} for 1 minute then 50% VO_{2max} for 1 minute for 34 minutes. Food intake was recorded 24 hours before and up to 72 hours after each trial. Resting metabolic rate (RMR) was measured prior to and 24, 48, and 72 hours following each trial. A visual analog scale was used to assess appetite before and immediately following each trial. **RESULTS:** Caloric expenditure was higher during SS (302.78±28.40kcal) and HI (278.39±24.94kcal) compared to CON (68.10±2.94kcal) ($p<0.001$); however, no differences existed between exercise trials ($p=0.53$). Caloric intake was not different ($p=0.82$) between SS (1505.56±135.41kcal), HI (1562.67±118.91kcal), and CON (1485.89±136.52kcal) 24 hours post exercise. Differences in caloric intake were not observed 48 ($p=0.42$) and 72 hours ($p=0.60$) post exercise. There were no differences ($p=0.55$) in RMR 24 hours after SS (1598.98±197.80 kcal), HI (1426.57±66.23 kcal), or CON (1430.83±68.93 kcal). Differences were not observed ($p=0.72$) in change in appetite following SS (2.89±7.13 mm), HI (8.22±10.57 mm), and CON (0.11±3.74 mm). **CONCLUSION:** Caloric intake and RMR were not different after SS or HI exercise. Appetite did not significantly change after exercise though large individual variability was observed; the

largest change in appetite was observed following HI exercise. Compensatory eating may be highly individualistic and appetite following exercise should be considered further, particularly following HI exercise.

2891 May 31 4:00 PM - 4:15 PM

The Energy Cost Of Sitting versus standing In Man.

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(No relevant relationships reported)

Abstract

PURPOSE: Prolonged sitting is a major health concern, targeted via government policy and the proliferation of height-adjustable workstations and wearable technologies to encourage standing. Such interventions have the potential to influence energy balance and thus facilitate effective management of body/fat mass. It is therefore remarkable that the energy cost of sitting *versus* standing *naturally* remains unknown. **METHODS:** Metabolic requirements were quantified via indirect calorimetry from expired gases in 46 healthy men and women (age 27±12 y, mass 79.3±14.7 kg, body mass index 24.7±3.1 kg·m⁻², waist:hip 0.81±0.06) under basal conditions (i.e. resting metabolic rate; RMR) and then, in a randomized and counterbalanced sequence, during lying, sitting and standing. Critically, no restrictions were placed on natural/spontaneous bodily movements (i.e. fidgeting) to reveal the fundamental contrast between sitting and standing *in situ* whilst maintaining a comfortable posture. **RESULTS:** The mean [95% CI] increment in energy expenditure was 0.18 [0.06 to 0.31] kJ·min⁻¹ from RMR to lying, 0.15 [0.03 to 0.27] kJ·min⁻¹ from lying to sitting and 0.65 [0.53 to 0.77] kJ·min⁻¹ from sitting to standing. The observed energy cost of each posture above basal metabolic requirements exhibited marked inter-individual variance, which was inversely correlated with resting heart rate for all postures ($r=-0.5$ [-0.7 to -0.1]) and positively correlated with self-reported physical activity levels for lying ($r=0.4$ [0.1 to 0.7]) and standing ($r=0.6$ [0.3 to 0.8]). **CONCLUSION:** Interventions designed to reduce sitting typically encourage 30-120 min·d⁻¹ more standing *in situ* (rather than perambulation), so the 12 % difference from sitting to standing reported here does not represent an effective strategy for the treatment of obesity but may have a role in primary prevention by maintaining long-term energy balance.

2892 May 31 4:15 PM - 4:30 PM

Change in Visceral Adiposity with a 12-Month Behavioral Weight Loss Intervention with Varying Doses of Physical Activity: The Heart Health Study

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(No relevant relationships reported)

Visceral adipose tissue (VAT) is considered to have biochemical characteristics that influence several pathophysiological processes of the body and high levels are associated with increased risk for metabolic syndrome, cardiovascular disease, and certain cancers. There is data to suggest that supervised aerobic exercise may reduce VAT in the absence of caloric restriction.

PURPOSE: To examine whether VAT is reduced within the context of a comprehensive weight management program, varied by prescribed levels of home-based moderate-to-vigorous physical activity (MVPA) in adults who were overweight or obese across 12 months.

METHODS: Data were examined from sedentary adults (N=309; BMI: 32.3±3.8 kg/m²; age=45.1±7.9 years) enrolled in a behavioral program and randomized to a reduced calorie diet (DIET, N=107), diet plus a moderate dose of MVPA (MOD-EX, N=101), or diet plus a high dose of MVPA (HIGH-EX, N=101). All groups received weekly intervention sessions in months 1-6 followed by 2 group and 2 telephone contacts per month in months 7-12, and were prescribed a diet to reduce energy intake (1200-1800 kcal/day). MOD-EX was prescribed unsupervised MVPA that progressed to 150 min/wk, whereas HIGH-EX was progressed to 250 min/wk. Body composition and VAT were measured by DXA (GE Lunar iDXA, CoreScan) along with weight at 0, 6 and 12 months.

RESULTS: Weight significantly decreased in all groups at 6 months (DIET: -9.0±5.9 kg, MOD-EX: -10.2±6.4 kg, HIGH-EX: -9.4±5.3 kg; $p<0.001$) and 12 months (DIET: -10.0±8.3 kg, MOD-EX: -11.1±8.1 kg, HIGH-EX: -9.7±6.9 kg; $p<0.001$), with no significant difference between groups. A similar pattern was observed for percent body fat (Baseline: 43.3±5.5%, 6-month: 38.3±7.0%, 12-month: 37.7±7.6%; $p<0.001$) with

no difference between groups. VAT decreased across time (Baseline: $1518 \pm 907 \text{ cm}^3$, 6-month: $1018 \pm 617 \text{ cm}^3$, 12-month: $971 \pm 648 \text{ cm}^3$; $p < 0.001$) with no difference between groups.

CONCLUSIONS: The interventions were successful at reducing body weight and improving body composition in adults with obesity. The lack of additional weight loss, reductions in body composition and VAT with participation in MVPA at two different doses may suggest that there is a compensatory response in factors influencing energy balance that warrant further investigation. Supported by: NIH (R01 HL103646)

2893 May 31 4:30 PM - 4:45 PM

Impact of Intermittent Fasting on Energy Balance and Associated Health Outcomes in Lean Adults

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(No relevant relationships reported)

PURPOSE: To establish the effects of a diet combining intermittent fasting (IMF) with calorie restriction on energy expenditure and metabolic health, and to isolate the relative contributions of fasting and negative energy balance to any observed effects. **METHODS:** After a 4-week control phase, 36 lean adults (mean \pm SD; age = 42 ± 11 y, BMI = $23.9 \pm 2.1 \text{ kg/m}^2$) were randomised to one of three conditions for 20 days; 1) daily calorie restriction (75:75; 75% of habitual intake daily), 2) IMF with calorie restriction (0:150; alternating 24-h periods of fasting and feeding to 150% of habitual intake), 3) IMF without calorie restriction (0:200; alternating 24-h periods of fasting and feeding to 200% of habitual intake). In the IMF groups, transitions from feeding to fasting and vice versa occurred at 15:00 each day. In addition to free-living measures of energy intake (weighed record) and physical activity (combined heart rate/accelerometry), body composition (DEXA), metabolic rate and substrate oxidation (indirect calorimetry), fasted health markers and postprandial metabolic responses were measured at pre- and post-intervention.

RESULTS: Energy intake was reduced in the two energy-restricted groups (75:75 = $-2602 \pm 904 \text{ kJ/d}$, 0:150 = $-2105 \pm 1105 \text{ kJ/d}$; $p = 0.24$) and maintained by 0:200 ($+63 \pm 1439 \text{ kJ/d}$; $p < 0.01$ v 75:75, $p < 0.01$ v 0:150), a pattern mirrored by changes in body mass (75:75 = $-1.9 \pm 1.0 \text{ kg}$, 0:150 = $-1.6 \pm 1.1 \text{ kg}$, 0:200 = $-0.5 \pm 1.1 \text{ kg}$; $p = 0.46$ 75:75 v 0:150, $p = 0.01$ 75:75 v 0:200, $p = 0.04$ 0:150 v 0:200). However, the decrease in fat mass with 75:75 ($-1.8 \pm 0.8 \text{ kg}$) was greater than the decrease accompanying 0:150 ($-0.8 \pm 0.9 \text{ kg}$, $p = 0.01$ v 75:75), both of which differed from the stability seen following 0:200 ($-0.1 \pm 0.7 \text{ kg}$, $p < 0.01$ v 75:75, $p = 0.05$ v 0:150). Furthermore, physical activity energy expenditure decreased following 0:150 when compared to 0:200 (0:150 = $-410 \pm 707 \text{ kJ/d}$, 0:200 = $+247 \pm 594 \text{ kJ/d}$; $p = 0.07$) but was unaffected by 75:75 ($+4 \pm 527 \text{ kJ/d}$; $p = 0.24$ v 0:150, $p = 0.31$ v 0:200). Despite these differences, metabolic rate, substrate oxidation, fasting biochemistry and postprandial metabolism were all unaffected.

CONCLUSIONS: In lean adults, restricting calories through a complete alternate-day approach to IMF attenuated reductions in fat mass and prompted declines in physical activity, whilst metabolic health was unaffected.

2894 May 31 4:45 PM - 5:00 PM

Changes In Health-related Quality Of Life In A 12-month Behavioral Weight Loss Intervention: The Heart Health Study

Katherine A. Collins, Renee J. Rogers, John M. Jakicic, FACSM. University of Pittsburgh, Pittsburgh, PA. (Sponsor: John Jakicic, FACSM)

(No relevant relationships reported)

Overweight and obesity have been shown to adversely affect health-related quality of life (HRQOL). HRQOL has been shown to improve with weight loss. However, it is important to examine whether physical activity in conjunction with weight loss has an added benefit for improvement in HRQOL. **PURPOSE:** To examine whether HRQOL improves with a lifestyle intervention for weight loss with varying doses of moderate-to-vigorous physical activity (MVPA) in adults who are overweight or obese. **METHODS:** Participants ($N = 270$; age = 45 ± 7.95 years; BMI = $32.2 \pm 3.7 \text{ kg/m}^2$) engaged in a 12-month behavioral weight loss intervention. Participants were randomized to reduced calorie diet (DIET; $N =$), diet plus 150 min/week MVPA (DIET+PA150; $N =$), or diet plus 250 min/week MVPA (DIET+PA250; $N =$). All groups received weekly in-person intervention sessions for months 1-6, with combined in-person and telephonic sessions for months 7-12. Diet was prescribed at 1200-1800 kcal/day. Assessment of body weight and HRQOL (SF-36) were measured at baseline, 6 months, and 12 months. **RESULTS:** Weight significantly decrease in all groups at

12 months (DIET: $-9.2 \pm 5.8 \text{ kg}$, DIET+PA150: $-10.2 \pm 6.4 \text{ kg}$, DIET+PA250: $-9.5 \pm 5.4 \text{ kg}$; $p < 0.001$) with no significant difference between groups. There were significant improvements in HRQOL components of physical function, energy and fatigue, and change in health (Table); however, these did not differ by group. There were no significant changes in social function, mental health, pain, and general health. **CONCLUSION:** The addition of moderate or higher levels of physical activity to an energy restricted diet for weight loss did not improve quality of life compared to the diet alone. These results demonstrate the positive benefits that weight loss may have on HRQOL regardless of whether physical activity is included as a component of the intervention. (Supported by: NIH (R01 HL103646))

2895 May 31 5:00 PM - 5:15 PM

Reductions in Energy Expenditure After Aerobic and Resistance Exercise in Resistance-trained Males

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to examine the effects of exercise mode and intensity on energy expenditure (EE) during and after five time-matched aerobic and resistance exercise protocols in resistance-trained (RT) males. **METHODS:** Fourteen RT males (mean \pm SD; age: 24.2 ± 4.0 yrs; body mass: $84.7 \pm 13.3 \text{ kg}$; height: $181.2 \pm 8.8 \text{ cm}$; and body fat: $15.9 \pm 4.6\%$) completed five separate protocols on separate days ≥ 48 hrs apart in random order, each lasting 40 min in duration: continuous aerobic (continuous), high intensity interval aerobic (HIIT), strength endurance (2x20), traditional resistance (3x10), and high intensity resistance (4x6). EE was measured before, during, immediately post- (0-30 min), and delayed post-exercise (60-90 min) using indirect calorimetry. **RESULTS:** No significant differences in exercise EE were seen between aerobic protocols. EE during both aerobic protocols was significantly greater ($p < 0.0001$) than any of the three resistance protocols. EE during 4x6 was significantly greater than 3x10 and 2x20 by $38 \pm 10 \text{ kcal}$ ($p = 0.04$) and $67 \pm 8 \text{ kcal}$ ($p < 0.001$), respectively. From 0-30 min post-exercise, a mean increase in EE of 6.2% was seen only following the 2x20 protocol as compared to baseline pre-exercise ($p < 0.05$). From 60-90 min post-exercise, the 3x10, 4x6, and HIIT protocols showed significant mean reductions in EE of 10.7%, 8.7%, 7.1% ($p < 0.05$) as compared to baseline pre-exercise, respectively. The combined EE from during and after exercise resulted in the same rank order as during exercise (least to greatest: 2x20, 3x10, 4x6, continuous, and HIIT). **CONCLUSIONS:** Significant reductions in EE were found in the 3x10, 4x6, and HIIT protocols from 60-90 min post-exercise as compared to baseline pre-exercise. Continuous and HIIT protocols had the greatest EE during exercise when compared to the resistance protocols. These results have important implications on EE during and after exercise and should be considered when designing exercise training programs. Given the reductions found in EE 60-90 min post-exercise in the 3x10, 4x6, and HIIT protocols, special consideration should be given to post-exercise nutrition to avoid energy deficits which could negatively impact recovery. Supported by an ASPIRE I Grant from the University of South Carolina.

F-37 Free Communication/Slide - Immunology

Friday, May 31, 2019, 3:15 PM - 4:45 PM
Room: CC-105B

2896 Chair: Kyle Timmerman, FACSM. *Miami University, Oxford, OH.*

(No relevant relationships reported)

2897 May 31 3:15 PM - 3:30 PM

Cytokine Response to Traditional and Cluster Sets in Resistance-trained Women

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(No relevant relationships reported)

Resistance exercise that incorporates intra-set rest between repetition blocks (i.e., cluster sets [CS]) can produce a smaller metabolic stress and endocrine response than traditional sets (TS). **PURPOSE:** To examine the effect of CS on the acute cytokine response in resistance trained women. **METHODS:** 12 resistance-trained women (mean \pm SE; 23.7 \pm 1.1 years; 160.1 \pm 1.5 cm; 62.5 \pm 1.7 kg; 5 \pm 1 years training) completed 3 sessions in the follicular phase. One-repetition maximum (1RM) back squat (BS) (98.7 \pm 4.1 kg), and BS:body mass (1.6 \pm 0.1) were determined in Session 1. For Session 2 (3 days post Session 1) and Session 3 (7 days post Session 2), subjects were randomly assigned to either 4 sets of 10 reps with 120 seconds (s) inter-set rest (TS) or 4 x (2 x 5 reps) with 30s intra-set rest and 90s inter-set rest (CS). All performed both protocols at 70% 1RM BS. Instructions were to perform every rep "as explosively as possible". Blood was collected pre-exercise (PRE), immediately after sets 1, 2, 3, 4 (IP), and at 5 (+5), 15 (+15), 30 (+30), and 60 (+60) min post-exercise and analyzed for interleukin (IL)-1 β , IL-2, IL-6, IL-8, IL 10, and IL-15. Data were analyzed using repeated measures ANOVAs (2 \times 9). **RESULTS:** A significant main effect of time ($p < 0.05$) was found for IL-1 β , IL-2, IL-8, IL-10, and IL-15. Concentration of IL-1 β was smaller at +5 (3.9 \pm 0.4 ng/mL), +15 (3.6 \pm 0.4) +30 (3.5 \pm 0.3), and +60 (3.7 \pm 0.4) compared to IP (4.1 \pm 0.4). IL-2 was greater after set 1 (10.8 \pm 1.0 ng/mL), and set 2 (11.0 \pm 1.2) compared to PRE (10.2 \pm 1.0), and smaller at +30 (9.9 \pm 1.0) compared to IP (11.0 \pm 1.0). IL-8 was greater after set 1 (8.4 \pm 0.6 ng/mL), set 2 (8.6 \pm 0.7), and set 3 (8.5 \pm 0.7) compared to PRE (8.0 \pm 0.6). IL-10 was smaller at +30 (31.3 \pm 7.4 ng/mL) compared to PRE (34.0 \pm 7.4), and also smaller at +15 (32.6 \pm 7.9) +30 (31.3 \pm 7.4), and +60 (33.4 \pm 8.6) compared to IP (38.0 \pm 8.6). IL-15 was greater at IP (15.5 \pm 4.0 ng/mL) compared to PRE (13.4 \pm 3.5), and smaller at PRE (13.4 \pm 3.5), +30 (11.9 \pm 3.3), and +60 (11.6 \pm 3.2) compared to IP (15.5 \pm 4.0). No condition \times time point effects were observed. **CONCLUSIONS:** Both TS and CS induced an acute cytokine response in resistance-trained women; incorporating intra-set rest (CS) did not appear to affect this cytokine response.

Supported in part by a grant from the National Strength and Conditioning Association Foundation.

2898 May 31 3:30 PM - 3:45 PM

The Relationship between Increased Cytokine Concentrations with Body Temperature Changes

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(No relevant relationships reported)

Purpose: To identify relationships between cytokines and time spent above critical body temperatures in response to aerobic exercise in various environments. **Methods:** 12 recreationally active men (24.4 \pm 3.1 yrs; 1.81 \pm 0.07m; 81.5 \pm 8.0kg; 47.2 \pm 4.8 ml/kg/min) completed five experimental visits: a $\dot{V}O_2$ max, and a cycling trial in 23°C/45%RH, 23°C/70%RH, 34°C/20%RH and 34°C/45%RH. After supine rest, exercise conditions consisted of 60mins of cycling at 60% $\dot{V}O_{2max}$, a 15min rest, and a time to exhaustion (TTE) trial at 90% $\dot{V}O_{2max}$. Blood was obtained before exercise (PRE), after 60min cycling (60), and after TTE (90). Serum concentrations of IL-1 β , IL-1ra, IL-6, IL-10 and TNF- α were analyzed via ELISA. Participant's rectal (T_{re}) and skin temperatures (T_{sk}) at five locations: Chest, Triceps, Forearm, Thigh and Calf

were monitored continuously. Whole body temperature (T_{wb}) and T_{sk} were calculated via weighted averages. Area Under the Curve with respect to increase (AUCi) was calculated for T_{re} , T_{wb} and T_{sk} . Data were analyzed with Pearson Product Moment Correlations between AUCi for T_{re} , T_{sk} and T_{wb} with changes in cytokine concentration. Time spent above specific critical temperatures for T_{re} , T_{wb} and T_{sk} were related to changes in cytokine concentrations from PRE-60 and PRE-90 using stepwise linear regression. **Results:** Correlations were observed between TNF α PRE-60, and PRE-90 with T_{sk} ($r=0.576$ $p<0.001$; $r=0.515$ $p=0.001$, respectively) and T_{wb} ($r=0.611$ $p=0.001$; $r=0.516$ $p=0.001$, respectively) but not T_{re} . Time spent with T_{sk} above 33.5°C and 35°C were predictive of increases seen in TNF α PRE-60 ($r=0.695$, $p<0.001$). TNF α PRE-90 was related to time spent above 33.5°C for T_{sk} ($r=0.593$, $p<0.001$). Time spent with T_{wb} above 38°C was correlated to, but not predictive of increases seen in TNF α from PRE to 60 and PRE to 90 ($p=0.030$, $p=0.020$). Time spent above 38.5°C for T_{re} displayed significant correlations with increases seen in IL-6 PRE-60 ($r=0.470$, $p=0.002$). No other correlations or relationships were observed with changes in cytokine concentration and body temperature. **Conclusions:** Data indicate that changes in TNF α may be related to time spent above critical T_{sk} of 33.5°C and 35°C. Increases in IL-6 appear to be related to time spent above T_{re} of 38.5°C.

2899 May 31 3:45 PM - 4:00 PM

Exercise Suppresses Prostate Tumor Aggressiveness by Modulating Inflammatory Cytokines

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(No relevant relationships reported)

Inflammatory cytokines are thought to be at the root of prostate tumor progression. Exercise has been shown to be beneficial in men with prostate cancer (PCa), however, the impact of exercise on tumor physiology is not clearly understood. **PURPOSE:** Test the hypothesis that exercise inhibits tumor progression and modulates pro-tumorigenic cytokine concentrations in the transgenic adenocarcinoma of mouse prostate (TRAMP) model. **METHOD:** Thirty, 10-week old TRAMP mice were randomized to either voluntary wheel running (VWR) or control group. Palpable tumors and VWR activity were monitored weekly. Mice were sacrificed at 4, 8, 12 and 20-weeks to assess time point differences. Excised tumors were paraffin embedded, sectioned, and stained with hematoxylin and eosin. Sectioned tumor slides were scored by a pathologist blinded to the groups. Serum collected from mice sacrificed at the 4-week and 20-week time points were assayed in duplicate using a 32 panel Mouse Cytokine Magnetic Multiplex Assay. Analysis of variance was performed to determine significant differences between treatment groups. **RESULTS:** Control mice presented first with palpable tumors at 14 weeks of age. VWR significantly delayed the presence of palpable tumors by 5 weeks (19 weeks old; $p=0.05$). No significant pathological changes were observed as a function of time; therefore, data were pooled for analysis. A treatment effect was observed with VWR mice having significantly lower number of high-grade tumors compared to controls. Specifically, 71% of control mice had high grade tumors compared to only 17% in the VWR group ($p<0.001$). Of the 32 cytokines measured, VWR significantly lowered concentrations of tumor modulating cytokines eotaxin (pre: 1291.2 \pm 310; post: 702.2 \pm 273; $p=0.03$), IL-1 α (pre: 457 \pm 97; post: 167 \pm 161; $p=0.03$), IL-5 (pre: 4.7 \pm 0.2; post: 1.9 \pm 0.4; $p=0.001$), IL-12(p40) (pre: 16.9 \pm 1.5; post: ND; $p=0.001$) and VEGF (pre: 1.37 \pm 0.3; post: 0.31 \pm 0.3; $p=0.004$). No changes were observed in the control group. After 20 weeks, VWR group had significantly lower IL-5 (Con: 3.75 \pm 0.7; VWR: 1.9 \pm 0.4; $p=0.01$) and VEGF (Con: 1.72 \pm 0.7; VWR: 0.31 \pm 0.3; $p=0.02$) compared to controls. **CONCLUSIONS:** These results suggest VWR suppresses tumor aggressiveness by altering the inflammatory cytokine profile. Further research on mechanisms of action is needed.

2900 May 31 4:00 PM - 4:15 PM

Circulating Mcp-1 Is Not Related To Self-reported Moderate To Vigorous Physical Activity.

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(No relevant relationships reported)

PURPOSE: Monocyte chemoattractant protein-1 (MCP-1) is a key chemotactic signal which influences the recruitment and infiltration of circulating monocytes and macrophages. The purpose of this study was to examine the relationship between physical activity and circulating MCP-1 and monocytes in healthy, young adults. **METHODS:** Fourteen young (22.4 \pm 0.58 years), healthy adults were recruited for study. Subjects were asked to self-report their activity and were divided into two groups: high physical activity and moderate physical activity. Physical activity was confirmed with accelerometers (ActiGraph). A resting blood sample was collected from each subject. MCP-1 levels were analyzed via ELISA while classical (CD14+CD116-) and non-classical (CD14+CD116+) monocyte levels were analyzed via flow cytometry. **RESULTS:** Self-reported active subjects (N=9, $\dot{V}O_{2max}$: 50.3 \pm 2.7

$\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, Average Weekly MVPA: 712.7 ± 69.5 min) had higher ($p<0.05$) $\text{VO}_{2\text{max}}$ and weekly MVPA measures from the self-reported inactive group ($N=5$, $\text{VO}_{2\text{max}}$: 35.6 ± 4.2 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, Average Weekly MVPA: 548.2 ± 64.6 min). There were no significant differences observed between the self-reported active and inactive groups for MCP-1 serum concentration, classical monocyte percentage or non-classical monocyte percentage and no correlation was observed between MCP-1 and circulating monocytes subsets. Based on ActiGraph data recorded from subjects over the course of one week, the active and inactive groups were adjusted based on average weekly MVPA. The MVPA active group ($N=8$, $\text{VO}_{2\text{max}}$: 50.8 ± 2.9 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, Average Weekly MVPA: 797.9 ± 35.7 min) had higher ($p<0.05$) $\text{VO}_{2\text{max}}$ and weekly MVPA measures from the MVPA inactive group ($N=6$, $\text{VO}_{2\text{max}}$: 37.5 ± 4.2 $\text{mL}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$, Average Weekly MVPA: 462 ± 44.6 min). No significant differences in MCP-1 serum concentration, classical monocyte percentage or non-classical monocyte percentage were observed between the groups divided by MVPA level. **CONCLUSION:** Differences in MCP-1 concentration based on amount of regular physical activity may not exist in a cohort of healthy young adults. All participants, even those who did not report regular physical activity, had at least 150 minutes of MVPA as confirmed by accelerometry and not having a true physically inactive group may have influenced the results.

2901 May 31 4:15 PM - 4:30 PM

Acute Heavy Resistance Exercise Protocol Induces Significant Physiological Stress Elevating Extracellular Heat Shock Protein

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(No relevant relationships reported)

Cytoprotective protein HSP70 is important in recovery from stress and exercise, but has not been well-characterized in response to muscle damaging resistance exercise protocols.

PURPOSE: To characterize the physiological response to a high stress acute heavy resistance exercise protocol (AHREP) in blood biomarkers including extracellular HSP70 (eHSP70). **METHODS:** Healthy, resistance-trained men ($n = 10$, 24 ± 4.5 years, 176.8 ± 5.5 cm, 84.65 ± 12.78 kg, $17.6\pm 6.3\%$ body fat, 145 ± 18 kg 1RM) completed an AHREP (6×10 RM). Blood samples were collected pre-exercise (PRE), immediately post (IP), and at 15, 30, 60, 120 minutes (min) and 24, 48, 72 hours (h) post-exercise. Samples were analyzed for stress biomarkers including lactate, creatine kinase (CK), complete blood count, cytokines, and eHSP70. The results were analyzed with a rANOVA and post hoc t tests. **RESULTS:** Plasma lactate was elevated 12 fold (vs. PRE 0.880 ± 0.296 $\text{mmol}\cdot\text{L}^{-1}$) immediately after the AHREP (12.15 ± 3.19) and remained elevated (vs. PRE, $p\leq 0.0002$) at 120 min. Muscle damage was demonstrated by significantly ($p < 0.01$) elevated CK (vs. PRE 126 ± 29 $\text{IU}\cdot\text{L}^{-1}$) at 24h post-exercise (439 ± 151). CBC indicated changes in leukocyte populations that were coincident with post-exercise increases ($p<0.05$) in chemoattract cytokine IL-8 (PRE $4.77\pm 2.73\%$, IP 6.38 ± 3.53). eHSP70 levels were increased ($p<0.05$, vs. PRE 0.391 ± 0.244 $\text{ng}\cdot\text{mL}^{-1}$) at IP (0.567 ± 0.366) and 15 min post-exercise (0.515 ± 0.345). **CONCLUSIONS:** The AHREP caused significant physiological stress that coincided with increases in circulating eHSP70 that returned to baseline levels within minutes post-exercise. eHSP70 likely responds with different kinetics during resistance exercise than as has been well-characterized during aerobic exercise.

Supported by: New Faculty Start-up Funds.

2902 May 31 4:30 PM - 4:45 PM

A Single High-Intensity Exercise Bout Reduces Tumour Hypoxia in Mice.

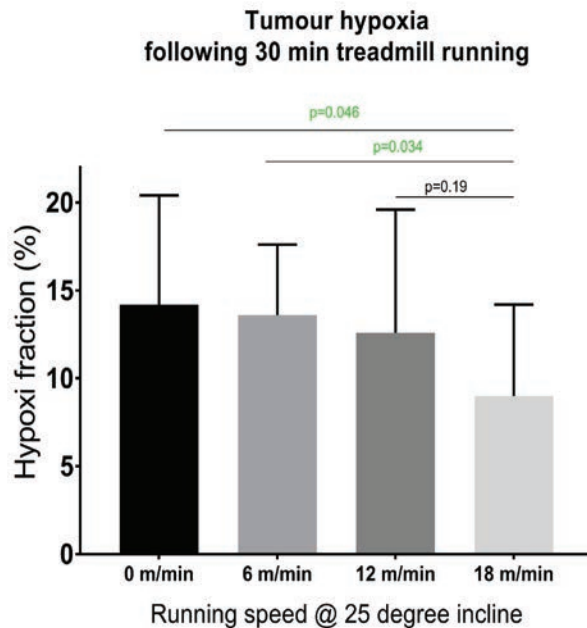
Simon Lønbro¹, Pernille Byrjalsen Elming², Thomas Wittenborn², Michael R. Horsman². ¹Aarhus University, Aarhus C, Denmark. ²Aarhus University Hospital, Aarhus C, Denmark.

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(No relevant relationships reported)

INTRODUCTION: Low blood perfusion and hypoxia are characteristic features of tumors and are factors of resistance to radiation and chemotherapy. A few rodent studies show that aerobic exercise, that has no severe side effects, may improve perfusion and reduce hypoxia but the significance of exercise intensity is unknown. **METHODS:** Female CDF1 mice were injected with the C3H mammary carcinoma in the mammary fat pad and allocated to either a Control group (no exercise) or a group performing low (6 m/min), moderate (12 m/min) or high intensity (18 m/min) treadmill running for 30 minutes ($n=11$ /group). Prior to running, all mice were injected with Pimonidazole and immediately after exercise injected with Hoechst 33342 before being sacrificed 1 minute later. Tumors were excised, and histological sections prepared. Hypoxia was determined from the degree of Pimonidazole binding, while

analysis of the Hoechst 33342 staining enabled analyses of perfused vessels in the tumor (latter analyses ongoing. Data not presented). **RESULTS:** The mean hypoxic fraction was $9.0\pm 5.2\%$ for mice exposed to the high intensity running schedule and was significantly lower compared with the hypoxic fraction in tumors from the control group ($14.2\pm 6.2\%$, Student's T-test $p=0.046$) and low intensity group ($13.6\pm 4.0\%$, $p=0.034$) but not the moderate intensity group ($12.6\pm 7.0\%$, $p=0.19$). **CONCLUSION:** High intensity for 30 minutes may reduce tumor hypoxic fraction in mice and our current studies investigate the duration of the reduction in hypoxia after exercise cessation and examine the effect of this exercise regime on tumor radiation response.



F-38 Clinical Case Slide - Rehabilitation Issues: Older Adults

Friday, May 31, 2019, 3:15 PM - 4:55 PM
Room: CC-306

2903 Chair: Kenneth Vitale. *University of California San Diego, San Diego, CA.*

(No relevant relationships reported)

2904 Discussant

Arthur Jason De Luigi. *MedStar NRH/Georgetown University Hospital, Olney, MD.*

(No relevant relationships reported)

2905 Discussant

Wayne Elton Derman. *Stellenbosch University, Cape Town, South Africa.*

(No relevant relationships reported)

2906 May 31 3:15 PM - 3:35 PM
The Effects of a Linearly Progressed Resistance Training Program on a Previously Sedentary 86 Year Old Woman

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(No relevant relationships reported)

History:

86 year old previously sedentary female agreed to participate in a linearly progressed resistance training program for six months. Prior to participation, the subject was evaluated by a physician and cleared to participate in the program. Medical history revealed a history of atrial fibrillation, hypothyroidism, hypertension, glaucoma, osteoarthritis, as well as peripheral edema. The subject reported the use of Norvasc, Losartan Potassium, Hydralazine Hcl, and Doxazosin Mesylate for her hypertension, Xarelto for her atrial fibrillation, Levothyroxine for her hypothyroidism, Latanoprost for her glaucoma as well as Lasix for her peripheral edema. Prior to initiation of the resistance training intervention, the subject's only self-reported physical activity was walking. She reported walking, on average, 1 - 3 hours per week. The subject also reported sleeping, on average, less than 5 hours per night.

Physical Examination:

The subject completed the Short Physical Performance Battery (SPPB) prior to initiating the resistance training intervention. Results of the subject's initial SPPB showed that she was unable to maintain a semi-tandem or tandem stand for 10 seconds, required the use of a walker to ambulate a distance of four meters, and was unable to transfer from sit-to-stand without the use of her upper extremities.

Test and Results:

Initial SPPB score of 2/12, consistent with poor balance, gait speed, and lower extremity functional strength

Initial Leg Press calculated 1RM = 23.1 kg

Initial Lat Pulldown calculated 1RM = 8.6 kg

Initial Bench Press calculated 1RM = 7.7 kg

Intervention:

A linearly progressed resistance training program comprised of the leg press, barbell bench press, and lat pulldown machine was implemented an average of twice per week for 6 months. The goal of the resistance training program was to make a small increase in the training load used on each of the three exercises as often as possible.

Outcomes:

Improvements of calculated 1RM of 209.8%, 268.4%, and 94.1% were noted for the leg press, lat pulldown, and bench press respectively. SPPB score double from 2/12 to 4/12. Additionally, the subject was also able to successfully transfer from sit-to-stand without the use of her upper extremities for assistance and no longer required the use of a walker during ambulation.

2907 May 31 3:35 PM - 3:55 PM

Complications Post Unicompartmental Knee Arthroplasty and Physical Therapy Manual Therapy

Julie B. Barnett. *UT Health San Antonio Texas, San Antonio, TX.*
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(No relevant relationships reported)

HISTORY: 65 year old male underwent an initial medial unicompartmental knee arthroplasty and physical therapy manual therapy and exercise. The patient had significant increase in pain after physical therapy manual techniques in extension and exercises interventions. Subsequently, the patient underwent a total knee arthroplasty after a lateral tibial plateau fracture was revealed.

PHYSICAL EXAMINATION: Patient had approximately minus 10 degrees of knee extension at eight weeks post unicompartmental medial arthroplasty.

DIFFERENTIAL DIAGNOSIS: Joint adhesions vs muscular restrictions vs fracture.

TEST AND RESULTS: Passive range of motion measurements taken during physical therapy with restrictions in knee extension passive range of motion. 2nd MRI revealing lateral tibial plateau fracture

FINAL WORKING DIAGNOSIS: Lateral tibial plateau fracture per MRI

TREATMENT AND OUTCOMES: Total knee arthroplasty performed and patient eventually gained full range of motion of the knee joint, normal gait, and reduction in pain.

2908 May 31 3:55 PM - 4:15 PM

Transplant Frailty Prehabilitation

Dimitri Constantinou, Keegan Willemse. *University of the Witwatersrand, Wits, South Africa.* (Sponsor: Yoganathan Coopoo, FACSM)

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(No relevant relationships reported)

HISTORY: 72 year old male, liver problem of non-cirrhotic portal hypertension and esophageal varices treated with ligation. Developed sudden onset Klebsiella pneumonia septicaemia, with atrial fibrillation whilst hospitalised and cardioverted pharmacologically. Whilst investigating, liver tumor identified on CT scan. Diagnosed as hepatoma. Treatment included 2 x chemoembolization. Lost 15 kg in the previous 8 months. Previous DVT following torn Achilles tendon repair. Insulin resistance. Ex-smoker. Activity - walking and golf. Minimal alcohol use. Medication - Prazolol, furosemide, spironolactone. Referred for prehabilitation whilst awaiting liver transplant.

PHYSICAL EXAMINATION: Colour - ashen/pallor. HR = 62 bpm, regular, good volume. BP = 96/74 mmHg. Cor - NAD Lungs - NAD. Abdomen - NAD. Clinically balance reduced, generalised muscle weakness.

DIFFERENTIAL DIAGNOSIS: Anemia, paraneoplastic syndrome, chemotherapy / oncology deconditioning, cardiac dysfunction

TEST AND RESULTS: Lab results - marginally raised liver enzymes. No current anemia. Staged treadmill test using modified Bruce Protocol with ECG monitoring and mobile metabolic measurements. The results showed pre-exercise HR = 60 bpm, regular, pre exercise BP = 94/76 mmHg; maximum BP post exercise expected increases with peak RPE of 15/20 although physically could not continue. ECG normal at rest and with effort. Peak heart rate = 184 (112% of predicted). Exercise time = 9.58 minutes. Maximum load to stage 5 = 17 mets. Peak Vo₂ = 18.8 ml/min/kg at 08.30 minutes. RER reached 1 at 3.15 mins. Ventilatory equivalent was high, and occurred early - implying early anaerobic dependent metabolism, likely from compromised aerobic energy system. Liver dysfunction with effects on glycogenolysis and gluconeogenesis unknown.

FINAL WORKING DIAGNOSIS: General deconditioning of multiple etiologies related to liver tumor

TREATMENT AND OUTCOMES: Exercise prehabilitation for transplant to improve aerobic function, muscle strength and balance. Exercise sessions three times per week, with significant improvements in objective outcome measures and subjective energy levels, function and quality of life.

2909 May 31 4:35 PM - 4:55 PM

Age and Gender Specific Issues - Power Based Exercise Program in a Postmenopausal Female

Michele Aquino, John Wygand, FACSM, Robert M. Otto, FACSM, John Petrizzo. *Adelphi University, Garden City, NY.* (Sponsor: John Wygand, FACSM)

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(No relevant relationships reported)

History:

70 year old female with Osteoporosis was referred to Physical Therapy for gait and balance training. The patient denies any prior history of cancer, diabetes, neurological history, prior orthopedic injuries/surgeries, or major cardiac events/surgeries. Her

current prescribed medications include Lipitor, Norvasc, Hyzaar and Lexapro. The patient further mentions a history of osteopenia, but a recent DEXA scan classified the patient as Osteoporotic at femoral neck with a T-score of -2.5. The patient was prescribed 70 mg of Fosamax QD and continued with supplemental Calcium with Vitamin D. The patient reported reduction of balance with day to day activities and reported a fear of falling, but denied any falls.

Physical Examination:

Postural assessments demonstrated excessive forward head posture, with increased thoracic kyphosis along with excessive lumbar lordosis. Neurological assessment and ROM at the lumbar spine and hips were all within normal limits. Limited muscular strength was noted in bilateral lower extremities. Deficits in static balance were also noted with tandem stance.

Test and Results:

Dynamic Gait Index Score of 15/24, consistent with an increased fall risk.

DEXA results at femoral neck: T-Score: -2.5; BMD: .572 gr/cm²

DEXA results at lumbar spine: T-Score: -2.2; BMD: .807 gr/cm²

Intervention:

A Progressive Resistive Functional Power based exercise program was conducted an average two times per week for one year. A treadmill warm-up followed by progressive functional activities such as sit to stands for speed, forward step ups for speed, hip abduction and hip extension for speed were included. Progressions consisted of increased resistance and increased speed of movement.

Outcomes:

DEXA scan demonstrated BMD improvements of 29% (742 gr/cm²) and 24% (1.003 gr/cm²), as well as improvements in T-score to -2.1 to -1.5 at her femoral neck and lumbar spine, respectively. The changes attenuate fracture and mortality risk. Furthermore, a 7 point change in her Dynamic Gait Index score was noted post intervention, resulting in a decreased risk of falling. The patient has continued to be independent with a home exercise program along with continued use of her prescribed medications.

2910 May 31 4:15 PM - 4:35 PM

Mitochondrial Myopathy, The Use Of Resistance, Mobility And Neuromuscular Exercise Training In A Community Clinic.

Catherine R. Moss. *Optimize Health Ltd; The University of Auckland, Auckland, New Zealand.*

(No relevant relationships reported)

History:

A Female 68 yrs old was presented to the exercise rehabilitation clinic with:

Mitochondrial Disease (ragged red muscle fibers, excessive mitochondria)

POLG-associated CPEO

Osteoporosis

Physical examination:

Extreme muscle weakness

Low BMI

No eye movement tracking, eyelids paralyzed

Fatigue

Differential Diagnosis:

Severe cervical kyphosis and mild thoracic kyphosis and anterior pelvic tilt, low muscle strength.

Testing and Results:

A continuous recumbent cycle protocol with peak power of 28 Watts, peak blood pressure 168/74 mmHg, 110 bpm.

Functional testing findings: 30-second Sit to stand test: 3 reps in 30 seconds; Dumbbell bicep curl test (60 seconds): Left arm was 30 reps, Right arm was 20 reps; Romberg (eyes open): <3 seconds for each leg, Tandem stance balance test: not possible without modification.

Results

- Post 8 week test results

30-second Sit to stand test: 6 reps in 30 seconds (100% increase); Dumbbell bicep curl test (60 seconds): Left arm was 47 reps (17 rep increase), Right arm was 41 reps (21 rep increase); Romberg (eyes open): Left leg was 4.50 seconds (~2 second improvement) and right leg was 5.46 seconds (~3.5 second improvement), Tandem stance balance test: Left leg was 6.12 seconds and right leg was 5.59 seconds (and increase on both sides from 0 seconds). Working Diagnosis:

Mitochondrial myopathy with POLG-associated CPEO and osteoporosis with associated poor muscular strength, poor balance and posture.

Treatment and Outcomes:

The client attended a community clinical exercise rehabilitation program for 8 weeks, 2 x week 30 minutes. After a 5-minute warm up on a recumbent cycle (28-30 Watts), the client went through a one-on-one resistance & mobility training session focusing on variations of: Strength training, proprioception training, upper body & neck mobility & posture, co-ordination and muscle activation, functional balance training

Outcomes: A low intensity progressive resistance program that incorporates a variation of balance, proprioception, flexibility and muscle activation as well as upper back

mobility training is recommended for the mitochondrial myopathy conditions. Program should be continued for a further 10-12 weeks, 2 x per week of ~30 minutes with slow to moderate intensity progression.

F-39 Clinical Case Slide - Spine II

Friday, May 31, 2019, 3:15 PM - 4:55 PM

Room: CC-202C

2911 **Chair:** Sherrie L. Ballantine-Talmadge, FACSM. *CU Sports Medicine and Performance Center, Boulder, CO.*

(No relevant relationships reported)

2912 **Discussant**

Dina C. Janse van Rensburg, FACSM. *University of Pretoria, Pretoria, South Africa.*

(No relevant relationships reported)

2913 **Discussant**

Lindsay Ramey. *University of Texas Southwestern Medical Center, Dallas, TX.*

(No relevant relationships reported)

2914 May 31 3:15 PM - 3:35 PM

Progressive Asymmetric Low Back Pain in a Young Basketball Player

Marianne Luetmer, Edward Laskowski, FACSM. *Mayo Clinic, Rochester, MN.*

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(No relevant relationships reported)

History: A 23 year old otherwise healthy male basketball player developed acute onset of sharp right-sided low back pain upon landing after performing a slam dunk. He had no lower extremity radicular pain, focal weakness, or sensory loss; no constitutional symptoms. At first presentation he was diagnosed with mechanical low back pain. The prescribed physical therapy intervention was beneficial however his pain progressed. He returned to Sports Clinic one year later; the pain had spread to his right gluteal region and was exacerbated by impact exercise. He could no longer play basketball and pain interfered with daily activities.

Physical Examination:

On initial examination: tight hip internal and external rotators bilaterally, negative Stinchfield and FABER tests bilaterally, and tenderness to palpation over right lumbar paraspinals with an otherwise normal exam. One year later: strength, sensation, and reflexes remained intact. Focal tenderness over right SIJ. Normal lumbar ROM.

FABER and Stinchfield tests reproduced right-sided SI region pain. FADIR and labral scour maneuvers negative.

Differential Diagnosis:

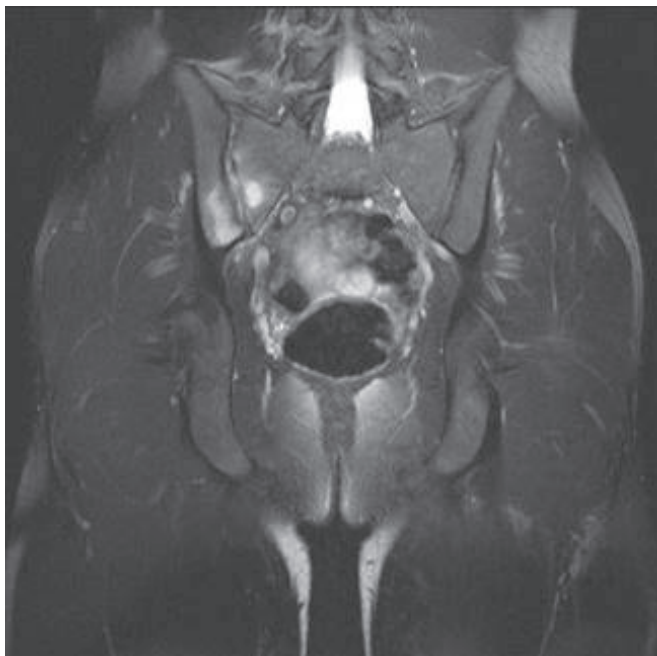
1. Mechanical low back pain
2. Spondylolysis
3. Sacroiliitis
4. Femoral acetabular impingement
5. Labral pathology
6. Avascular necrosis

Tests and Results:

-Lumbar radiographs, year 2017: Normal.

-Pelvic radiographs, 2018: Mild iliac-sided sclerosis and irregularity bilateral SIJs, more prominent on right. No fracture or dislocation.

-Lumbar and pelvic MRI, 2018: Extensive subchondral marrow edema right SIJ; right SIJ effusion with changes suggesting enthesitis. Compatible with marked asymmetric sacroiliitis. Normal lumbar spine.



-HLA-B27 positive. ESR and CRP normal.

Final Working Diagnosis: Axial spondyloarthritis

Treatment and Outcomes:

1. Trial of naproxen 500 mg BID
2. Fluoro-guided right SIJ corticosteroid injection
3. Low-impact aerobic conditioning; core and back strengthening exercises with emphasis on optimal technique

2915 May 31 3:35 PM - 3:55 PM

Back Pain in a Multi-Sport High School Athlete

John Diefenderfer, Rob Stevens. *Maine General Sports Medicine, Augusta, ME.* (Sponsor: James Dunlap, FACSM)
(No relevant relationships reported)

HISTORY: A 15 year old male football player presented with low back pain that was worse on the left side. His injury occurred about 3 weeks ago during practice where he dove to tackle another teammate and had sharp pain in his lower back. He stated running/sprinting, jumping, twisting to throw the football, and sometimes bending forward all worsened the pain. Rest seemed to help, but he continued to have a dull ache in his low back that was fairly constant. He has tried heat and stretching before practice. He denies numbness, tingling, or weakness. He denies any bowel/bladder incontinence. He denies previous back injury or trauma. He is a year round athlete and also participates in basketball and hockey.

ROS: pertinent negatives include no fevers, rash, recent weight loss/gain, or joint pains. **PHYSICAL EXAMINATION:** Height: 5'7" Weight 133 lbs. Gen: no acute distress. Gait: normal, able to effectively toe and heel walk, tandem gait intact. Lumbar Spine Exam: Skin / Lymph: normal, no scars, mild stretch marks superficially midline around T10-L2. Tenderness: midline L5-S1 as well as adjacent on the left, no step-offs noted, TTP SI joints bilaterally. Flexion: 60 degrees with pain. Extension: 20 degrees. Moderate to severe bilateral hamstring tightness.

Strength/reflexes/sensation/distal pulses of both LE intact. Special testing: Seated/Supine SLR, FABER, FADIR negative bilaterally. Stork testing positive bilaterally.

DIFFERENTIAL DIAGNOSIS: Lumbar muscle strain, Iliolumbar ligament sprain, SI joint dysfunction, Spondylolysis with or without spondylolisthesis, Ankylosing Spondylitis.

TEST AND RESULTS: X-rays lumbar spine: Bilateral pars defect L5 with mild Grade 1 spondylolisthesis of L5/S1. MRI lumbar spine without contrast - Acute bilateral pars defects at L4. At L5/S1 there are bilateral L5 pars defects which appear chronic and have no associated edema. There is resultant uncovering of the disc and some mild bilateral foraminal narrowing at L5/S1. No spondylolisthesis at L4/5.

FINAL WORKING DIAGNOSIS: Multilevel Bilateral Spondylolysis, acute at L4, with grade 1 spondylolisthesis L5/S1

TREATMENT AND OUTCOMES:

Physical therapy without bracing due to patient choice. Relative rest and discontinuation of contact sports while in PT. Discussion about further return to play will take place upon completion of PT.

2916 May 31 3:55 PM - 4:15 PM

Fragile Bones in a Horseback Rider

Jacob Wessels. *University of Minnesota, Minneapolis, MN.*

(Sponsor: Suzanne Hecht, FACSM)

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(No relevant relationships reported)

HISTORY: A 55-year-old postmenopausal female presents with back pain that started when landing a jump while horseback riding. The jump was a routine jump and she felt sharp immediate pain in her mid-back. She has been riding more infrequently but no other change to her landing. This felt similar to a compression fracture five years ago she sustained sitting while on a boat ride. She has reported general fatigue and sleeping more than usual. Some heat and cold intolerance. No kidney stones. She has history of vitamin d deficiency, heartburn on omeprazole and moderate alcohol use, never smoker.

PHYSICAL EXAMINATION: P: 90 BP: 128/76 Height: 66.5in Weight: 156lb

Gen: pleasant well appearing female in no distress

Neck: no thyromegaly or palpable mass

Heart: rrr, no murmur

Back: no deformity, normal posture, tender to palpation over T6-T9 spinous processes, tender over adjacent paraspinal muscles. Forward flexion and back extension reproduces pain, no radiation down legs or to abdomen.

Neuro: reflexes 2+, strength 5/5 in upper and lower extremity.

DIFFERENTIAL DIAGNOSIS:

1. Primary osteoporosis
2. Hyperparathyroidism
3. Hypothyroidism
4. Pituitary dysfunction
5. Multiple myeloma

TEST AND RESULTS:

DXA: L1-L3 t-score -2.2BMP: Na 140, K 4.4, Cl: 105, CO2: 28, Creatinine 0.59, GFR >90, Glucose: 97, Calcium 9.8

TSH: 0.04 (0.40 - 4.00 mU/L) T4: 0.30 (0.76 - 1.46 ng/dL)

PTH: 19 (18 - 80 pg/mL)

Vita D 37 (20 - 75 ug/L)

Further Labs:

Free T3: 2.0 (2.3-4.2 pg/mL)

FSH: 100.1 LH: 23.8 Prolactin 5 (3-27ug/L)

Insulin Growth Factor 1: 89 (49 - 234 ng/mL)

Cortisol stimulation test: (850AM) 16.3, 30 min: 22.5, 1 hour: 26.0 (8 AM Reference Range 4-22 ug/dL, 30-60 minutes post stim: >20 ug/dL)

Tissue Transglutaminase IgG: <1

Lumbar X-ray: Anterior vertebral compression deformity involving T7, T8, and T9 vertebral bodies. There is also anterior wedging of T10 vertebral body which may be physiologic.

MRI Head/Brain: No focal abnormality of the pituitary gland.

FINAL WORKING DIAGNOSIS: Osteoporosis with insufficiency fracture and isolated central hypothyroidism

TREATMENT AND OUTCOMES:

1. Calcitonin nasal spray for acute pain control
2. Levothyroxine replacement to T4 in normal range
3. Yearly pituitary laboratory evaluation
4. Follow up when euthyroid for osteoporosis treatment
5. Repeat DXA in 1-2 years

2917 May 31 4:15 PM - 4:35 PM

Back Pain - Swimming and Lacrosse

McKayla Schmitt. *University of Minnesota, Minneapolis, MN.*

(Sponsor: Suzanne Hecht, FACSM)

(No relevant relationships reported)

HISTORY: A 17-year-old senior swimmer and lacrosse player has had 6 months of low back pain. She had no acute injury but reports gradual onset of pain that has progressed causing her to be unable to participate in her sports. She has almost nightly awakening secondary to back pain. She denies numbness, tingling, weakness, or radiation of pain into her lower extremities.

She has a history of celiac disease. There is a family history of hypothyroidism, celiac disease, and rheumatoid arthritis.

PHYSICAL EXAMINATION: Exam revealed bilateral, left greater than right, paraspinal muscle tightness from T10-L5. She had full forward flexion, extension, rotation, and lateral flexion. She had a negative straight leg raise, slump test, and stork test, bilaterally. No neurological signs or symptoms.

DIFFERENTIAL DIAGNOSIS:

1. Strain of lumbar paraspinal muscles
2. Spondylolysis
3. Spondylarthritis

TESTS AND RESULTS:

Thoracic and lumbar spine anterior-posterior and lateral radiographs:

--Spondylolysis with spondylolisthesis at L5-S1
 Lumbar spine MRI:
 --Anterolisthesis with spondylolysis of L5 on S1.
 --Desiccation at the level of L5-S1 with mild loss of disc height
 HLA-B27: negative
 TSH: 0.86 (normal)
 Vitamin D: 37
 CBC: within normal limits
 CRP: 6.8 (normal)
 ESR: 16 (normal)

FINAL/WORKING DIAGNOSIS:

Spondyloarthritis

TREATMENT AND OUTCOMES:

1. Referral to rheumatology
2. Initiation of Methotrexate and Humira
3. Returned to swimming within 4 weeks of initiation Methotrexate, and 2 weeks of initiation of Humira, with significant reduction in low back pain

2918 May 31 4:35 PM - 4:55 PM**Elite Weightlifter With Acute Back Pain**

Taoufik Bel Fekih, Nidal Hammad, Louis Holtzhausen, FACSM,
 Yasin Al Makhadma. *Aspetar, Doha, Qatar*. (Sponsor: Louis
 Holtzhausen, FACSM)
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(No relevant relationships reported)

HISTORY: An 18 years old male, elite weightlifter sustained a sudden onset of sharp pain in the low back during back squat training (150 kg), with an episode of numbness of posterior right thigh which quickly resolved.

The pain was localized in the right lateral L4/L5 area, with intensity rated 8/10 on a Numerical Pain Scale.

Training history: Weightlifting and resistance training 6 days (30 hours)/week.

PHYSICAL EXAMINATION: No gait abnormality

No neurological deficit, Straight leg raise test negative

Para-spinal muscular spasm and a mildly limited ROM in right rotation, lumbar spine extension, lateral flexion to the right.

Pain-free sacroiliac joint.

Tenderness on palpation of spinous process and L4-L5 facet area on the right side.

Neurological examination normal, including motor function, sensory and reflexes.

DIFFERENTIAL DIAGNOSIS: A simple "lumbago"

Intervertebral disc prolapse

Burst fracture

Spondylolysis

Acute deterioration of spondylolisthesis

TEST AND RESULTS: Standard X-rays showed probable L5 pars lesion, Loss of disc height at L4-L5. An osseous fragment overlying the L4-L5 neural foramina.

The MRI images showed an apophyseal ring fracture involving the postero-inferior L4 vertebral body, with mild bone edema. There was no clear root impingement. There was an L5-S1 disc hernia.

CT scan with 3D rendering confirmed the presence of L4-L5 (acute) ring fracture; and an older fracture at L5-S1.

Laboratory tests showed: Vitamin D deficiency (<10 ng/ml for range 30-80 ng/ml)

Bone densitometry (L4 and 5): Minus 2 (Osteopenia)

FINAL WORKING DIAGNOSIS: Posterior apophyseal ring fracture.

Psycho-social status:

High anxiety levels because of fear of missing an upcoming international competition.

TREATMENT AND OUTCOMES: A "conservative" approach was followed.

Including:

NSAID's

Use a lumbar brace for 4 weeks.

Abstain from weight-lifting for 8 weeks (reviewed regularly)

Vitamin D supplementation: 50,000 IU, 1 tab/week

Calcitonin IM injections 100 UI/dayx10 days

Graded exercise rehabilitation, including incident-free progressive weight loading.

The athlete returned to previous level of activity after 8 weeks.

He could back squat 260 kg at 3 months' post injury, and won the Junior World Championships in his weight class.

F-41 Rapid Fire Platform - Vascular Function

Friday, May 31, 2019, 3:15 PM - 4:35 PM

Room: CC-Hall WA2

2920

Chair: J. Derek Kingsley, FACSM. *Kent State University, Kent, OH.*

(No relevant relationships reported)

2921

May 31 3:15 PM - 3:25 PM

Alterations in Vagal Tone After Acute Resistance Exercise in Resistance-Trained and Untrained Individuals

Stacie M. Humm, Erica M. Marshall, Jason C. Parks, J. Derek Kingsley, FACSM. *Kent State University, Kent, OH.* (Sponsor: J. Derek Kingsley, FACSM)

(No relevant relationships reported)

Data have demonstrated that an acute bout of resistance exercise (ARE) reduces vagal modulation. However, only a handful of studies have evaluated differences between resistance-trained (RT) and untrained (UT) individuals in response to an ARE.

PURPOSE: To compare alterations in vagal modulation during recovery from ARE in RT and UT individuals. **METHODS:** Eighteen RT individuals (Mean±SD; Age: 23±3yrs; Ht: 1.7±0.1m; Wt: 75.2±15.6kg) and eight UT individuals (Age: 24±3yrs; Ht: 1.6±0.09m; Wt: 61.9±10.8kg) volunteered to participate. Vagal modulation was assessed using heart rate variability (HRV) in the frequency domain [High-frequency power (lnHF)], as well as heart rate complexity [sample Entropy (SampEn) and Lempel-Ziv entropy (LZEn)]. Data were collected at rest, 15 minutes (Rec1) and 30 minutes (Rec2) during recovery from ARE and a control (CON). The ARE utilized 3 sets of 10 repetitions at 75% 1-repetition maximum (1RM) and 2 minutes of rest between sets and exercises on the chest press, leg press, latissimus dorsi pulldown, leg curl and leg extension. A 2x2x3 repeated measures ANOVA was used to examine groups (RT, UT) across conditions (CON, ARE) on the repeated factor of time (rest, Rec1, Rec2). **RESULTS:** The groups were similar ($p \geq 0.05$) for age, and height, but not weight. The 1RMs on all the exercises were different ($p \leq 0.05$) between groups. At rest, all measures of vagal modulation were similar between groups. In addition, there were no 3-way interactions for any measures of vagal modulation. There were significant time x condition interactions for lnHF (ARE: rest: $7.5 \pm 1.2 \text{ ms}^2$; Rec1: $5.8 \pm 2.2 \text{ ms}^2$; Rec2: $4.5 \pm 1.2 \text{ ms}^2$; $p = 0.0001$), SampEn (ARE: rest: 1.5 ± 0.4 ; Rec1: 1.3 ± 0.4 ; Rec2: 1.4 ± 0.4 ; $p = 0.022$), and LZEn (ARE: rest: 0.8 ± 0.08 ; Rec1: 0.7 ± 0.1 ; Rec2: 0.7 ± 0.2 ; $p = 0.001$). LnHF and LZEn were reduced at Rec1 and Rec2 compared to rest, with similar responses between the resistance-trained and untrained groups. SampEn was reduced only at Rec1 compared to baseline, with no difference between groups. **CONCLUSIONS:** These data demonstrate that both resistance-trained and untrained individuals have similar reductions in vagal modulation in response to an acute bout of resistance exercise using weight machines.

2922

May 31 3:25 PM - 3:35 PM

Influence of Cardiorespiratory Fitness on Central and Local Arterial Stiffness During Acute Inflammation

Elizabeth C. Schroeder¹, Thessa IM Hilgenkamp¹, Wesley K. Lefferts¹, Amanda V. Sardeli², Stacy Arriola¹, Tracy Baynard, FACSM¹, Bo Fernhall, FACSM¹. ¹University of Illinois at Chicago, Chicago, IL. ²Campinas University, Campinas-SP, Brazil. (Sponsor: Bo Fernhall, FACSM)
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(No relevant relationships reported)

Acute inflammation is associated with increased cardiovascular (CV) risk. Aortic stiffness, a risk factor for CV disease, increases during acute inflammation. However, whether inflammation affects the aorta and carotid similar has not been determined. High cardiorespiratory fitness is cardio-protective and associated with lower central artery stiffness and inflammation. Thus, cardiorespiratory fitness may be protective and attenuate increases in arterial stiffness during acute inflammation. **PURPOSE:** Determine the effect of acute inflammation and fitness on arterial stiffness. **METHODS:** Arterial stiffness was assessed in 11 low fit (6 male, 24 ± 5 yrs, 22.8 ± 4.3 kg/m², 34.5 ± 2.9 ml/kg/min) and 12 high fit (VO_{2peak} >75th age- and sex-specific percentile; 5 male, 27 ± 4 yrs, 22.6 ± 1.9 kg/m², 56.4 ± 9.7 ml/kg/min) participants at baseline and 24h-post typhoid vaccination. Aortic pulse wave velocity (PWV) and brachial blood pressure were assessed with the Mobilograph device. Carotid β-stiffness was assessed via ultrasound with echo-tracking. Carotid pressure and wave reflections were obtained via tonometry (SphygmoCor) and calibrated to brachial mean and diastolic pressure. C-reactive protein (CRP) and interleukin-6 (IL-6) were assessed via ELISA. **RESULTS:** Acute inflammation was induced as evident by increases in CRP

and IL-6 ($p < 0.01$; Table). Mean arterial pressure and PWV were unaltered ($p > 0.05$), and heart rate increased at 24h ($p < 0.05$). β -stiffness and pulse pressure increased in high fit participants, with no change in low fit (interaction, $p = 0.02$). Carotid wave reflections were reduced at 24h in both groups ($p < 0.05$). **CONCLUSION:** While neither fitness nor acute inflammation altered aortic stiffness, fitness may alter the sensitivity of the carotid artery to acute inflammation. Future research is necessary to examine the mechanism of these differential stiffness responses during acute inflammation and their implications for the cerebrovasculature.

	Low Fit		High Fit		p-value		
	Baseline	24h	Baseline	24h	Time	Group	Interaction
Inflammatory Markers	n=8		n=11				
CRP, mg/L*	1.51 \pm 1.97	3.50 \pm 3.69	0.70 \pm 2.01	2.31 \pm 3.95	<0.01	0.17	0.16
IL-6, pg/mL	1.35 \pm 0.46	2.60 \pm 1.36	0.90 \pm 0.49	2.22 \pm 1.35	<0.01	0.27	0.80
Arterial Stiffness	n=11		n=12				
PWV, m/s	5.0 \pm 0.5	5.1 \pm 0.3	5.1 \pm 0.6	5.2 \pm 0.3	0.30	0.54	1.00
Beta-stiffness Index	4.5 \pm 1.1	4.2 \pm 1.0	4.0 \pm 1.2	4.4 \pm 1.4 ¹	0.74	0.63	0.02
Hemo-dynamics	n=11		n=12				
Heart rate, bpm	60 \pm 9	63 \pm 7	50 \pm 9	52 \pm 8	0.02	0.01	0.58
MAP, mmHg	92 \pm 9	91 \pm 8	92 \pm 10	91 \pm 7	0.22	0.96	0.59
Carotid SBP, mmHg	107 \pm 10	107 \pm 9	107 \pm 12	108 \pm 11	0.99	0.94	0.89
Carotid DBP, mmHg	71 \pm 9	71 \pm 8	71 \pm 7	69 \pm 6	0.31	0.59	0.27
Carotid PP, mmHg	35 \pm 7	33 \pm 8	37 \pm 8	39 \pm 8	0.95	0.28	0.02
Carotid Wave Reflection	n=11		n=11				
Forward wave, mmHg	33 \pm 7	36 \pm 13	34 \pm 8	37 \pm 11	0.09	0.69	0.58
Reflected wave, mmHg	15 \pm 3	13 \pm 3	17 \pm 4	17 \pm 5	0.03	0.06	0.17
Reflection index, a.u.	45 \pm 8	39 \pm 9	52 \pm 12	47 \pm 15	0.01	0.16	0.46

Data mean \pm standard deviation. ¹different from baseline, $p < 0.05$; CRP: C-reactive protein; DBP: diastolic blood pressure; IL-6: interleukin-6; MAP: mean arterial pressure; PWV: pulse wave velocity; SBP: systolic blood pressure; *analyzed using log-transformed values

2923 May 31 3:35 PM - 3:45 PM

The Influence Of Habitual Moderate-Vigorous Physical Activity Levels Versus Aerobic Fitness On Age-Related Endothelial Function

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(No relevant relationships reported)

Older adults (OA) have reduced vascular function, as assessed via flow-mediated dilation (FMD). However, it is unknown whether OA also have reduced low flow-mediated constrictor (L-FMC) responses than younger adults (YA). Further, we have previously demonstrated in OA that FMD responses are influenced more by habitual moderate-vigorous physical activity (MVPA) levels than aerobic fitness. It is unclear whether differences in habitual MVPA levels between YA and OA contribute to age-related declines in vascular function. **PURPOSE:** To test the hypotheses that: 1) YA would have superior brachial (BA) and popliteal (POP) FMD and L-FMC versus OA, and 2) that habitual MVPA levels would have a greater influence on endothelial function than age- and sex- aerobic fitness levels. **METHODS:** FMD and L-FMC were measured via duplex ultrasonography in 9 YA (5♀, 24 \pm 3 yr) and 9 OA (5♀, 68 \pm 4 yr) matched for body mass index, as well as age- and sex-related aerobic fitness categories (Poor-Excellent). L-FMC and FMD were quantified as the percent decrease in diameter (from baseline) during the last 30-s of a 5-min distal cuff occlusion and the percent increase in diameter during a 5-min post-cuff deflation period, respectively. Peak oxygen consumption was measured via indirect calorimetry using an incremental cycle ergometer test. MVPA was quantified over at least 7-d using a PiezoRx® physical activity monitor. **RESULTS:** Compared to OA, YA spent more time engaged in MVPA (426 \pm 178 vs. 260 \pm 91 min/week, $p = 0.03$), had higher BA-FMD (8.0 \pm 2.8 vs.

5.6 \pm 1.7%, $p = 0.04$) and POP-FMD (5.8 \pm 0.8 vs. 3.2 \pm 1.2 %, $p < 0.01$). However, both groups had similar BA L-FMC (YA, -1.5 \pm 1.7 vs. OA, -0.8 \pm 1.1%, $p = 0.35$) and POP L-FMC responses (YA, -1.7 \pm 1.7 vs. OA, -0.6 \pm 1.9%, $p = 0.19$). MVPA was moderately correlated to BA-FMD ($r = 0.64$, $p < 0.01$) and POP-FMD ($r = 0.53$, $p = 0.03$). However, age-/sex-specific aerobic fitness categories were not correlated to BA-FMD ($p = 0.28$) or POP-FMD ($p = 0.30$). **CONCLUSION:** Based on age- and sex-related aerobic fitness categories, our results suggest that lower weekly MVPA time may have a greater influence on age-related declines in endothelial-dependent vasodilation than aerobic fitness status *per se*. However, neither BA nor POP endothelial-dependent vasoconstrictor responses were altered with aging.

2924 May 31 3:45 PM - 3:55 PM

Vascular Responses To Acute Exercise Following Catheterization-induced Damage In Humans.

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(No relevant relationships reported)

Diagnosis and treatment for coronary artery disease (CAD) includes angiography and/or percutaneous coronary intervention. However, catheterization may result in acute artery dysfunction and damage. Whilst exercise training is recommended for CAD patients following catheterization, it is not known if there is an acute period when exercise may be detrimental due to the prior catheterization. In support of this, animal models have demonstrated exercise-induced paradoxical vasoconstriction post catheterization. **PURPOSE:** This study, for first time in humans, aims to examine the vascular responses to acute exercise following catheterization. **METHODS:** 24 CAD patients (age: 66.1 \pm 7.1 years 31.9 \pm 7 kg/m², 83.3% males) undergoing transradial catheterization were assessed pre and 1 week post intervention. Endothelial function was assessed by radial artery (RA) flow mediated dilation (FMD) in both catheterized and control arm. Bilateral RA diameter and blood flow were assessed during handgrip exercise (HE), 3min stages at 5%, 10%, 15% of maximum voluntary contraction. Differences pre-post catheterization, between the catheterized and control arm, and between HE intensities were determined using mixed-linear model (SPSS 25). **RESULTS:** FMD was impaired in the catheterized arm [6.4% (5.0, 7.7) to 4.3% (2.9, 5.6)] but not in the control arm [6.5% (5.2, 7.8) to 6.5% (5.2, 7.9)], post catheterization (time*arm $p < .05$). There was a significant dose-dependent increase in blood flow with incremental exercise ($p < .001$). However, there was no difference in the exercise responses between arms or pre-post catheterization. Baseline RA diameter was higher in the catheterized arm post catheterization [0.28cm (0.26, 0.30) to 0.29 (0.28, 0.31) $p < .001$]. There was no dilation in the RA, in any condition, with increasing exercise intensity ($p > .05$). **CONCLUSION:** Endothelial function, assessed by FMD, was impaired 1 week post catheterization. Interestingly, the RA's ability to dilate with increased blood flow was not apparent pre or post catheterization. This suggests either that the artery does not dilate at these exercise intensities, or that these patients have an inherent impaired vasodilation. Further work is needed to examine this with different exercise intensities/modes and in different groups following catheterization.

2925 May 31 3:55 PM - 4:05 PM

Effect of Acute Hyperglycemia on Microvascular Hemodynamics and Tissue Oxygenation during Handgrip Exercise

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(No relevant relationships reported)

Acute hyperglycemia elicits endothelial dysfunction at rest through reactive oxygen species-mediated damage to the endothelial surface layer (ESL). The ESL is associated with many of the mechanisms responsible for appropriate microvascular adjustments to exercise. **PURPOSE:** We tested the hypotheses that acute hyperglycemia would lead to 1) an 'overshoot' in deoxygenated heme concentration (deoxy-[heme]) at exercise onset reflecting greater fractional oxygen extraction and 2) less increase in total heme concentration (total-[heme]) during exercise reflecting less increase in microvascular hematocrit. **METHODS:** Three healthy young men (26 \pm 4 yr) completed a 10-minute constant-load handgrip exercise test at 40% of peak power (9.6 \pm 0.7 W) under control conditions (CON) and during acute hyperglycemia (HGL), i.e., 90-minutes after oral consumption of a 10 ounce solution containing 75g of dextrose. Near-infrared spectroscopy was used to measure deoxy-[heme] and total-[heme] of the flexor digitorum superficialis (FDS) continuously at rest and during exercise. **RESULTS:** Deoxy-[heme]_{CON} and total-[heme]_{CON} were significantly greater during exercise (189 \pm 28 μ M and 341 \pm 34 μ M, respectively) compared to rest (164 \pm 13 μ M and 302 \pm 17 μ M, respectively) ($p < 0.01$). Deoxy-[heme]_{HGL} and total-[heme]_{HGL} were significantly greater during exercise (181 \pm 14 μ M and 322 \pm 27 μ M, respectively)

compared to rest ($168 \pm 26 \mu\text{M}$ and $313 \pm 16 \mu\text{M}$, respectively) ($p < 0.01$). As a percent of steady-state (SS) values, deoxy-[heme]_{CON} was greater than deoxy-[heme]_{HGL} from 35s until 75s of exercise ($p < 0.05$). Deoxy-[heme]_{CON} and deoxy-[heme]_{HGL} were not different at SS. Total-[heme]_{HGL} was significantly lower than total-[heme]_{CON} at SS ($p < 0.01$). **CONCLUSION:** These data suggest that acute hyperglycemia leads to 1) increased fractional oxygen extraction at the onset of moderate-intensity handgrip exercise reflecting impaired perfusive oxygen delivery and 2) less of an increase in microvascular hematocrit reflecting impaired diffusive oxygen conductance during exercise steady state.

2926 May 31 4:05 PM - 4:15 PM

A Longitudinal Investigation On The Effect Of Age And Sex On Flow-mediated Dilation In Children

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Flow-mediated dilation (FMD) is a non-invasive assessment of arterial endothelial function. Previous cross-sectional analysis suggests resting arterial diameter and FMD increase throughout childhood, with no sex-based differences in FMD until girls exceed that of boys at 17-18 years old. No previous investigations included longitudinal examinations of the change in FMD over time, between boys and girls. **PURPOSE:** To assess the effects of age and sex on arterial diameters and FMD in school-aged children annually over a 3-year period. We hypothesized that resting arterial diameters will be larger in boys compared to girls at every time point and will increase each year, in both sexes. We also hypothesized that there would be no difference in FMD in girls versus boys over all 3 years as all of the children were tested younger than 17-18 years. **METHODS:** This observational study assessed 100 participants initially aged 8.5 ± 1.1 years, (range 6-10 years, 53 boys) annually for 3 years from the School-age Kids' health from early Investment in Physical activity (SKIP) study. The primary outcome was brachial artery FMD, which was measured using ultrasound technology. **RESULTS:** One-way repeated measures ANOVA was followed up with paired-sample t-test to compare mean differences between years. Two-way repeated measures ANOVA with sex as the between subjects' factor was used to determine interaction effects. Resting arterial diameter was largest across the cohort at year 3 ($2.8 \pm 0.28\text{mm}$) compared to year 1 ($2.7 \pm 0.30\text{mm}$, $p < 0.001$) and year 2 ($2.7 \pm 0.30\text{mm}$, $p < 0.001$). Contrary to our hypothesis, allometrically scaled FMD for boys was larger than girls (boys: 6.4 ± 3.09 , girls: $6.2 \pm 3.17\text{mm}$, $p = 0.002$) and no time differences were observed between years 1, 2 and 3 (year 1: 6.2 ± 3.11 , year 2: 6.2 ± 3.14 , year 3: $6.35 \pm 3.15\%$, $p = 0.67$). On average, boys had a larger resting arterial diameter compared to girls (boys: 2.8 ± 0.3 , girls: 2.6 ± 0.24 , $p = 0.001$). **CONCLUSION:** Differences observed in resting arterial diameter are driven by year 3 data and allometrically scaled FMD was larger in boys compared to girls, which may be explained by boys having larger resting arterial diameters compared to girls, and may also be accounted for by rapidly changing growth patterns in children. Funded by CIHR.

2927 May 31 4:15 PM - 4:25 PM

HIITing The Brain Enhances Cerebrovascular Shear Stress; The Link To Neuroprotection?

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(No relevant relationships reported)

High-intensity interval exercise training (HIIT) is considered a more time-efficient alternative to moderate-intensity continuous training (MICT) that can optimize metabolic and cardiovascular health though its impact on the cerebrovasculature is unknown.

PURPOSE: Pilot examination to characterise local cerebrovascular shear stress responses during an acute bout of HIIT and MICT.

METHODS: Following ethics approval, 2 physically-active males (21-23 yrs) were randomly assigned to HIIT or MICT (semi-recumbent cycling) preceded by a standardized warm-up and separated by sufficient time to allow for full haemodynamic recovery. During HIIT, subjects performed 3 intervals (each consisting of 2 mins at 60W and 2 mins at 100W) and for MICT, isovolume work performed continuously at 80W for 12 mins. Diameter, blood flow and shear rate in the internal carotid artery (ICA) were measured using Doppler ultrasound at rest and averaged over the final 4 min of HIIT and MICT. The end tidal partial pressure of carbon dioxide (PET_{CO2}), heart rate (HR), mean arterial pressure (MAP) and oxygen uptake (VO₂) were recorded continuously photoplethysmography and respiratory gas analysis.

RESULTS: Exercise-induced increases in HR, MAP and VO₂ were comparable between HIIT and MICT and were accompanied by an equivalent, progressive

reduction in PET_{CO2}. In contrast, ICA diameter decreased more markedly during HIIT [Δ (exercise minus rest) HIIT: -0.15 mm vs. Δ MICT: -0.01 mm] with increased velocity (Δ HIIT: $7.75 \text{ vs. } \Delta$ MICT: 3.39 cm.s^{-1}) and corresponding elevation in shear rate (Δ HIIT: $38 \text{ vs. } \Delta$ MICT: 9 s^{-1}).

CONCLUSIONS: These findings, albeit proof-of-concept, provide preliminary evidence highlighting a fourfold greater elevation in local cerebrovascular shear stress during HIIT compared to an equivalent volume of MICT. This is primarily attributable to local vasoconstriction that cannot be explained by hyperventilation-induced hypocapnia though likely represents a functional response coupling cerebral O₂ delivery to demand. To what extent repeated exposure to the intermittency of HIIT-induced cerebrovascular shear stress confers enhanced neuroprotection in the long-term is currently under investigation.

Supported by a Royal Society Research Fellowship (#WM 1000707)

2928 May 31 4:25 PM - 4:35 PM

Impairments In Lower Limb Microvascular Function Associated With Cycle Phases In Young Healthy Women.

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Impairments in lower limb microvascular function associated with cycle phases in young healthy women.

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University of Calgary, Faculty of Kinesiology.

Purpose: Differences in women's hormone concentrations throughout the menstrual cycle affects vascular responsiveness. Previous investigations have shown that these changes can be modulated by regular use of oral contraceptives. However, most of these studies only assessed changes in vascular function at the upper limb conduit artery level. This study investigated whether vascular function at the lower limb microvasculature of healthy young women might be affected by the phase of the menstrual cycle. **Methods:** 14 young (25 ± 5 years of age) physically active women participated in the study. The participants were assigned to two groups of seven participants each according to oral contraceptive use: non-contraceptive group (women who did not use any contraceptive within the last two years prior to the intervention - NCP) and oral contraceptive group (seven women who used oral contraceptive regularly for at least two years prior to the intervention - OCP). The participants underwent two lower limb vascular occlusion tests (5 min of baseline, 5 min of occlusion, and 8 min following cuff release) in two different phases of the menstrual cycle (follicular and luteal phase). Microvascular responsiveness was assessed by the percent of change of the NIRS-derived muscle oxygen saturation (StO₂) reperfusion slope (%/sec) of the tibialis anterior muscle. **Results:** There was no difference in the reperfusion slope of the NCP group between the follicular ($1.18 \pm 0.5 \text{ %/sec}$) and luteal ($1.01 \pm 0.3 \text{ %/sec}$) phases. The reperfusion slope of the OCP group was significantly steeper in the follicular ($0.85 \pm 0.2 \text{ %/sec}$) compared to the luteal phase ($0.63 \pm 0.2 \text{ %/sec}$). **Conclusion:** Use of oral contraceptive is associated with reduced microvascular function in the luteal phase in young physically active women.

F-54 Free Communication/Poster - Youth

Friday, May 31, 2019, 1:00 PM - 6:00 PM

Room: CC-Hall WA2

2955 Board #1 May 31 2:00 PM - 3:30 PM

Vertical Jump and Agility Performance Improves After 8-week Conditioning Program in Youth Female Volleyball Athletes

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Volleyball athletes must employ specific conditioning exercises with high levels of force, high rates of speed, and quick changes-of-direction. Volleyball sport specific vertical jumping ability can be assessed through various types of vertical jumping protocols such as the block vertical jump (BVJ), the countermovement vertical jump (CMJ), and the two-step approach vertical jump (AVJ). Sport specific agility testing for volleyball can be assessed with a 9-cone (9C) test to determine the athletes' ability to generate quick and accurate movement with change-of-direction and/or acceleration and deceleration.

PURPOSE: The purpose of this study was to determine if an 8-week combined high intensity interval training and plyometric (HIIT-PT) conditioning program improves

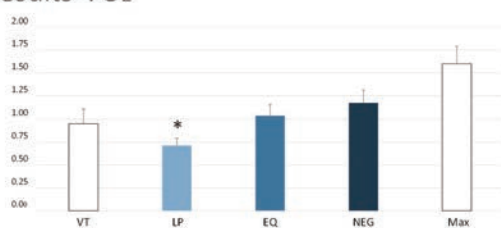
performance on three vertical jump protocols and agility time in youth female volleyball athletes. **METHODS:** Eleven female youth volleyball players (ages: 15±2.7 yrs.; height: 68.2±1.3 in; mass: 143.5±14.8 lbs) completed an 8-week summer HIIT-PT conditioning program. The 8-week summer conditioning program consisted of combined 2 x week (60 min each) high intensity interval exercises and 2 x week (60 min each) plyometric exercises. Three vertical jump protocols (BVJ, CMJ, AVJ) and an agility test (9C) were administered at the beginning of the first week and at the end of week 8 of the summer HIIT-PT conditioning program.

RESULTS: Prior to data comparisons, a Kolmogorov-Smirnov test of normality was performed for each of the four variables and determined to be from a normal distribution (BVJ: $p = .096$, CMJ: $p = .200$, AVJ: $p = .187$, 9C: $p = .127$). A series of paired sample t-tests were performed to compare pretest and posttest vertical jump heights (inches) and agility times (seconds). All three vertical jump protocols significantly increased (BVJ: 14.6 vs 16.1, $p.000$; CMJ: 17.3 vs 18.4, $p.000$; AVJ: 21.0 vs 23.1, $p.001$) and agility times decreased (9C: 25.3 vs 23.6, $p.000$) following the 8-week HIIT-PT summer conditioning program. **CONCLUSION:** Results from this study indicate that employing an 8-week combined HIIT-PT conditioning program may improve jumping and change-of-direction outcomes in youth female volleyball athletes.

2956 Board #2 May 31 2:00 PM - 3:30 PM
The Talk as a Measure of Exercise Intensity in Children
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Purpose: The purpose of this study was to determine if the Talk Test (TT) is a valid measure of ventilatory threshold (VT) in children. **Methods:** Thirteen healthy children (age 8-12 y) performed maximal incremental exercise with respiratory gas exchange and with the TT. During the last 30 seconds of each stage they read a passage containing 100-106 words and were asked if they could "speak comfortably". Gas exchange was measured and was used to identify VT. Comparison measurements occurred at the last positive (LP), equivocal (EQ), and negative (NEG) stages of the TT. **Results:** There were significant ($p < 0.05$) differences in $\dot{V}O_2$ (VT vs LP and NEG stages; 0.95 ± 0.580 vs $0.71 \pm 0.284^*$ and $1.17 \pm 0.504^*$), HR (VT vs LP, EQ, and NEG stages; $136.0 \pm 19.0^*$ vs $126.3 \pm 12.91^*$ and $152.5 \pm 15.40^*$ and $160.5 \pm 16.28^*$), and RPE (VT vs LP and NEG stages; 5.2 ± 2.70 vs $3.6 \pm 1.32^*$ and $7.2 \pm 1.09^*$). **Conclusion:** It was concluded that the EQ stage of the TT is a valid measure of the exercise intensity at VT in children, as it is already known to be in adults.

Results- $\dot{V}O_2$



2957 Board #3 May 31 2:00 PM - 3:30 PM
Predicting Changes in Adolescent Muscle Mass with Field Testing
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With physical training and normal adolescent growth, gains in lean muscle mass can be seen among the healthy adolescent population. Assessing these gains is crucial to monitoring and adjusting training protocols and helping with client motivation and investment. However, the ability of common field tests to accurately predict changes in muscle mass among this population has yet to be proven.

PURPOSE: The purpose of this study was to assess the ability of the standing long jump (SLJ) and 90° push-up (PU) test to accurately predict changes in lean mass (ΔLM) among healthy adolescents aged 12-18 years.

METHODS: Forty-five healthy adolescents completed the standing long jump, 90° push-up test, and a full-body dual energy x-ray absorptiometry (DEXA) scan twice

with 7-10 months between test sessions. The difference in each outcome was calculated and used to indicate change. Field test predictive ability was evaluated using multiple regression and accounted for age (yrs), sex (female = 0, male = 1), height (cm), body mass, and pubertal stage using the Pubertal Development Scale (PDS).

RESULTS: A mean change of 2198.82 g of lean mass (range = -1193.60, 7307.70; SD = 1816.67) was shown using DEXA. The SLJ and PU had a mean change of 5.11 cm (range = -36.00, 35.70; SD = 16.40) and 0 repetitions (range = -13, 11; SD = 5.30) respectively. Both ΔSLJ ($r = .340$, $p = .011$) and ΔPU ($r = .315$, $p = .018$) had significant moderate relationships to ΔLM . The inclusion of ΔSLJ and ΔPU in the model accounted for an additional 8.8% of the variability ($R^2 = .551$ from .463) and 4.2% ($R^2 = .593$) respectively. The overall model explained 59.3% of the variability in lean mass change and resulted in the following predictive equation: $\Delta LM = 1237.59 + (-630.44 \times \text{age}) + (-169.34 \times \text{PDS}) + (847.31 \times \text{gender}) + (33.89 \times \text{height}) + (199.04 \times \text{BMI}) + (29.07 \times \Delta SLJ) + (73.13 \times \Delta PU)$

CONCLUSIONS: Along with anthropometric developmental factors, the SLJ and PU tests can be used to estimate changes in lean muscle mass. However, these factors only account for approximately 60% of the change in lean muscle mass leaving the remaining 40% attributable to other (neural, mechanical, motivational) factors. Nevertheless, this prediction equation can assist in monitoring changes in lean muscle mass during adolescence.

2958 Board #4 May 31 2:00 PM - 3:30 PM
Relationship Between Physical Activity and Motor Skills in 3-5 year olds: National Youth Fitness Survey
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PURPOSE: The purpose of this study was to examine what kind of physical activity would have a positive relationship with motor skills in children through secondary data analysis.

METHODS: Data from children 3-5 years old ($N = 352$, 179 males) who participated in the National Youth Fitness Survey (2012) were used. Included in this study were demographics, anthropometrics, physical activity questionnaire by parent report, and motor skill score determined by Test of Gross Motor Development-2nd Edition. Multiple regression was conducted to examine the relationship between physical activity and motor skills controlling for sex, race, and parent's socioeconomic status.

RESULTS: The most commonly reported activities were running (43%), playing outdoor games (35%), and riding a bike (34%). Motor skills standard scores were locomotor (Mean (SE) = 9.99 (.16)), object control (Mean (SE) = 8.52 (0.14)), and gross motor skill (Mean (SE) = 95.57 (.68)). Participation in the following activities were positively related to gross motor skill score: riding a bike (β (SE) = 5.27 (2.02), $p = 0.02$), scooter riding (β (SE) = 9.83 (2.59), $p = 0.002$), swimming (β (SE) = 4.01 (1.17), $p = 0.004$), and jumping on a trampoline (β (SE) = 7.45 (3.09), $p = 0.03$). With the exception of riding a bike the activities positively related to gross motor skill score had a reported range of participation between 7-12%.

CONCLUSIONS: The key findings of this study indicated that participation in specific physical activities were related to gross motor skill score in preschool aged children. Further, it showed that with the exception of riding a bike the activities that the children participated in the most were not the same as those activities that were positively related to their gross motor skill score.

2959 Board #5 May 31 2:00 PM - 3:30 PM
Tri-Ponderal Mass Index and Fitnessgram BMI Classification In Sixth-grade Children
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To classify the health status of children, criterion standards for body composition and body mass index (BMI) have been established by FITNESSGRAM according to gender and age. Standards for aerobic capacity (AC) have also been established to assess cardiorespiratory function. Tri-Ponderal Mass Index (TMI) has been shown to better classify overweight and obesity than BMI in youth. **PURPOSE:** The purpose of this study was to determine the association between TMI and FITNESSGRAM BMI classification in sixth-grade children. **METHODS:** Subjects were 439 sixth-grade boys and girls, ages 11-13, who completed each of the FITNESSGRAM components as a part of their yearly assessment. In addition to height and weight, subjects' AC was determined from one-mile run/walk times, age, gender and BMI. 43% percent of these students were classified within the Healthy Fitness Zone (HFZ) for BMI. 42% percent of these students were classified as High Risk for BMI. **RESULTS:** The correlation

between TMI and BMI was .98, and the correlation between BMI and AC was -.82. The correlation between TMI and AC was -.80. Receiver Operating Characteristic (ROC) analysis indicated that a TMI of 13.97 represents the best cut-off score for classifying girls within the HFZ for BMI, with 94% classified correctly, and AUC = .98. Also, a TMI of 13.41 represents the best cut-off score for classifying boys within the HFZ for BMI, with 94% classified correctly, and AUC = .98. For determining High Risk classification for BMI, a TMI of 14.90 represents the best cut-off score for classifying girls as High Risk for BMI, with 96% classified correctly, and AUC = .99. Also, a TMI of 15.24 represents the best cut-off score for classifying boys as High Risk for BMI, with 94% classified correctly, and AUC = .98. **CONCLUSIONS:** TMI is strongly associated with classification according to FITNESSGRAM BMI standards in sixth-grade children. These data suggest that a TMI of 13.97 for girls and 13.41 for boys are the best criteria for HFZ classification for FITNESSGRAM BMI. Also, a TMI of 14.90 for girls and 15.24 for boys are the best criteria for High Risk classification for FITNESSGRAM BMI. TMI is a substantial factor in determining overweight and obesity, and body size has been shown to be an important health-related outcome, especially in youth.

2960 Board #6 May 31 2:00 PM - 3:30 PM

A Comparison Of Health-related Fitness Variables Between Youths In Singapore And Taipei

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Health-related fitness (HRF) variables may reduce cardiovascular risk factors if detected early in youths. A comparison between two similar high-density cities may reveal more information on their health status. **PURPOSE:** To compare HRF variables between youths in Singapore (SGP) and Taipei (TP).

METHODS: A total of 1559 youths from SGP (age: 13.49 ± 1.21 years, height: 159.76 ± 8.94 cm, weight: 51.91 ± 13.38 kg, Body Fat (BF) %: 21.51 ± 10.25 %) and 1620 youths from TP (age: 13.84 ± 0.91 years, height: 160.89 ± 7.86 cm, weight: 55.57 ± 13.35 kg, BF%: 23.29 ± 10.30 %) participated in this study. Body Mass Index (BMI) was calculated and BF% was measured by bio-electric impedance analysis. Aerobic fitness, lower limb flexibility, arm strength, and abdominal endurance were tested using the 15m youth Progressive Aerobic Cardiovascular Endurance Run (PACER) test, one-legged sit-and-reach (SRT), handgrip strength (HS) test, and 1-minute sit-up test (SUT) respectively.

RESULTS: Higher percentage of youths from TP were in the normal (TP: 54.88%, SGP: 46.89%) and overweight (TP: 18.15%, SGP: 12.70%) BMI range, while there was a higher percentage of underweight youths in SGP (40.41%) compared to TP (26.98%). Significant differences were found between SGP and TP for height (SGP: 159.76 ± 8.94 cm, TP: 160.89 ± 7.86 cm, $p < 0.0005$), weight (SGP: 51.91 ± 13.38 kg, TP: 55.57 ± 13.35 kg), BMI (SGP: 20.19 ± 4.21 kg·m⁻², TP: 21.35 ± 4.28 kg·m⁻², $p < 0.0005$), BF% (SGP: 21.51 ± 10.25 %, TP: 23.29 ± 10.30 %, $p < 0.0005$), SRT (SGP: 54.14 ± 10.15 cm, TP: 51.78 ± 11.29 cm, $p < 0.0005$), SUT (SGP: 38.94 ± 11.92, TP: 33.03 ± 9.71, $p < 0.0005$) and PACER (SGP: 40.93 ± 23.90 laps, TP: 37.75 ± 18.86 laps, $p < 0.0005$). No significant difference was found in HS between youths in both countries (SGP: 25.18 ± 7.77 kg, TP: 25.45 ± 7.33 kg, $p = 0.32$), with SGP having a lower obesity rate (SGP: 12.7%, TP: 18.15%).

CONCLUSIONS: Higher BMI and BF% values were found in TP as compared to SGP. While youths in both countries had similar arm strength, SGP youths had higher abdominal endurance, better flexibility and higher aerobically fitness as compared to TP youths. Youths from both countries have differences even with similar population density and should maintain their fitness health status through physical activities as this will help to reduce the risk of cardiovascular diseases in the future.

2961 Board #7 May 31 2:00 PM - 3:30 PM

High Intensity Interval or Moderate Continuous Training in Health Indicators of Adolescents with Central Obesity

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(No relevant relationships reported)

PURPOSE: To evaluate the effects of HIIT and moderate intensity continuous training (MICT) on health indicators from adolescents with central obese.

METHODS: This is a randomized clinical trial, with three evaluations: baseline, after 8 and after 16 weeks. The sample was composed by 42 participants, randomized in two groups: HIIT (n = 22) and a MICT (n = 20). After 16 weeks of training (3 sessions/

week), 34 adolescents finished the program (HIIT, n = 21; MICT, n = 13). The HIIT group performed different models of interval training, progressively organized, and the MICT trained in a fixed intensity from 60 to 80% of HRmax. Anthropometrical data ([BMI, Waist Circumference [WC], Height Waist Ratio [HWR], Body Fat Percentage [%BF]), cardiorespiratory fitness (CRF), blood pressure (systolic and diastolic) and metabolic profile (fasting blood glucose [FBG], high density lipoproteins [HDL-C], low density lipoproteins [LDL-C], total cholesterol, non-HDL cholesterol and triglycerides [TG]) were analyzed.

RESULTS: Sixteen weeks of aerobic training resulted in significant reductions in BMI (HIIT = -4.5% [ES = -0.26] vs MICT = -3.9% [ES = -0.24]), WC (HIIT = -6.9% [ES = -0.64] vs MICT = -6.6% [ES = -0.61]), HWR (HIIT = -10.5% [ES = -1.00] vs MICT = -5.2% [ES = -0.50]), %BF (HIIT = -14.3% [ES = -0.59] vs MICT = -9.8% [ES = -0.40]), FBG (HIIT = -6.1% [ES = -0.65] vs MICT = -11.1% [ES = -0.89]) and non HDL cholesterol (HIIT = -14.5% [ES = -0.44] vs MICT = -11.0% [ES = -0.37]), and increased CRF (HIIT = 13.0% [ES = 1.77] vs MICT = 10.3% [ES = 0.76]). Only HIIT improved diastolic blood pressure (-17.0%, ES=-0.87), LDL-C (-13.3%, ES=-0.34) and total cholesterol (-11.9%, ES = -0.47), but only MICT changed positively TG (-23.4%, ES = -0.44). No changes were observed for systolic blood pressure and HDL-C. No differences were found in all variables between groups. Relating to inadequacy cases, both groups changed TG (HIIT = 20 to 11, MICT 13 to 6), but only HIIT decreased the number of adolescents in inadequacy from CRF and blood pressure (from 14 to 3).

CONCLUSIONS: 16 weeks of HIIT or MICT positively impact anthropometrical variables, metabolic profile and CRF in obese adolescents.

2962 Board #8 May 31 2:00 PM - 3:30 PM

Physiological And Anthropometric Profiles Of Elite Teenage Cyclists In The United States

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(No relevant relationships reported)

PURPOSE: Maximal oxygen consumption ($\dot{V}O_{2max}$), power output at $\dot{V}O_{2max}$ (W_{max}), lactate threshold (LT), and several anthropometric characteristics are related to elite cycling performance in adults. These factors may change during adolescent development, yet little is known about how values among teenage cyclists compare to their adult counterparts. Low bone mineral density (BMD) has also been reported in competitive adult road cyclists versus recreationally active controls, but BMD in younger cyclists has not been thoroughly investigated.

METHODS: We examined variables from a graded exercise test (LT, $\dot{V}O_{2max}$, W_{max}) and anthropometric characteristics (height, weight, % fat) in 8 elite male teenage cyclists (16.8 ± 1.4 y) and compared them to junior Italian cyclists and professional cyclists in the literature. BMD was also measured via DXA, and compared to age-specific norms.

RESULTS: Our cohort possessed comparable absolute/relative $\dot{V}O_{2max}$ (4.6 ± 0.7 L/min; 74.9 ± 6.6 mL/kg/min) and W_{max} (375 ± 67 W; 6.1 ± 0.7 W/kg) values to previously studied junior Italian cyclists, with inter-study differences potentially explained by different rider specializations and competitive-levels, and methodological differences between studies. Our teenaged cyclists were smaller (176 ± 6 cm), lighter (61.5 ± 5.0 kg), and had lower absolute $\dot{V}O_{2max}$ and W_{max} than professional adult cyclists in prior studies. Total BMD values (1.142 ± 0.088 g/cm²), and values for the spine, femur, and femoral neck were all > 50th percentile for age/sex.

CONCLUSIONS: The largest differences in exercise responses between competitive teenage and adult cyclists were in absolute aerobic power (rather than per kgBW), which would presumably diminish with any further increases in size/mass with maturation in young cyclists. The healthy BMD levels in this group could be related to age, or to mountain biking and other cross-training completed by this group of athletes.

2963 Board #9 May 31 2:00 PM - 3:30 PM

The Chinese Assessment Of Motor Quotient: Methods For Children In 7 To 9 Years Old

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PURPOSE: Motor quotient is described as an index of the present rate of development and, possibly, predicts future development. As such, it is expected that those who have greater motor quotient would be more likely to obtain the health benefits offered by habitual physical activity. A theoretical model and assessment frame, the Chinese

Assessment of Motor Quotient (CAMQ), for the assessment of childhood motor quotient had been proposed in theory, but validity data were lacking. The purpose of this study was to explore validity evidence for the CAMQ among children 7 to 9 years.

METHODS: The CAMQ validity was evaluated through two analyses that utilized cross-sectional data obtained through local schools in Chongqing, China. A confirmatory factor analysis (CFA) compared the data to the theoretical model. Patterns of association between age and gender and the CAMQ total and domain scores were examined using regression models. The CAMQ was completed by 572 children (53 % male) in 7 to 9 years (mean 8.2 years), with all guardian of children approached agreeing to participate.

RESULTS: The CAMQ model included three domains: physical competence (fitness), athletic performance (motor skill) and motor behavior (motivation). Using CFA analyzed the validity data 557 children with complete raw scores. The results showed the $\chi^2/df=2.79$, GFI = 0.96, CFI=0.95, NFI=0.93, TLI= 0.95, RMSEA=0.05. Regression models showed that interpretive categories, developed from age and gender-adjusted normative data, were not associated with age indicating that the CAMQ is suitable for use across this age range. Children's gender was associated with physical competence and athletic performance domain scores, indicating that further research is required regarding the gender adjustment of the raw CAMQ scores.

CONCLUSIONS: The CAMQ offers a comprehensive assessment of physical competence, athletic performance, and motor behavior as components of children motor quotient (7 to 9 years). Monitoring of these measures enhances our understanding of children's motor quotient and assists with the identification of areas where additional supports are required.

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2964 Board #10 May 31 2:00 PM - 3:30 PM
Comparison Of Adolescents' Fitness Between Hong Kong, Taipei And Shanghai

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Poor health status in childhood has been documented to persist into adulthood, reducing quality of life. **PURPOSE:** To understand the fitness levels in adolescents between three countries that share similarities in race and culture.

METHODS: A total of 4736 healthy adolescents (age: 13.79 ± 0.93yrs, height: 162 ± 8.21cm, weight: 54.79 ± 12.82kg, BF%: 22.25 ± 10.00%) were recruited for the intervention from Shanghai (SH) (n=1586), Hong Kong (HK) (n=1530) and Taipei (TP) (n=1620). Anthropometric measurements were taken on the same day. Participants took their percent body fat (BF%) with a bio-impedance analysis, and handgrip strength test (HGS) with a hand dynamometer. Flexibility, abdominal muscular strength, and cardiovascular fitness (CF) were measured with one-legged sit and reach test (SRT), one-minute sit-up test, and 15m PACER test respectively.

RESULTS: One-way ANOVA showed significant differences between the three countries for height (SH: 164.4 ± 7.83cm, HK: 160.7 ± 8.40cm, TP: 160.89 ± 7.86cm; p < 0.0005), weight (SH: 56.48 ± 12.24kg, HK: 52.2 ± 12.44kg, TP: 55.58 ± 13.35kg; p < 0.0005), BF% (SH: 22.23 ± 9.64%, HK: 21.16 ± 10.00%, TP: 23.3 ± 10.30%; p < 0.0005), HGS (SH: 55.53 ± 14.09kg, HK: 51.94 ± 13.90kg, TP: 50.86 ± 14.67kg; p < 0.0005), abdominal muscular strength (SH: 36.20 ± 9.24 reps, HK: 30.56 ± 10.14 reps, TP: 33.03 ± 9.71 reps; p < 0.0005) and CF (SH: 40.11 ± 16.05 laps, HK: 35.48 ± 18.44 laps, TP: 37.77 ± 18.86 laps; p < 0.0005). Kruskal-Wallis Test analyzed results of SRT showed significant difference between the three countries (SH: 54.96 ± 9.70cm, HK: 49.61 ± 12.03cm, TP: 51.79 ± 11.29cm; p < 0.0005). Significant differences were observed in the inverse relationship between BF% and CF (r = -0.46; p < 0.0005), BF% and abdominal strength (r = -0.30; p < 0.0005) and a positive linear relationship between abdominal strength and CF (r = 0.54; p < 0.0005).

CONCLUSIONS: Adolescents from Shanghai, Hong Kong and Taipei are vastly different in all health-related fitness variables which could be attributed to environmental and social factors. However, they are generally healthy and fit with good BF% level and CF. Adolescents should continue to be exposed to regular physical activities to maintain and improve fitness status. This would prevent unwanted cardiovascular diseases in future which would lead to higher quality of life.

2965 Board #11 May 31 2:00 PM - 3:30 PM

The Effects of Plyometric or Combined Training on Kicking Time in Teenager Taekwondo Athletes

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Purpose: To compare the effectiveness of a general plyometric training (GP) and a GP plus transfer exercises (GP + TE) on kicking time (KT) in cadet and junior taekwondo athletes. **Methodology:** Volunteers were 33 athletes between 12 and 17 years old and taekwondo practice experience of 3.0 ± 1.2 yr. Participants were randomly assigned to GP, GP+TE, or a control (CON) group, and underwent a 3-week intervention, training 3 times per week. The training session was divided into a stretch, a general warm-up and the treatment phase, according to the specifications for each group, each lasting approximately 10-min. Following the intervention, the athletes completed their regular training. The exercises performed by the participants only differed in the 10-min lasting the intervention. The GP group completed 8 sets of 6 repetitions of countermovement jumps (CMJ), the GP+TE completed the same exercise exercises as the GP group immediately followed by a taekwondo kicking technique on a kicking pad. The CON group only performed static stretching. A Fitlight Trainer System was used to measure before and after KT performance. For the KT drill, the athlete was instructed to use the dominant leg in a circular kick ("Bandal Chagui") and in a frontal kick ("Mirot Chagui"). The front leg was used for both kicks, and the first sensor of the measurement system was located at ankle height to start the time and a second sensor was located at the height of the performer's navel to stop the time and register the KT. A 3 x 2 (groups x measurements) general linear model ANOVA was used to analyze KT. **Results:** No significant interaction or main effects were shown on circular kick KT scores (p > 0.05). A significant measurement main effect was found on frontal kick KT (F = 4.743, Pre = 0.354 ± 0.004s vs. Post = 0.344 ± 0.004s; p < 0.037) regardless of the experimental group. **Conclusion:** The GP and the GP+TE training elicited similar improvements in frontal kick KT in cadet and junior taekwondo athletes. Circular kick KT was unaffected by training.

2966 Board #12 May 31 2:00 PM - 3:30 PM
Which Is Better In Physical fitness Between Obese And Lean Young Children?

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[Introduction] The number of children being diagnosed with infant metabolic syndrome is also on the rise. Moreover, an increase in the prevalence of lean children is also beginning to be seen in recent years.

[Purpose] This study aims to examine the characteristic of physical fitness according to level of obesity index among young children from the age of three to six by using a large-scale dataset.

[Methods] The subjects included 5640 young children (2840 boys and 2800 girls). We administered physical fitness tests comprising seven types of exercises (grip strength, standing long jump, softball throw, 25-m run, side-step, upright hand standing time, and sitting trunk flexion) to gauge the children's state of physical fitness. A T-score was calculated on the basis of the mean and standard deviation according to sex and age, and this score was used as an individual score of physical fitness. Children were divided into seven groups on the basis of the obesity index (~15%, -15%~-5%, -5%~-0%, 0%~-5%, +5%~-15%, +15%~-20%, +20%~). Further, the extent of differences among children with different obesity index was examined for each type of exercise. To conduct a statistical analysis of the data, one-way ANOVA and multiple comparisons (Tukey's HSD test) were employed.

[Results] The analysis revealed a significant difference among the groups for all the exercises. In the 25-m run, standing long jump, and upright hand standing time, "+20% or more" group had the lowest scores. In the softball throw, sitting trunk flexion, side-step, grip strength, and overall physical fitness, "-15% or less" group scored the lowest. [Discussion] The physical fitness of obese (+20%~) and lean (~15%) children was found to be poor. In the lean children, the reason is thought to be low muscle mass and underdevelopment due to a lack of physical activity. Moreover, their low expenditure of energy is suspected to result in a low appetite, which can lead to poor nutrition. On the other hand, the severely obese children (+20% or more) may be undeveloped due to their lack of physical activity and excessive and imbalanced diet. However, the mildly obese (up to +15%) are not physically underdeveloped at infancy. They do not need extreme obesity prevention measures, and it is important for them to acquire a "play a lot, eat a lot" lifestyle.

- 2967** Board #13 May 31 2:00 PM - 3:30 PM
Unit Characteristics Of Physical Activity Intensity In Physical Education Lesson Among Elementary School
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 (No relevant relationships reported)

[PURPOSE] This study aimed to measure the intensity of a given physical exercise during an elementary school level physical education class.

[METHODS] The subjects of this study were 28 elementary school children (16 boys and 12 girls) in the 5th grade. To measure exercise intensity, a Lifecorder GS (manufactured by SUZUKEN Co., Ltd) was used. There were five target units of exercise including long jump, expression, tag rugby, hurdle run, and Tee-ball. The length of each class as well as the proportion of each exercise were measured according to the period recording method (Instruction, Management, Motor learning, Cognitive learning). To assess the difference in intensity across each of the five units of exercise, the coefficient of variation (CV) was calculated. A corresponding one-way analysis of variance and a multiple comparison test were used for clarification. In addition, when Bartlett's test was applied and a significant main effect was observed, a test of equal variances between the two groups was used.

[RESULTS] Regarding individual differences in exercise intensity, significant differences were found between tag rugby and both tee balls and long jump, as well as between expression and long jump. The coefficient of variation was calculated as follows: expression (29%), tag rugby (27%), Tee-ball (25%), hurdle run (18%), long jump (17%). In addition, differences in units were significantly higher in exercise intensity between hurdle run and tag rugby, expression and tee ball, as well as between long jump and Tee-ball.

[CONCLUSIONS] In physical education classes, there is a difference in physical activity among the five exercises measured, and it is presumed that the magnitude of these differences varies depending on the individual exercise. That such individual differences exist in physical education classes is, in itself, not a problem. However, this would become undesirable in any situation in which the difference becomes large, thus failing to ensure consistency in the amount of physical activity and potentially resulting in children performing less physical activity. In order to secure a consistent level of activity intensity in physical education lessons, it is necessary to take measures for children with less physical activity.

- 2968** Board #14 May 31 2:00 PM - 3:30 PM
Physical Fitness Level And Personality Traits At Age Six: Longitudinal Relationship With The Big Five
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 (No relevant relationships reported)

PURPOSE: To examine the longitudinal change of the Big Five factors of personality in children aged six years with high and low physical fitness (PF) levels.

METHODS: The participants were 186 six-year-old children (87 boys, 99 girls). To measure PF level, PF tests for young children were conducted. Principal component analysis was performed for the seven PF test parameters, and the first principal component scores were converted into T scores classified by sex and age (categories spanning 0.5 years), which were treated as overall PF scores. To investigate children's personalities with regard to the Big Five factors of personality, a questionnaire survey was administered to the children's teachers. The five main factors of personality traits were "openness(O)," "conscientiousness(C)," "neuroticism(N)," "extraversion(E)," and "agreeableness(A)." Based on the overall PF score at age six we divided the participants into a higher PF level group (upper 25%, 47 participants) and lower PF level group (lower 25%, 47 participants). We conducted a two-factor analysis of variance (PF level \times age) that corresponded to only one factor concerning the evaluation. When a significant main effect was observed, multiple comparison test (Tukey's HSD) was conducted. The statistical significance level of this study was less than 5%.

RESULTS: "O" was significantly higher in the higher PF level group at ages five and six. "C" and "E" were significantly higher in the higher PF level group at ages four and six. "A" was significantly higher at ages four, five, and six in the higher PF level group. For "A," a significant difference was found between the age of four and six and five and six in both groups, and for "E," a significant difference was observed only in the higher PF level group, between the ages of four and five, four and six, and five and six. **CONCLUSION:** It was suggested that "A" and "E" are particularly fostered from the ages of five to six. It was inferred that personality characteristics were nurtured through physical activities such as athletic play, which involve communicating with multiple persons and obeying rules.

- 2969** Board #15 May 31 2:00 PM - 3:30 PM
Relationship Between Physical Fitness Characteristics Of Girls And Attitudes And Preference For Exercise
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 (No relevant relationships reported)

PURPOSE: The purpose of this study is to investigate the relationship between physical fitness characteristics of girls and their attitudes toward and preference for exercise and physical education.

METHODS: The participants of this study were 181 public elementary school girls, ranging from third grade to sixth grade. Eight items of a physical fitness test were divided by grade, and we calculated T-scores; the average T-scores of the eight items was taken as the total physical fitness score. An upper group of physical fitness was established for those that scored in the upper 25% (45 people); the lowest 25% (45 people) made up the lower group of fitness. These two groups were analyzed. A questionnaire survey was conducted using a five-point scale for the investigation of attitude and preference of exercise and physical education.

In order to investigate the difference between the attitudes toward and preference for exercise and physical education between the two groups, an independent t-test was used.

RESULTS: Statistical analysis of survey results demonstrated that 31 out of 40 items showed a significant difference. Among them, for items such as "I don't want to get tired," "I am not interested in exercise," "I dislike feeling inferior," "I don't want people to know about my abilities," and "I don't want my friends to get angry when I can't do something well," the lower group reported higher scores than the upper group.

CONCLUSIONS: Based on physical fitness level, the upper group and the lower group displayed very different thinking processes about exercise and physical education. It is particularly conceivable that girls with inferior physical fitness have negative thoughts about exercise. In addition to this, girls with inferior physical fitness was suggested that tends to extremely dislike to be seen movement and to be evaluated by someone.

- 2970** Board #16 May 31 2:00 PM - 3:30 PM
Physical Activity And Physical Fitness Characteristics Of Young Children With Extended-hours Childcare
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 (No relevant relationships reported)

[Purpose] This study aimed to clarify the difference between the amount of physical activity obtained and the physical fitness characteristics of infants in extended child care and those not in extended childcare.

[Method] Forty-two aged 6years-old children enrolled in a private kindergarten participated with 21 of those having used extended childcare for two years or three years (the use group), and 21 who had not used it (the non-use group). The amount of physical activity the infants engaged in was measured using Panasonic's Day calorie. For physical fitness and exercise ability, we conducted an infant physical fitness test and calculated the T score by gender and age (0.5 year categorizations) from the results of the seven items measured; the average T score of seven items was taken as the total physical fitness score. A t-test that did not correspond to the comparison between the number of steps and the total physical fitness score within the normal amount of childcare time of the use group and the non-use group was applied. In addition, Pearson's correlation coefficient was used to examine the relationship between the use group and the non-use group's physical activity levels and overall physical fitness scores.

[Results and Discussion] The results of the analysis found that there was no significant difference in amount of physical activity and physical strength/exercise ability between the use group and the non-use group. Regardless of whether extended-hours childcare use is used or not, it appears that the same tendency was shown because all of the children are doing the same activities during regular childcare hours. On the other hand, the extended-hours childcare children showed 2,335.84 steps per hour, so it is possible that extended-hours childcare is playing an important role in securing the amount of physical activity.

- 2971** Board #17 May 31 2:00 PM - 3:30 PM
Seasonal Variation In Physical Activity Levels Among Elementary School Children In The Arctic Areas.
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PURPOSE

To compare elementary school children's physical activity levels during two different seasons in Northern Norway.

METHODS:

Elementary school children from 1st, 3rd, 5th and 7th grade were recruited to wear an accelerometer (GT3X-BT, ActiGraph, LLC, Pensacola, United States) for seven consecutive days during two different seasons: The winter season in November ($n=235$), and the summer season in June ($n=214$). The primary physical activity outcome was measured as total counts per minute and time spent at different activity intensities. We defined moderate-to-vigorous physical activity (MVPA) as >2000 counts per min, as previously used (Ekelund et al., 2004).

RESULTS

Girls had more counts per min during the measured week in the summer season (616 ± 380.5) compared to the winter season (589 ± 124.8) ($p<0.001$), while there was no significant differences among boys. Boys spent more time in MVPA during the winter season (71.5 minutes ± 26.7) compared to the summer season (61.5 minutes ± 12.9) ($p<0.05$). Children in 7th grade spent more time in MVPA during the winter season (64.6 minutes ± 26.1) compared to the summer season (44.9 minutes ± 23.6) ($p<0.001$). There were no differences between sexes for time spent in MVPA or counts per min ($p<0.05$) during the winter season, except for counts per min in 1st grade ($p<0.05$). During weekdays in the winter season, 53.1% of the children reached MVPA of ≥ 60 minutes physical activity daily. In weekdays during the summer season, 62.5% of the children reached MVPA ≥ 60 minutes.

CONCLUSION Girls had more counts per minute during the summer season compared to the winter season, but there were no differences in time spent in MVPA. Boys spend more time in MVPA during the winter season compared to the summer season. 62.5% met the recommended 60 min per day of MVPA during the summer compared to the winter where 53.1% met the recommendations.

2972 Board #18 May 31 2:00 PM - 3:30 PM

Associated Factors To Health Risk Behaviors in Adolescent's Athletes

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(No relevant relationships reported)

PURPOSE: To verify associated factors with health risk behaviors (HRB) in Brazilian adolescents' athletes. **METHODS:** Cross-sectional study, with 367 athletes (15.68 ± 0.78 years) from Curitiba/PR/Brazil. The HRB evaluated were: insufficient levels of physical activity, high TV and videogame time, low consumption of fruits and vegetables, consumption of alcohol, tobacco and illicit drugs, sexual and violent behavior. Investigated associated factors were: sex, age, socioeconomic status, type of sport, years of training and weekly training volume, evaluated through questionnaires. Poisson regressions analyzed the factors associated with HRB, adopting $p<0.05$.

RESULTS: The collective sport (PR: 3.11, 95% CI: 1.13-8.58) and years of practice (PR: 1.14, 95% CI: 1.01-1.29) were positively associated to high TV time. For the high videogame time, inverse associations were seen for age (PR: 0.59, 95% CI: 0.39-0.89) and for the weekly training volume (PR: 0.92, 95% CI: 0.86-0.99), but not for years of practice (PR: 1.12, 95% CI: 1.01-1.25). For vegetable consumption, inverse associations were seen for the weekly training volume (PR: 0.98, 95% CI: 0.96 - 0.99). Age was positively associated with mild (PR: 1.64, 95% CI: 1.32-2.03) and excessive (PR: 1.82, 95% CI: 1.34-2.48) alcohol consumption. On the other hand, inverse associations were seen for the weekly training volume and mild (PR: 0.95, 95% CI: 0.92-0.99) and excessive (PR: 0.94, 95% CI: 0.89 - 0.99) alcohol consumption. Positive associations were seen for age (PR: 9.59; 95% CI: 3.36-27.38) and weekly training volume (PR: 1.20; 95% CI: 1.01-1.45) for tobacco consumption, and age for illicit drug use (PR: 18.08; 95% CI: 3.38-56.65). Girls were less likely to have sexual (PR: 0.28, 95% CI: 0.08-0.94) and violent (PR: 0.23, 95% CI: 0.08-0.62) risk behaviors. **CONCLUSIONS:** It was observed that characteristics of sports practice, such as years of practice and weekly training volume may favor healthy behaviors such as a lower videogame time, alcohol consumption and increased consumption of vegetables in adolescent's athletes.

2973 Board #19 May 31 2:00 PM - 3:30 PM
Comparison Of Physical Activity, Cardiovascular Endurance And Perception Of Quality Of Life Between Adolescents Engaged And Non-engaged In After School Sports Program

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(No relevant relationships reported)

Objective: To compare the level of physical activity, cardiovascular endurance and perception of quality of life of male and female adolescents, of three different groups: 1) engaged in after school sports programs; 2) engaged in any other type of regular physical exercise; 3) not engaged in any type of formal physical exercise.

Methods: The sample consisted of 374 adolescents, 198 boys (16.35 ± 0.65) and 176 girls (16.19 ± 0.67). The QAFA questionnaire was used to evaluate the level of physical activity (min/week) and the Pacer test for cardiovascular endurance (VO_{2max}). The KIDSCREEN-52 was used to evaluate perception of quality of life. Anova's One-way and post hoc Scheffé were used for the comparisons, with $p<0.05$. **Results:** non-exercising adolescents presented lower levels of physical activity (Boys: 471.72 ± 570.07 min/week; Girls: 332.09 ± 359.22 min/week) and cardiovascular endurance (Boys: 36.41 ± 4.70 ml/kg/min; Girls: 31.16 ± 3.23 ml/kg/min) when compared to those engaged in after school sports programs (Boys: 1074.17 ± 733.98 min/week; 40.15 ± 6.50 ml/kg/min; Girls: 985.00 ± 634.95 min/week; 33.46 ± 4.70 , respectively) and other type of regular physical exercise (Boys: 866.89 ± 572.45 min/week; 38.49 ± 5.45 ml/kg/min; Girls: 635.43 ± 467.78 min/week; 32.96 ± 4.5 ml/kg/min, respectively), $p<0.01$. Boys (77.51 ± 8.45 points) and girls (74.84 ± 8.90 points) engaged in after school sports program had higher scores for perception of quality of life when compared to boys (72.74 ± 9.15 points) and girls (74.18 ± 6.95 points) engaged in other type of physical exercise and non-exercise boys (72.18 ± 10.31 points) and girls (69.98 ± 9.35 points), $p<0.05$. **Conclusion:** adolescents engaged in after school sports programs presented higher levels of physical activity, cardiovascular endurance and better perception of quality of life. Support: Fundação Araucária

2974 Board #20 May 31 2:00 PM - 3:30 PM
Relationship Between Physical Fitness Level At Age 6 And Motivation And Perseverance

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(No relevant relationships reported)

[Purpose]

The purpose of this study was to investigate the relationship between physical fitness (PF) level at the age of 6 and longitudinal change of motivation (M) and perseverance (P).

[Methods]

The participants were 186 young children (87 boys and 99 girls). For measuring PF, PF tests for young children were conducted. Principal component analysis was performed for the seven PF test parameters, and first principal component scores were converted into T-scores classified by sex and age (categories spanning 0.5 years), which were treated as overall PF scores. The upper 25% of the overall PF scores was classified as a higher PF level group (47 participants), and the lower 25% of the overall PF scores was classified as a lower PF level group (47 participants). In addition, in order to objectively investigate young children's personalities with regard to "M" and "P", a questionnaire survey was administered to the young children's schoolteachers.

A two-factor analysis of variance (PF level group \times grade) that corresponded to only one factor concerning the evaluation was conducted. Multiple comparison tests (Tukey's HSD) were performed for all observed significant main effects. The statistical significance level of this study was less than 5%.

[Results]

With respect to "M" and "P", the results showed no significant interaction between PF level and grade; however, a significant main effect was observed between the PF level groups and grade.

The multiple comparison test between the PF level groups showed that "M" and "P" were significantly higher in the higher PF level group, and it is motivated at the ages of 4 (0.477), 5 (0.631), and 6 (0.870), the patience. In terms of strength, the effects increased at the ages of 4 (0.655), 5 (0.904), and 6 (1.232).

The multiple comparison test between the grade levels showed that both "M" and "P" were significantly higher in the higher PF level group at age 6 than at age 4 and at age 5.

[Discussion]

Infants with high PF at the age of 6 show high “M” and “P” at the age of 4. Further, the difference widens with successive grade levels, thereby suggesting that the bipolarization of “M” and “P” originates in early childhood.

2975 Board #21 May 31 2:00 PM - 3:30 PM

Acute Cardiometabolic Responses to Integrative Neuromuscular Training in Children

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Integrative neuromuscular training (INT) is a method of conditioning that includes strength and conditioning exercises which are designed to enhance both health- and skill-related components of physical fitness. While previous investigations have examined the effects of INT on performance, the acute cardiometabolic responses to INT have not been examined. **PURPOSE:** To examine the acute cardiometabolic responses to a specific INT protocol and to compare these responses to a bout of moderate intensity treadmill (TM) walking in children. **METHODS:** 14 children (10.7±1.1 yr) were tested for peak oxygen uptake ($\dot{V}O_{2\text{peak}}$) and peak heart rate (HR) on a maximal TM test and subsequently participated in 2 experimental conditions on nonconsecutive days: a 12-min INT protocol of 6 exercises and a 12-min TM walking protocol at 50% $\dot{V}O_{2\text{peak}}$. The INT protocol included balance board squats (EX1), medicine ball squats with toss (EX2), planks with side step (EX3), medicine ball forward lunges (EX4), battling rope double arm waves (EX5) and medicine ball slams (EX6). Each INT exercise was performed twice for 30 sec with a 30-sec rest interval between sets and exercises. Participants performed the INT and TM protocols while connected to a metabolic system and HR monitor. **RESULTS:** Throughout INT mean HR significantly increased from 121.1±9.0 b·min⁻¹ during EX1 to 183.5±7.9 b·min⁻¹ during EX6 and mean $\dot{V}O_2$ significantly increased from 14.9±3.6 ml·kg⁻¹·min⁻¹ during EX1 to 33.3±6.0 ml·kg⁻¹·min⁻¹ during EX6 ($p<0.05$). Mean HR and $\dot{V}O_2$ values during INT ranged from 60.9% to 92.4% of HRpeak and from 28.1% to 63.0% of $\dot{V}O_{2\text{peak}}$, respectively. During the TM condition, mean HR and $\dot{V}O_2$ values ranged from 121.1±11.7 b·min⁻¹ to 150.4±17.3 b·min⁻¹ and from 19.2±2.5 ml·kg⁻¹·min⁻¹ to 26.8±6.2 ml·kg⁻¹·min⁻¹, respectively. Mean HR and $\dot{V}O_2$ values were significantly higher during EX5 and EX6 of INT than during the same time intervals of TM walking ($p<0.05$). **CONCLUSION:** These data indicate that INT can pose a moderate to vigorous cardiometabolic stimulus in children, and selected INT exercises are more intense than moderate intensity walking.

2976 Board #22 May 31 2:00 PM - 3:30 PM

Longitudinal Assessment of Peak Power During Childhood

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Factors influencing peak power (PP) during childhood are still unclear. Even though physical activity in children consist mostly of high intensity short burst movement, there are limited longitudinal studies assessing PP during childhood. **PURPOSE:** To evaluate PP in children and identify the possible influence of sex and body fat (BF). **METHODS:** Forty-four children (24 girls and 20 boys), were evaluated in 1st grade and for the next four consecutive years (mean group age on the first and last evaluation: 6.4±0.5, and 10.5±0.5 years respectively). Counter-movement vertical jump height (JH) was determined using an electronic platform and converted to PP(W) using Canavan & Vescovi's equation. Height and weight were measured, and triceps and calf skinfolds were also measured for BF estimate. Repeated measures ANOVA were performed to determine differences in all variables by grade and Pearson correlations to evaluate relationships between BF, JH, PP and relative peak power (RPP). Independent sample t-test was used to detect differences between sex. **RESULTS:** JH increased between grades, being significant between 2nd, 3rd and 4th grade (27.1±4.3, 28.4±4.2, 29.9±4.9, 31.7±6.0, 32.7±7.0 cms, for 1st, 2nd, 3rd, 4th and 5th grade respectively, $p<0.05$). PP (W) also increased significantly, except from 3rd to 4th grade (1009.7±41.9, 1177.8±35.5, 1537.7±86.3, 1587.9±46.3, 1812.3±47.3 W for 1st, 2nd, 3rd, 4th, and 5th grade respectively, $p<0.01$). No differences were found in JH or PP between boys and girls in any grade. Negative correlations were found between BF and JH ($r = -.48, -.59, -.71, -.63, -.46$ for the 1st, 2nd, 3rd, 4th and 5th grade respectively, $p<0.01$), also between BF and RPP (W/Kg) ($r = -.61, -.67, -.69, -.77$, for the 1st, 2nd, 4th and 5th grade respectively, $p<0.001$). **CONCLUSION:** These results suggest that JH and PP increase similarly between boys and girls as they move from 1st to 5th grade

and are negatively influenced by BF. Further studies addressing the variation in growth characteristics and health behaviors that potentially influence muscle power during childhood are needed. Supported in part by FIPI/DEGI/UPRRP.

2977 Board #23 May 31 2:00 PM - 3:30 PM
Criterion-related Validity Of A Cadence Rope Skipping Test For Estimating $\dot{V}O_{2\text{peak}}$ In Adolescents

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(No relevant relationships reported)

Rope skipping is a fun and excellent moderate to vigorous physical activity (MVPA) for school students especially for elementary and junior high schools. Studies demonstrate that prolonged rope skipping exercise could effectively improve aerobic fitness. Considering the specificity principle in fitness evaluation, it is desirable to develop a rope-skipping specific exercise testing for evaluating aerobic fitness. **Purpose** The purpose of this study was to develop a prediction model to estimate peak oxygen uptake ($\dot{V}O_{2\text{peak}}$) from a sub-maximal cadence rope skipping test among secondary school students. **Methods** A total of 58 secondary school students (38 boys, 20 girls, age=13.8±1.1 yrs) completed two different forms of rope-skipping exercises (free-style skipping & Gallop-style skipping, in randomized order) with a steady cadence of 60 skips per min, for 3 min each and at least 20 min apart. Exercise heart rates (EHR) throughout the 3-min skipping and additional 1-min post-exercise HR (PHR) were monitored continuously using Polar HR monitor. Students also completed a treadmill $\dot{V}O_{2\text{peak}}$ test using calibrated direct $\dot{V}O_2$ metabolic measuring system (COSMED K4b2). Moderate to vigorous physical activity habits (MVPA), in term of average min per day were assessed by questionnaire. $\dot{V}O_{2\text{peak}}$ was then correlated with HER and PHR at various time points, as well as MVPA, BMI, age, and gender, using stepwise regression, to determine criterion-related validity. **Results** Regardless of skipping style, $\dot{V}O_{2\text{peak}}$ was best correlated with PHR at 20s after the exercise, followed by MVPA, gender, and BMI. The best equation was: $\dot{V}O_{2\text{peak}} = 70.422 + (7.542 * \text{gender}) + (.126 * \text{MVPA}) - (.470 * \text{BMI}) - (.167 * \text{PHR@20s})$; $R = .870$, $\text{SEE} = 4.54 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, using the free-style rope skipping test. Both free-style and Gallop-style rope skipping gave similar level of criterion-related validity. **Conclusion** A 3-min free-style cadence rope skipping submaximal test was effective to estimate $\dot{V}O_{2\text{peak}}$ of secondary school students using post-exercise heart rate at 20 seconds after the exercise, and gender, MVPA, and BMI. This test is particularly suitable for athletes of rope skipping to evaluate aerobic fitness due to its' good validity and specificity.

2978 Board #24 May 31 2:00 PM - 3:30 PM

Acute Physiological And Perceptual Responses To Body-weight Circuit And Treadmill-based High-intensity Interval Exercise In Children

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(No relevant relationships reported)

Research examining acute responses to non-laboratory-based high-intensity interval exercise (HIE), such as body-weight exercise, in children is lacking. **PURPOSE:** To compare the acute physiological and perceptual responses between body-weight circuit (CIRC) and treadmill high-intensity interval running (TM) in children. **METHODS:** Physically active boys (n=17; age = 9.7 ± 1.3 years) completed a graded exercise test to determine maximal heart rate (HR_{max}), peak oxygen uptake ($\dot{V}O_{2\text{peak}}$) and maximal aerobic speed (MAS). Time-matched (8-min) CIRC and TM were completed in a randomized order on separate days within a 1 to 2-week period. CIRC consisted of two sets of 4 bouts of 30 s of maximal repetitions of mountain climbers, jump squats, jumping jacks, and burpees, whereas TM included 30 s bouts at 100% MAS. Both had a 30 s recovery between bouts. HR and gas exchange data were continuously assessed using a portable metabolic analyzer and HR monitor, and blood lactate concentration (BLA) was measured pre- and post-exercise. Global affect (PANAS) and exercise enjoyment (PACES) were assessed at baseline and post-exercise. Rating of perceived exertion (RPE), affect (Feeling Scale) and enjoyment (Exercise Enjoyment Scale) were recorded pre- and post-exercise and at 38% and 75% of session completion. **RESULTS:** Mean peak HR and $\dot{V}O_2$ were 87% HR_{max} and 74% $\dot{V}O_{2\text{peak}}$ for CIRC and 89% HR_{max} and 80% $\dot{V}O_{2\text{peak}}$ for TM, with a significant difference in peak $\dot{V}O_2$ between regimens ($p<0.05$). Yet, there were no differences in session HR, $\dot{V}O_2$ or \dot{V}_E ($p>0.05$). Post-exercise BLA was significantly higher following CIRC vs. TM (mean difference = 3.0 ± 2.2 mM, $p<0.05$). RPE, affect and enjoyment responses did not differ between regimens during exercise, and affect did not differ from pre- to post-exercise within or between regimens ($p>0.05$). Post-exercise enjoyment was significantly lower after CIRC vs. pre-exercise (mean difference = 3.9 ± 1.1, $p<0.05$). **CONCLUSION:** Although HR was similar, there was a higher peak $\dot{V}O_2$ in response to TM, paralleling previous work in adults. The greater BLA accumulation in CIRC may be explained by

greater muscle recruitment required for multi-joint, dynamic movements and could explain the reduced post-exercise enjoyment. Future research should investigate higher volume protocols utilizing different body-weight exercises.

2979 Board #25 May 31 2:00 PM - 3:30 PM
The Effect Of Comprehensive Coordination Training On Children's Cognitive Function

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PURPOSE: The aim of this study was to investigate the impact of comprehensive coordination training on children's cognitive function by adding two extracurricular exercises per week.

METHODS: A sample of 120 children aged 7-9 years old who participated in the "MQ101" program were randomly divided into two groups. The experimental group consisted of 58 people and the control group of 62 people. The experimental group participated in extracurricular comprehensive coordination training for 12 weeks, 2 times a week, and 1 hour each time. The control group did not participate in specialized training courses (not limiting students' self-exercise). The height, weight, 50-meter run, Body Comprehensive Coordination Test (BCCT) and the Eriksen Flanker test were tested in the pre-post experiment. The independent sample T-test and factor analysis were used to analyze the change values between the experimental group and the control group.

RESULTS: The two groups had no significant demographic differences in age, gender, height, weight, physical fitness tests or BCCT before the experiment. After the experiment, height, weight, and 50-meters-run had significantly changed in two groups ($p < 0.05$). However, regarding a body comprehensive coordination test, only the experimental group has significant differences before (29.75 ± 6.75) and after (32.80 ± 5.21) the experiment ($p < 0.05$). The results of Flanker test indicated that the post-test period had a higher accuracy rate in both congruent ($95.27\% \pm 9.76$) and incongruent ($91.03\% \pm 6.97$) trials compared with those in the pre-test period ($84.7\% \pm 10.29$ and $73.69\% \pm 7.79$, respectively) in the experimental group. Additionally, no significant differences were found in the reaction time between the experimental group and the control group.

CONCLUSIONS: Comprehensive coordination training has a great impact on the development of children's coordination skills. In addition, behavioral testing results also suggest that coordinative training may specifically benefit prefrontal-dependent tasks in the immature brain state of children aged 7-9 years old by increasing the allocation of attention resources and enhancing the efficiency of neurocognitive processing. (This study was supported by NPOPSS Grant 15CTY011.)

2980 Board #26 May 31 2:00 PM - 3:30 PM
Clarify The Influence Of Changing Parental Consciousness On Opportunities Of Children's Exercise

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 (No relevant relationships reported)

PURPOSE: This study was to clarify the influence of changing parental consciousness on children's exercise opportunities.

METHODS: We urged a change in parental consciousness by showing them how pleasantly children exercised in various exercise programs. The participants included 32 children and their parents. The selection method firstly extracted the lowest 50% ranked by three test (50 m run, standing long jump, and soft ball throw) total scores out of the 103 elementary school 1st and 2nd graders who intending to participate in the program. We then used based on the results of a questionnaire on extracted person, "children who do not like exercising and have few opportunities to exercise" were selected. Various exercise programs were conducted seven times in total. The program also consisted of playful activities in addition to basic physical activities such as running, jumping, and throwing. We tried a questionnaire on the first and last day of the program. We examined the following three issues using the collected data: whether parents intending to increase opportunities for children to get exercise actually did it, whether the presence of a playground is related to intention of parents to increase those opportunities, and whether the presence or absence of a place is relevant to the increase in children's exercise opportunities.

RESULTS: The findings revealed that although 96% of the parents intended to increase opportunities for children to get exercise, only 25% were actually able to increase it. Further, 56% of those who intended to increase such opportunities had an appropriate playground near their houses, although 69% of them could not actually increase it.

CONCLUSION: The number of parents intending to create more opportunities for children to exercise increased. However, this change in consciousness did not necessarily lead to an actual increase. The result suggests that other factors are involved in increasing opportunities for children to exercise, such as time and environment. This study was limited by time constraints. Therefore, it is necessary to continue the program over a longer period of time and analyze further changes in parental consciousness to determine the influence on opportunities for children's exercise activities.

2981 Board #27 May 31 2:00 PM - 3:30 PM
Body Mass Index and Physical Fitness Measures of 6th, 7th, and 8th Grade Boys and Girls

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PURPOSE: To describe the anthropometric and fitness profiles of 6-8 grade students who participated in 2-3 days/week of PE classes during the academic year.

METHODS: Data was collected on all willing 6-8 graders from the years 1992 to 2002, for a total of 10 years. Subjects included 1374 6th graders (height 59.33 ± 3.3 in, weight 102.6 ± 28.2 lbs), 1267 7th graders (height 62.4 ± 3.0 in, weight 117.7 ± 31.4 lbs), and 634 8th graders (height 63.1 ± 3.2 in, weight 125.7 ± 29.7 lbs) at a Chambersburg, PA junior high school. Participants completed fitness markers (height, weight, one-mile run, and curl ups) once in a year. Descriptive/frequency statistics were used to examine dependent variables for each participant, analyzing by grade and gender. Values were compared to the normative healthy fitness zones (HFZ) by FITNESSGRAM. **RESULTS:** 6th grade boys had a mean body mass index (BMI) of 19.7 ± 3.7 kg/m², one-mile run of 9.4 ± 2.3 minutes, and curl ups of 45.8 ± 10.1 ; 63.9% met the HFZ for BMI, 77.5% met the HFZ for one-mile run, and 96.5% met the HFZ for curl ups. 6th grade girls had a mean BMI of 20.6 ± 4.8 kg/m², one-mile run of 10.7 ± 2.3 minutes, and curl ups of 39.9 ± 10.7 ; 57.5% met the HFZ for BMI, 70.0% met the HFZ for one-mile run, and 94.7% met the HFZ for curl ups. 7th grade boys had a mean BMI of 20.2 ± 3.8 kg/m², one-mile run of 9.0 ± 2.6 minutes, and curl ups of 49.7 ± 11.6 ; 71.9% met the HFZ for BMI, 72.2% met the HFZ for one-mile run, and 97.1% met the HFZ for curl ups. 7th grade girls had a mean BMI of 21.5 ± 5.0 kg/m², one-mile run of 10.7 ± 2.6 minutes, and curl ups of 41.3 ± 10.7 ; 63.8% met the HFZ for BMI, 69.2% met the HFZ for one-mile run, and 98% met the HFZ for curl ups. 8th grade boys had a mean BMI of 21.1 ± 3.7 kg/m², one-mile run of 9.2 ± 3.3 minutes, and curl ups of 50.9 ± 11.6 ; 67.2% met the HFZ for BMI, 53.1% met the HFZ for one-mile run, and 85.3% met the HFZ for curl ups. 8th grade girls had a mean BMI of 22.6 ± 4.9 kg/m², one-mile run of 10.5 ± 1.8 minutes, and curl ups of 38.0 ± 9.6 ; 54.0% met the HFZ for BMI, 59.7% met the HFZ for one-mile run, and 80.1% met the HFZ for curl ups. **CONCLUSIONS:** Many junior high aged children are not meeting standards that are accepted regarding BMI, one-mile run, and curl ups. More work is needed to decrease BMI and obesity in children. More physical activity/sports involvement outside of PE programs may be needed for children not meeting these HFZ standards.

2982 Board #28 May 31 2:00 PM - 3:30 PM
The Role of Growth and Maturation During Adolescence on Team Selection and Short-Term Sports Participation

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 (No relevant relationships reported)

Older (born in a month at the start of the team selection year; termed relative age (RA)), more mature adolescent athletes are more likely to be selected onto youth teams. However, little is known as to whether selection onto a team influences an individual's short-term sports participation. **Purpose:** (i) to investigate the relationship of RA, anthropometrics, and maturity on team selection and (ii) the short-term (3 years) consequence of selection on sports participation. **Methods:** 851 participants were recruited from six bantam team sport try-outs: soccer, football, basketball, volleyball, baseball and hockey. Parental heights, date of birth, date of test, height, sitting height and weight were recorded and age at peak height velocity (APHV) and final adult height predicted. Athletes were placed in month quartiles for month of birth. Reference standards were used to create z-scores. Sports participation was recorded at try outs and at 3 year follow-up. Analysis included chi-squared and ANOVA. **Results:** The sample showed an over representation of the first and second birth month quartiles ($p < 0.05$). Z-scores for height ranged from 0.1 (1.1) to 1.8 (1.2) and were significantly different between sports ($p < 0.05$). Some height and APHV differences

were found between selected and non-selected athletes ($p < 0.05$). 4% of non-selected athletes dropped out of all sport participation. 84% of selected athletes were still in the same sport compared to 68% of athletes still in the same sport but who were not selected. **Discussion:** In general athletes at try-out were already taller than the general population, in some sports were maturing earlier, and were born early in the selection year. If not selected a large percentage changed sports. Coaches should be aware of the consequences of selecting the oldest, tallest and more mature athletes on continued sports participation.

2983 Board #29 May 31 2:00 PM - 3:30 PM

An Evaluation of the Irish Life Schools Fitness Challenge

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BACKGROUND: Children and adolescents with high levels of cardiorespiratory fitness (CRF) have a favourable cardiovascular risk profile and a reduced risk of myocardial infarction, stroke, and mortality in adulthood. Furthermore, levels of CRF tend to track from adolescence to adulthood. The 20m shuttle run test (20mSRT) is the most widely-used test to estimate CRF in adolescents. The Irish Life Health Schools Fitness Challenge is a national initiative designed to improve CRF levels among first year students attending Irish secondary-level schools.

PURPOSE: To assess the effect of the annual Irish Life Health Schools Fitness Challenge on CRF in 12-year old boys and girls between 2012 and 2017.

METHODS: Participating schools used a 20mSRT to assess CRF levels before and after a 6-week exercise intervention. The exercise intervention was designed and implemented by teachers in each school. The 20mSRT involved running back and forth between two lines 20m apart, keeping in time with a series of audio signals. The starting speed was 8.5 km.hr⁻¹ and increased by 0.14 m.sec⁻¹ every min. The test was terminated if a participant stopped voluntarily, or was unable to maintain the set pace.

RESULTS: Mean 20mSRT score was significantly higher in boys than girls at baseline ($p < 0.001$) and 6 weeks ($p < 0.001$). Mean 20mSRT score (total number of shuttles) increased ($p < 0.001$) by 16% (53.5 ± 14.7 vs. 62.0 ± 15.4) in boys ($n = 14,378$) and 19% (37.2 ± 11.8 vs. 44.1 ± 12.6) in girls ($n = 14,698$) ($p < 0.001$).

CONCLUSIONS: A 6-week school-based exercise intervention designed and implemented by teachers resulted in a significant improvement in 20mSRT performance in 12-year old boys and girls.

2984 Board #30 May 31 2:00 PM - 3:30 PM

Presence Of The Pediatric Inactivity Triad (PIT) In 4th And 5th Graders.

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(No relevant relationships reported)

The Pediatric Inactivity Triad (PIT) has recently been proposed as new way to examine the relationships between physical inactivity and impaired health in youth. Physical inactivity, dynapenia, and physical illiteracy are believed to be the primary determinants of PIT. **PURPOSE:** The purpose of this investigation is to determine if important relationships exist between the proposed determinants of PIT with anthropometric and psychometric measures. **METHODS:** Thirty children (10 females, 20 males) completed a series of tests and questionnaires to assess physical activity (Evaluation of Physical Activities in Youth: EASY), muscular strength and power (hand grip, vertical leap), physical literacy (Physical Literacy Assessment for Youth: PLAY Basic), body image (Social Physique Anxiety Scale for Children: SPAS) and anthropometrics (BMI, waist circumference). **RESULTS:** One third of participants (10 out of 30) were identified as not being compliant by the PLAY Basic. 40% of participants did not achieve the federal guideline for physical activity in youth. 37% of participants were in the lowest 25th percentile for hand grip and vertical leap. 5 (17%) participants displayed physical inactivity, dynapenia, and physical illiteracy. SPAS was correlated with BMI ($r = 0.38$, $p = 0.04$) and PLAY Basic ($r = -0.42$, $p = 0.02$). PLAY Basic was also correlated with EASY ($r = 0.44$, $p = 0.01$) and vertical leap ($r = 0.39$, $p = 0.04$). **CONCLUSIONS:** The results of this investigation suggest that it may be possible to identify individuals impacted by PIT. Several of these determinants are interrelated, so it may be possible to positively impact PIT by designing interventions to address specific outcomes.

2985 Board #31 May 31 2:00 PM - 3:30 PM

Sex-Based Differences in the Upper Body Musculature May Influence Rate of Force Development in High School Students

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(No relevant relationships reported)

Changes in skeletal muscle occur during the process of maturation that influence the expression of muscular strength. The isometric mid-thigh pull (IMTP) is used to measure force-time characteristics [peak force (PF) and rate of force development (RFD)], while the bioelectric properties of body tissues can be used to estimate lean body mass (LBM) and cellular health via phase angle. **PURPOSE:** To evaluate the contributions of segmental LBM, phase angle, and potentially relevant developmental indicators on IMTP performance in adolescents. **METHODS:** Twenty-three high school students (14 girls and 9 boys; age = 15.4 ± 0.8 y; height = 1.7 ± 0.0 m, body mass = 68.9 ± 14.9 kg) underwent anthropometric measurements to determine somatic maturity and multi-frequency bioelectrical impedance analysis to determine whole body phase angle (50 kHz), overall LBM, and segmental LBM of the arms, legs, and trunk. Participants performed an IMTP with a custom-built rack and force plates to determine peak RFD, absolute PF, and PF relative to body mass. Stepwise linear regression was used to determine the relationships between IMTP performance and segmental LBM as well as specific developmental indicators (chronological age and somatic maturity). Independent sample t-tests were used to evaluate sex-based differences. Pearson correlations were also used to compare IMTP performance with overall LBM and whole body phase angle. **RESULTS:** Sex-based differences ($p < 0.05$) were shown for maturity offset (female: 2.5 ± 0.6 y; male: 0.9 ± 0.8 y), whole body LBM (female: 101.3 ± 15.9 kg; male: 117.8 ± 18.3 kg), arm LBM (female: 10.2 ± 2.6 kg; male: 12.7 ± 2.7 kg), RFD (female: $1596.17 \text{ N}\cdot\text{s}^{-1}$; male: $2742.41 \text{ N}\cdot\text{s}^{-1}$). RFD was significantly associated with arm LBM ($r^2 = 0.239$; $p < 0.05$) while the addition of trunk LBM improved the model ($r^2 = 0.454$; $p < 0.05$). Neither chronological age nor somatic maturity were associated with any of the IMTP variables, while RFD was significantly correlated with both whole body phase angle ($r = 0.495$) and overall LBM ($r = 0.476$). **CONCLUSION:** Significant sex-based differences in the upper body musculature likely influence RFD in high school students despite girls displaying greater somatic maturity than boys. Phase angle may also play a role in the rate of muscular strength expression in adolescents.

2986 Board #32 May 31 2:00 PM - 3:30 PM

Physiological and Perceptual Responses to Step-Wise and Ramp Graded Exercise Tests in Children

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(No relevant relationships reported)

Step-wise graded exercise tests are common protocols to measure aerobic fitness in children but have limitations due to the nature of the increments. Modifying these tests to a ramp protocol could overcome some of these limitations. **PURPOSE:** To examine physiological and perceptual responses to step-wise and ramped graded exercise tests in children ($n = 8$; age = 13.3 ± 2.2 yrs.). **METHODS:** The standardized James protocol (STEP) and a modified-ramp James protocol (RAMP) were performed on a cycle ergometer on separate days. Protocol order was counterbalanced. STEP commenced with three 3-min stages, followed by 1-min stages. Work rate increases were based on body surface area. For RAMP, work rate was ramped to match the 3-min and 1-min stages of STEP. Work rate was increased until volitional exhaustion for both tests. Oxygen consumption (VO_2), heart rate (HR), respiratory exchange ratio (RER) and OMNI ratings of perceived exertion for chest (RPE-chest), legs (RPE-legs) and overall (RPE-overall) were recorded at the end of each 3-minute stage and peak exercise. Physiological and perceptual responses between tests were compared using two-way repeated-measure ANOVAs and test time (TT) and peak power (PP) were compared using repeated measure t-tests. Significance was established at $p < 0.05$. **RESULTS:** The physiological and RPE responses were similar between tests at the end of each 3-min submaximal stage ($p > 0.05$). At peak exercise, absolute and relative VO_2 for STEP were $2.17 \pm 0.67 \text{ L}\cdot\text{min}^{-1}$ and $42.5 \pm 5.9 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$. For RAMP, absolute and relative VO_2 peak were $2.33 \pm 0.89 \text{ L}\cdot\text{min}^{-1}$ and $45.3 \pm 8.9 \text{ ml}\cdot\text{kg}^{-1}\cdot\text{min}^{-1}$. The differences were not significant. There were no differences between STEP and RAMP for peak HR ($196.3 \pm 9.8 \text{ bpm}$ vs. $196.1 \pm 9.7 \text{ bpm}$) and peak RER (1.24 ± 0.11 vs. 1.21 ± 0.06). At peak exercise, RPE-chest, RPE-leg and RPE-overall were similar between STEP (4.8 ± 4.0 , 8.4 ± 2.1 and 7.6 ± 3.0 , respectively) and RAMP (5.6 ± 3.4 , 8.5 ± 2.3 and 8.0 ± 1.8 , respectively) ($p > 0.05$). TT and PP for STEP were 11.3 ± 2.5 min and $196.8 \pm 70.7 \text{ W}$ and 12.4 ± 2.4 min and $210.3 \pm 65.5 \text{ W}$ for RAMP ($p = 0.11$ and $p = 0.12$, respectively). **CONCLUSION:** Although limitations in step-wise protocols

exist, submaximal and peak physiological and perceptual responses were similar to a ramp protocol. Both protocols may be appropriate in children to measure aerobic fitness.

2987 Board #33 May 31 2:00 PM - 3:30 PM

Determinant Factors of Cellular Health Among Adolescent Girls and Boys

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Several studies have demonstrated that cardiorespiratory fitness (CRF) and body adiposity are strong indicators of health during childhood and adolescence. However, it is not known if these parameters are associated with cellular health. For example, phase angle (PhA) is used to evaluate nutritional status and is an indicator of cellular health. **PURPOSE:** In this study, we test if body composition and CRF have an influence on cellular health among adolescents of both genders. **METHODS:** 203 girls (12.7 ± 1.3 years) and 221 boys (12.8 ± 1.3 years) were evaluated. The peak of height velocity (PHV) was used as an indicator of somatic maturation. The percentage of fat mass (%FM) was calculated based on skinfold thickness (triceps and calf). CRF was assessed with the Leger test. Bioelectrical impedance analysis provided parameters to calculate the values of PhA and fat-free mass (FFM). Bivariate correlation was used to verify the association between PHV with PhA, %FM, FFM and CRF. We used partial correlation to evaluate if PHV was a mediator of the relationship between PhA, %FM and CRF. A linear regression analysis adjusted by PHV was used to verify if variables (%FM, FFM and CRF) influenced cellular health among adolescents of both genders. **RESULTS:** The PHV showed a significant positive correlation with FFM in girls ($r = 0.83$, $p < 0.001$) and boys ($r = 0.83$, $p < 0.001$); with PhA in girls ($r = 0.24$, $p < 0.01$) and boys ($r = 0.38$, $p < 0.001$); and with %FM but only in girls ($r = 0.15$, $p < 0.05$). PHV was negatively correlated with CRF in girls ($r = -0.54$, $p < 0.001$) and boys ($r = -0.20$, $p < 0.01$). Linear regression of the PhA adjusted by the PHV had an effect on %FM in girls ($\beta = 0.233$, $p < 0.05$) but not in boys ($\beta = 0.013$, $p = 0.834$), on CRF in boys ($\beta = 0.166$, $p < 0.05$) but not in girls ($\beta = 0.007$, $p = 0.931$), and on FFM in girls ($\beta = 0.697$, $p < 0.001$) and in boys ($\beta = 0.614$, $p < 0.001$). **CONCLUSION:** We discovered that PhA when controlled by somatic maturation seems to be more influenced by %FM in girls, CRF in boys, and FFM in both genders of adolescents. Interestingly, cellular health and CRF (for girls) and %FM (for boys) were not associated with PhA. This has implications for physical activity behavioral for improved health in adolescents of both genders. Supported by CAPES (No. 23001.000422/98-30)

2988 Board #34 May 31 2:00 PM - 3:30 PM
Resting Energy Expenditure and Metabolic Equivalents in Youth: Impact of Inconsistent Operational Definitions

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(No relevant relationships reported)

Youth metabolic equivalents (MET_y) are multiples of resting energy expenditure (REE), but there are different operational definitions for REE, including basal metabolic rate (BMR) and resting metabolic rate (RMR). **PURPOSE:** To compare MET_y defined as multiples of BMR (MET_{yBMR}) versus RMR (MET_{yRMR}). **METHODS:** Data from two studies (N = 255, 47.4% male, mean \pm SD age 10.2 ± 1.5 years) were analyzed. For all participants, BMR was predicted using Schofield's equations. RMR was assessed during 30-min supine rest while wearing a portable metabolic unit (Cosmed K4b²). Participants also performed structured physical activities (PA) ranging from sedentary behaviors (SB) to vigorous PA. MET_{yBMR} and MET_{yRMR} were calculated by dividing steady state oxygen consumption by BMR and RMR, respectively. Values were compared using two-way (Activity X MET_y calculation) analysis of variance on a mixed-effects model. Post-hoc tests were performed with Bonferroni correction ($\alpha = 0.05$). MET_{yBMR} and MET_{yRMR} values were also classified as SB (≤ 1.50 MET_y), light PA ($1.51-2.99$ MET_y), moderate PA ($3.00-5.99$ MET_y), or vigorous PA (≥ 6.00 MET_y). Classifications were compared with a confusion matrix. **RESULTS:** There was a significant interaction ($F(30) = 19.1$, $p < 0.001$) between activity and MET_y calculation. MET_{yBMR} and MET_{yRMR} differed significantly for 20 of 31 activities (64.5%), with differences ranging from 0.2 MET_y for supine rest to 4.8 MET_y for the running course ($p < 0.001$). For intensity classification, MET_{yBMR} and MET_{yRMR} gave the same classification in 61.4% of cases (see table). **CONCLUSION:** MET_{yBMR} and MET_{yRMR} are comparable (within 0.5 MET_y) for SB, but MET_{yBMR} becomes progressively higher than MET_{yRMR} as intensity increases, reaching differences $>40\%$. MET_{yBMR} and MET_{yRMR} are not interchangeable units, and care is necessary when interpreting and comparing the findings of studies that use MET_y.

Supported by NIH grants R21HL093407 and R01HD083431.

MET _{yBMR}	MET _{yRMR}			
	SB	Light PA	Moderate PA	Vigorous PA
SB	342	6	0	0
Light PA	180	220	10	0
Moderate PA	14	265	561	23
Vigorous PA	0	34	301	204

2989 Board #35 May 31 2:00 PM - 3:30 PM
Comparative Study On Body Composition Distribution Between Obese And Normal Children In China

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The prevalence of obesity among Chinese children is on the rise, and Asian are more likely to have centripetal obesity.

PURPOSE: To compare the body composition and distribution of obese children and normal children, and to find out the changing rules among different ages.

METHODS: We recruited 219 Chinese children (12.18 ± 3.05 yr.; height: 155.24 ± 15.66 cm; mass: 48.60 ± 14.41 kg; boys: 48.4%). The age ranges from 7 to 17, and is divided into three age groups, including 7-9, 10-13 and 14-17. According to national standards, <Screening for overweight and obesity among school-age children and adolescents>, they are divided into normal group ($n=161$) and obesity group ($n=58$). Their body composition was measured using dual-energy X-ray absorptiometry (DEXA), the main indicators were bone mineral content (BMC), fat mass (FM) and lean mass (LM) of trunk and limbs, and body fat percentage (BFP), trunk fat Percentage (TFP), trunk LM Percentage (TLP), trunk BMC Percentage (TBP). Paired samples t test and correlation analysis with age control was used for statistics.

RESULTS: BFP and FM in obesity group were higher than those in normal group with significant difference ($p < 0.01$). BMC and FM were higher in obesity groups, but there was no significant difference. The TFP of normal group was significantly lower than that of obesity group in each sex. ($p < 0.01$). Boys TBP normal group was significantly lower than obesity group ($p < 0.05$), and TLP had no significant difference. Girls have completely opposite results. In 7-9 years old group, there was no significant difference in all indexes between obesity group and normal group. In 10-13 years old group, TFP in obesity group was higher than that in normal group (boys $p < 0.01$, girls $p = 0.51$), and in 14-17 years old group, there was no significant difference in TFP ratio between obesity group and normal group. There was a moderate negative correlation between FM and BMC in the trunk of overweight women ($r = -0.515$, $p < 0.05$). TFP was negatively correlated with LM in obesity group (boys $r = -0.460$, $p < 0.01$, girls $r = -0.545$, $p < 0.01$), but there was no correlation in normal group.

CONCLUSIONS: TFP was higher in obese children, and the trend of fat centripetal distribution increases first and then decreases with age. Children with centripetal obesity tend to have lower LM, and girls also have lower BMC.

2990 Board #36 May 31 2:00 PM - 3:30 PM
Systolic Blood Pressure Mediates the Relationship Between Body Mass Index and Inhibitory Control in Children

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(No relevant relationships reported)

Increased body mass index (BMI) and systolic blood pressure (SBP) have been shown to be associated with poorer inhibitory cognitive control throughout childhood and impact children's health. Further statistical procedures may help to understand the nature of relationship between these variables in children. **PURPOSE:** Here, we verify the mediation role of the SBP in the relationship between BMI and inhibitory control. **METHODS:** Twenty non-normotensive (NNT) children (age: 10.86 ($10.18-10.98$) years; 8 hypertensive stage I; 1 hypertensive stage II and 11 pre-hypertensive) were paired with 20 normotensive (NT) children (age: 10.40 ($9.86-10.69$) years) by cardiorespiratory fitness, BMI, somatic maturation, scholar performance and age. They differed on SBP (NNT: 120.53 ± 6.73 mmHg vs NT: 106.64 ± 7.04 mmHg; $p < 0.01$) and diastolic blood pressure (DBP) (NNT: 75.83 ± 8.81 mmHg vs NT: 64.80 ± 4.94 mmHg; $p < 0.01$). BP was calculated by the average of three measures with a two-minute interval between them. Inhibitory control was measured by a food specific inhibitory Go/ No-go task. The Go stimuli were presented as office and bathroom pictures, whereas the No-go (inhibition) stimuli were food and toys images. Performance

was evaluated based on number of errors during No-go stimuli. T-tests were applied to verify differences between independent variables and cognitive performance. Thereafter, a four step mediation was applied using SBP as a mediator of the relation between BMI and number of errors. **RESULTS:** NNT group had higher number of errors compared to NT one (4.14 ± 0.92 vs. 2.43 ± 0.54 ; $p = 0.002$). In addition, a relationship between BMI and number of errors ($\beta = 0.38$, $SE = 0.16$, $p = 0.02$) was found. However, when considering SBP, this relationship was no longer statistically significant ($\beta = 0.24$, $SE = 0.16$, $p = 0.13$). The bootstrapped unstandardized indirect effect was 0.13 and the 95% confidence interval ranged from 0.02 to 0.35. This indicates SBP as a full mediation of the relation between BMI and inhibitory control. **CONCLUSION:** We confirm the relationship between body mass index and cognitive inhibitory control in children and for the first time present systolic blood pressure as a mediating mechanism.

2991 Board #37 May 31 2:00 PM - 3:30 PM
Examining the Relationship Between Physical Activity and Cardiometabolic Biomarkers in Youth with Overweight or Obesity

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While physical activity is known to have beneficial effects in youth, including short-term improvements in adiposity, little is known regarding the association of physical activity with cardiometabolic biomarkers among youth. This is especially true in youth with overweight or obesity. **PURPOSE:** To determine the relationship between achieving 30 minutes of moderate-to-vigorous physical activity (MVPA) per day and markers of cardiometabolic health in youth with overweight or obesity. **METHODS:** Eighty-one children (mean age $6.7 \text{ yrs} \pm 1.2$, 54% male, 47% with overweight, 53% with obesity), who are participating in a longitudinal intervention to increase physical activity and cardiometabolic health provided data on physical activity (via accelerometer), body composition (via DXA), blood pressure, and fasting biomarkers (insulin, glucose, triglycerides, & cholesterol). A series of ordinary least squares regressions were conducted examining the relationship between the various markers and achieving 30 minutes of MVPA, while controlling for age and sex (model one) and age, sex, and percent body fat (model two). **RESULTS:** Our results indicated that percent body fat was negatively associated with achieving 30 minutes of MVPA ($b = -2.98$, $P < .01$) after controlling for age and sex. Of the remaining biomarkers, only fasting insulin was associated with achieving 30 minutes of MVPA ($b = -3.81$, $P < .05$), but this relationship became non-significant ($b = -2.36$, $P = .16$) when adding percent body fat to the model ($b = 0.50$, $P < .01$). **CONCLUSIONS:** Achieving 30 minutes of MVPA was negatively associated with adiposity, but other cardiometabolic biomarkers were not associated with achieving 30 minutes of MVPA among youth with overweight and obesity.

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F-55 Free Communication/Poster - Injury, Injury Prevention, Recovery and Rehabilitation

Friday, May 31, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

2992 Board #38 May 31 2:00 PM - 3:30 PM
Negative Impact of Icing Treatment on Qualitative Recovery of Injured Soleus Muscle in Rats

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 (No relevant relationships reported)

PURPOSE: Although the RICE (Rest, Ice, Compression, and Elevation) treatment has been recognized as the gold standard of first aid treatment for sports injuries, we and the others previously demonstrated that a transient icing treatment immediately after skeletal muscle injury impaired muscle regeneration. However, the information

about the influence of icing treatment following skeletal muscle injury remains limited. This study was, therefore, to investigate the impact of icing as a first-aid treatment on qualitative recovery of damaged muscle in terms of fibrosis and myosin heavy chain (MyHC) profile.

METHODS: Male Wistar rats (9-10 weeks of age) were randomly assigned to control (Con), injured, and injured with icing groups (Ice). Bupivacaine (BPVC) was injected into slow soleus muscles bilaterally in order to induce muscle injury in the two injury groups. Application of icing treatment (ice pack, 0°C for 20 min) to the icing group was carried out immediately after the BPVC injection. At 3 days-4 weeks after BPVC injection, soleus muscles were removed and analyzed.

RESULTS: Compared with the Con group, a significant increase in fibrotic area was observed after 2 weeks following injury in the injured groups, but after 1 week following injury in the Ice group ($P < 0.05$). This area was also tended to be higher in Ice than in injured animals during 1-4 weeks of recovery period. In addition, the number of Tcf4-positive nuclei, a fibroblast marker, located in interstitial spaces in both injured groups markedly increased 1 week after BPVC injection. The numbers were tended to be more magnified in the Ice group than in the injured group, then their number in both injured groups gradually decreased thereafter. Injury-related de novo appearance of embryonic, neonatal, IId/x, and IIB MyHC isoforms was noted in both injured groups 1 week after BPVC injection. These MyHC isoforms were significantly decreased toward the undetectable level thereafter. However, the embryonic MyHC isoform was still detectable in icing, but not in injured, animals 4 weeks after BPVC injection.

CONCLUSIONS: Our results suggested that icing treatment following skeletal muscle injury will have a negative impact on recovery process (fibrosis and normalization of MyHC profile) of regenerating muscle.

2993 Board #39 May 31 2:00 PM - 3:30 PM
Stressed Outover Stress Fractures? Potential Predictive Model To Determinethose At Risk

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PURPOSE: Stress fractures are injuries caused by cumulative, repetitive stress that leads to abnormal bone remodeling. There are two causes of stress fractures, excessive stresses causing weakening of bone material and typical stresses acting on abnormal bone. Stress fractures are more common in certain populations including women, military personnel, high-level athletes, and the middle aged/elderly. Stress fractures have a large socioeconomic impact as they cause prolonged periods away from competition and a significant amount of healthcare spending. A reliable, reproducible method to determine which individuals are most susceptible within the predisposed populations would provide cost-effective prevention strategies. Advanced numerical simulation tools may be key to modeling the mechanical behavior of bones under different loading conditions.

METHODS: Method: The hybrid finite-discrete element method (FDEM) combines aspects of the finite element method to model the elastic behavior of materials and the discrete element method to model the initiation and propagation of fractures. The FDEM is used to simulate the deformation and fracturing in materials such as bone and rock. This can capture the transition of a solid from a continuous to a discontinuous state by directly simulating fracturing processes. See the Image 1 for further explanation of methods.

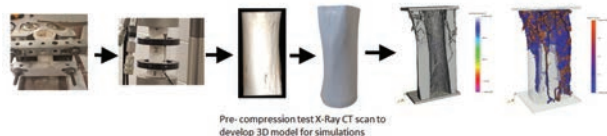
RESULTS: Refer to Image 2 for graphs and model results.

CONCLUSION: The FDEM model shows promise to help predict stress fractures. Further studies are needed; including realistic bone loadings to real life situations.

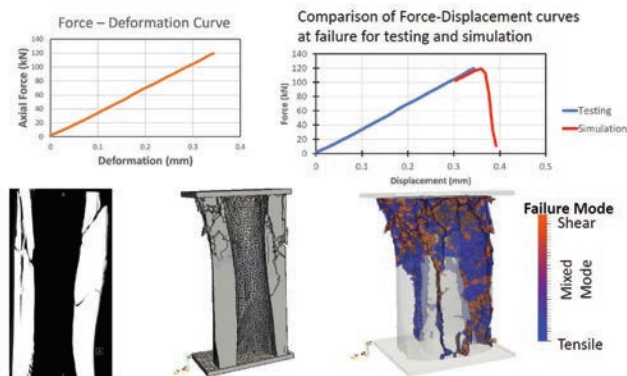
An initial simulation study was done in which prepared bovine tibiae without surrounding soft tissue was first imaged using computed tomography (CT). Following CT imaging, the bones were loaded in compression to the point of failure.

The tibiae were then re-imaged with CT. The initial CT data provided a three-dimensional model that could be used in the simulation software.

The 3D model, along with the compression test, were used to calibrate a FDEM numerical model. Once calibrated, a numerical simulation of the compression test was conducted. The strength, stiffness, and fracture patterns from the physical testing and numerical simulation were then compared.



Pre-compression test X-Ray CT scan to develop 3D model for simulations



Comparison of testing and simulated fracture patterns. Both methods showed the predominant failure mechanism was axial splitting with fractures forming parallel to the applied forces. There was an encouraging agreement between physical tests and numerical simulations.

2994 Board #40 May 31 2:00 PM - 3:30 PM
Association Between Femoral Cartilage Deformation and Pain Following Running

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Patellofemoral pain (PFP) is a multifactorial knee pathology and prevalent in physically active individuals. Running is one of the most popular forms of exercise accounting with nearly 17 million runners in the US. Despite the health benefits, running may lead to injury with more than 20% of runners injured annually. Of those, 10% develop PFP. Emerging evidence suggests chronic PFP may lead to patellofemoral osteoarthritis, a condition characterized by cartilage breakdown. However, little is known about how activities that cause the symptoms of PFP influence cartilage health. Diagnostic ultrasound imaging is an emerging technique to measure cartilage thickness immediately after physical activity. No research has analyzed femoral cartilage deformation followed by running in patients with PFP.

PURPOSE: To determine if 30 minute running changes cartilage thickness and joint pain in patients with PFP compared to healthy adults.

METHODS: As part of an ongoing investigation, 6 adults (n=3 PFP, age: 21.3±0.6yrs, body mass index[BMI]: 20.5±3.2kg/m²; n=3 healthy, age: 21.0±1.0yrs, BMI: 21.9±1.4kg/m²) participated. A GE LOGIQe diagnostic ultrasound machine with a 12MHz linear probe was used to obtain the knee cartilage images before and after 30 minutes running. Perceived pain level was measured using a 10cm Visual Analog Scale (VAS). Correlation between percent cartilage thickness change and VAS was performed to measure the association between two variables and a simple regression analysis was performed to determine the predictability of cartilage thickness measure according to the pain level change.

RESULTS: Pain level change and cartilage deformation showed a strong correlation ($r=0.85$, $p=0.033$), and pain level change explained 72% of the variance in cartilage thickness ($R^2=0.72$, $p=0.03$).

CONCLUSIONS: Though continuation of this investigation is needed to confirm our findings, the strong positive association between pain level and cartilage deformation implies that measuring pain by VAS before and after physical activities may be an easy and effective means for clinicians to evaluate cartilage deformation.

2995 Board #41 May 31 2:00 PM - 3:30 PM
Early Microfractures Of Talus And Calcaneus As A Predictor Of The Foot Injuries

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PURPOSE: The aim of this study was to investigate whether the early detected microfractures of talus and calcaneus may be a predictor for foot injuries.

METHODS: Five sportsman with microfractures of talus and five with microfractures of calcaneus that undergo foot injuries were included in the evaluation. Uninjured side served as a control. The reconstructions of the bones were performed and custom

made software was used to align the talus and calcaneus of the uninjured and injured side based on principal axis of inertia and moments of inertia. Thereafter, the curvature radius and arch length of each talus and calcaneus were measured in coronal and sagittal plane. Paired sample t test was used to compare the results in uninjured and injured side.

RESULTS: The analysis of the calcaneus have showed that there was no difference between uninjured and injured cases for curvature radius neither in coronal plane (60 ± 10 mm vs. 61 ± 11 mm, respectively) nor in sagittal plane (58 ± 16 mm vs. 60 ± 12 mm) ($p>0.05$). In addition, there was not statistical difference between uninjured and injured cases for the arch length neither in coronal (23 ± 3 mm vs. 21 ± 3 mm) nor in sagittal plane (19 ± 5 mm vs. 17 ± 5 mm) ($p>0.05$). The analysis of talus has shown that there was not significance between uninjured and injured side for the curvature radius measured in coronal plane (55 ± 7 mm vs. 56 ± 8 mm) and in sagittal plane (34 ± 4 mm vs. 34 ± 7 mm) ($p>0.05$). Additionally, there was not significance between uninjured and injured side for the arch length measured in sagittal plane (29 ± 4 mm vs. 28 ± 4 mm) ($p>0.05$). Importantly, there was statistical significance between uninjured and injured side for the arch length measured in coronal plane (29 ± 4 mm vs. 21 ± 4 mm) ($p<0.05$).

CONCLUSIONS: Microfractures of the talus and consequent decrease in its arch length measured in the coronal plane may be a predictor of the foot injuries.

2996 Board #42 May 31 2:00 PM - 3:30 PM
Intratendinous Distribution Of Achilles tendinosis, A retrospective Study.

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Background. Achilles tendinopathy is a very common condition. The pathology of overuse tendinopathy has been described as a continuum that comprises 3 stages: reactive tendinopathy, tendon disrepair and degenerative tendinopathy with tendinosis. The precise location of tendinosis in the Achilles tendon tends to vary from patient to patient: musculotendinous, insertional, anteriorly or posteriorly in the tendon.

Aim. This study describes the variation in the location of the intratendinous zone of tendinosis in the Achilles tendon.

Patients and methods. All ultrasound scans of all patients who presented with pain in the Achilles region were retrospectively analyzed and classified. In this respect, classification occurred into the following three categories: tendinosis, reactive tendinopathy or other (e.g. normal scan, peritendinopathy, bursitis,...). The tendinosis group was subdivided according to the location of the tendinosis zone into proximal or insertional, which were further subdivided into anterior, posterior or both.

Results. In total we recorded and examined the ultrasound scans from 395 tendons from 325 patients, meaning 70 patients had bilateral complaints. 209 of them were men and the mean age of this population was 43 years. In 41 patients we found two zones of tendinosis. In 55,5% of the patients with pain in the Achilles region tendinosis was seen, in 18,8% reactive tendinopathy and in 25,7% something else. The results showed that in 68,2% of the sample the tendinosis zone was proximal, whereas in 31,8 % it was insertional. The proximal tendinosis zone was mostly found right across the width of the tendon (57%), but also anteriorly (15,2%) and posteriorly (27,8%). The insertional tendinosis zone, however, was mostly found posteriorly (49,3%), followed by anteriorly (27,3%) and across the width of the tendon (23,4%).

Conclusions. Although we already know that the tendinosis zone in Achilles tendinopathy occurs at different locations, the relative distribution of these zones remained relatively unclear. The distribution described raises concern about the fact that all these patients are often treated with the same protocol. Further research is needed to determine whether a difference in approach according to the location of the tendinosis zone is appropriate.

2997 Board #43 May 31 2:00 PM - 3:30 PM
Side Differences in the Y-Balance Test Performance in Patients with Unilateral Low Back Pain

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PURPOSE: Diminished balance is a well-recognized impairment in individuals with low back pain (LBP). Clinically, the Y-balance test (YBT) has been recommended as an outcome measure to assess dynamic balance deficits in the LBP population. Specifically, the reach distances of the 3 testing directions collected from both limbs often are averaged to represent a patient's balance performance. However, it is unclear if these patients perform the YBT differently when they stand on their painful limb versus on their non-painful limb. The purpose of the study was to compare the differences in the YBT between the painful versus non-painful limbs of patients with LBP under two separate conditions: performing the YBT on the dominant leg and on the non-dominant leg.

METHODS: Thirty-one right-leg-dominant adults (37.1 ± 12.5 years) with unilateral LBP completed the study, including 14 participants with LBP on the right side (9 men, 5 women) and 17 participants with LBP on the left side (8

men, 9 women). Each participant stood on one leg unsupported, with the opposite foot reaching as far as they could without losing balance in 3 directions: anterior (ANT), posteromedial (PM), and posterolateral (PL). Each participant performed a total of 9 trials for each direction and for each limb, but only the last 3 trials were measured and normalized to the corresponding leg length for later statistical analysis. Two separate 2 (group) x 3 (direction) ANOVAs with repeated measures were used to determine differences between groups, one for the dominant (right) leg, and the other for the non-dominant (left) leg. **RESULTS:** There were no significant differences in age and body mass index ($p > .05$) between groups. When standing on the dominant (right) leg, there was a significance difference ($p = 0.037$) in the PM reach distance between groups, with the left LBP group (86.1 ± 4.7 cm) reaching a shorter distance than the right LBP group (101.6 ± 5.2 cm). There were no significant differences in the ANT and PL directions. In addition, there were no differences in all directions between groups when standing on the non-dominant (left) leg. **CONCLUSIONS:** The results of the study suggest that using a composite score may fail to show dynamic balance deficits. The PM reach direction appears to be the most challenging testing component for patients with LBP.

2998 Board #44 May 31 2:00 PM - 3:30 PM
Skeletal Muscle Size, Quality And Function In Patients With Several Years After Total Hip Arthroplasty

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Total hip arthroplasty (THA) leads decrease of physical activity and muscle function, and it would induce asymmetric motor performance in daily life since most cases of THA are applied to one side. For prevention of muscle dysfunction, some sports activities such as golf, walking, swimming and so on are recommended after THA. Recently, muscle quality, i.e. fat and/or connective tissue within skeletal muscle, has been used as one of important factors to determine muscle function. **PURPOSE:** The purpose of this study was to compare muscle size, quality and function between the operated and non-operated legs in patients with one side THA with several year's exercise habits after THA. **METHODS:** Fourteen men and women (67.1 ± 5.3 years; height, 161.3 ± 6.8 cm; body mass, 65.5 ± 18.5 kg) with exercise habits, such as golf, participated in this study. They had THA surgery in either side several years ago (4.9 ± 2.5 years). B-mode transverse images of rectus femoris were taken using ultrasound system (Logiq e Premium, GE Healthcare, USA), and isometric knee extension strength (KE) was measured in both operated and non-operated legs. Muscle thickness as an index of muscle size, echo intensity as an index of muscle quality and KE were compared between operated leg and non-operated leg. **RESULTS:** There were no differences between operated leg and non-operated leg in muscle thickness (1.4 ± 0.5 cm vs. 1.4 ± 0.4 cm, $P > 0.05$), echo intensity (88.7 ± 17.8 a.u. vs. 88.9 ± 17.3 a.u., $P > 0.05$) and KE (38.3 ± 13.8 kg vs. 41.3 ± 12.3 kg, $P > 0.05$). **CONCLUSION:** As the result of several years passing after THA, the difference of high muscle size, quality and function was not shown between operated and non-operated leg. Several year's exercise habits can improve not only muscle size and function but also muscle quality.

2999 Board #45 May 31 2:00 PM - 3:30 PM
Effects of Deep Oscillation Therapy on Symptoms Associated with Eccentric Exercise-Induced Delayed Onset Muscle Soreness

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 (No relevant relationships reported)

Delayed onset of muscle soreness (DOMS) has debilitating symptoms that produces muscle damage and performance deficits among athletes. Deep oscillation therapy (DOT) is a therapeutic intervention that utilizes an electrostatic wave to create a deep oscillation massage at the cellular level with proposed physiological benefits. There is little evidence to support the use of DOT on exercise-induced DOMS. **Purpose:** Examine the effects of DOT on girth, pain pressure threshold (PPT), perceived pain, strength, and range of motion (ROM) following a bout of eccentric exercise-induced DOMS when compared to control. **Methods:** Moderately active participants (age: 22 ± 2.5 years; male: $n=5$, female: $n=5$) completed an eccentric exercise protocol for the elbow flexors to induce DOMS as part of a randomized counter-balance design study [Control group (C: no treatment) and a treatment group (T: DOT)]. T group received a 20-minute DOT treatment for 6 days. Visual analog scale assessed pain and

a manual algometer assessed PPT and girth was measured at 3 sites on the bicep (5, 9, 13 cm proximal from the antecubital line). A goniometer assessed ROM for extension and flexion. Isokinetic dynamometer measured strength for 2 maximum voluntary isometric contractions at 3 angles (30° , 90° , 130°). A 2 x 6 repeated measures ANOVA to examine differences for girth, PPT, perceived pain, ROM, maximum voluntary isometric contraction (MVC) and maximum isokinetic contraction (MIC). **Results:** A significant main effect was found for perceived pain and PPT between groups ($P \leq 0.01$; $P = 0.002$); with significant interactions between days ($P \leq 0.01$; $P \leq 0.01$). Both displaying improvements for the T group. Girth was significantly different over time for both C and T (2.55 vs. 1.42 , $P = 0.03$) and T resulted in a reduction for days 2-6 ($P = 0.04$). Mean ROM significantly changed over time, with Days 2-6 significantly less than Day 1 ($P < 0.05$), but no significant differences occurred between groups. No differences were found in MVC and MIC at any angles over time or between groups. However, MIC at 30° was decreased over time (5.68 and $.41$, $P = 0.001$), with Day 2 significantly lower than Day 1 (mean difference 14.5 ± 4.8 , $P = 0.008$), with a resulting increase for T when compared to C. **Conclusion:** There are positive effects from DOT on symptoms of exercise-induced DOMS.

3000 Board #46 May 31 2:00 PM - 3:30 PM
Effects of Testosterone and Resistance Training on Anabolic and Inflammatory Biomarkers Following Spinal Cord Injury

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Resistance training (RT) evokes skeletal muscle hypertrophy via increasing insulin growth factors-1 (IGF-1) after spinal cord injury (SCI). Muscle hypertrophy increases basal metabolic rate (BMR) following 16 weeks of RT; increase in BMR is also linked positively to adiponectin after SCI. The effects of combining testosterone replacement therapy (TRT) and RT on circulating growth factors, adiponectin and inflammatory biomarkers are still unclear. **PURPOSE:** To examine the effects of TRT+RT on IGF-1, insulin growth factors binding protein-3 (IGFBP-3), adiponectin and interleukin-6 (IL-6) compared to TRT only in men with SCI. **METHODS:** Twenty-two men with motor complete SCI were randomized into either 16 weeks of TRT+RT ($n = 11$) or TRT ($n = 11$). After overnight fast, IGF-1, IGFBP-3, adiponectin and IL-6 were measured. Evoked progressive RT using neuromuscular electrical stimulation (2 lbs. increments) was administered twice weekly. Daily TRT patches (2-6 mg/day) were applied on both shoulders at bedtime for 16 weeks. **RESULTS:** IGF-1 showed a decrease ($P = 0.008$) in both TRT+RT ($n=11$; B2: 169.5 ± 96.5 to P1: 101.5 ± 28 ng/ml) and TRT only ($n=11$; B2: 136 ± 74 to P1: 99 ± 36 ng/ml) groups. IGFBP-3 increased significantly ($P = 0.0001$) in both TRT+RT ($n=11$; B2: 1764 ± 665 to P1: 2548.5 ± 853 ng/ml) and TRT ($n=11$; B2: 1918.5 ± 587 to P1: 2778 ± 967 ng/ml). A significant interaction was noted between TRT+RT and TRT groups in the circulating adiponectin ($P = 0.024$). IL-6 decreased ($P = 0.039$) in TRT+RT ($n=8$; B2: 5.5 ± 5.6 to P1: 2.9 ± 5.4 pg/ml) and TRT ($n=10$; B2: 5.9 ± 6.0 to P1: 3.9 ± 4.4 pg/ml) groups. **CONCLUSION:** Greater adipose tissue in men with SCI may have resulted in aromatization of testosterone to estradiol that has been previously shown to decrease IGF-1 and increase IGFBP-3. Increased circulating testosterone following TRT+RT may be responsible for suppressing adiponectin but not in the TRT group. Finally, administering TRT with or without RT may elicit anti-inflammatory effects after SCI.

F-56 Free Communication/Poster - Interventions and Health Promotion

Friday, May 31, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

3001 Board #47 May 31 3:30 PM - 5:00 PM
Effectiveness of One-Year FMS Based Training on Physica Function and Fitness of College Pilot Trainees

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 (No relevant relationships reported)

PURPOSE: The fitness and health of airline pilots are essential for the safety of billions of the people traveling on commercial airlines around the world every year. Yet, no effective intervention has been developed to improve pilots' fitness using a

simple and easy approach. Using a randomized controlled trial design, we examined the effectiveness of 1-yr. supervised FMS (functional movement system) based training.

METHODS: 122 male, healthy college pilot trainees (20.1 ± 0.3 yr.) were randomly assigned to FMS training ($n = 62$) and regular physical education control ($n = 60$), 178.99 times, about 192 hours in total, during one year, and their height, weight and a set of fitness were measured before and after the study.

RESULTS: Overall adherence to prescribed exercise sessions was 178.99 ± 12.95 times or a 93±6% adherence rate, and there is no difference between groups. FMS scores in the training group increased by 29.7% (from pretest of 13.8 ± 1.44 to posttest of 17.9 ± 1.03), but only 5.1% improvement in the control group (from 13.7 ± 1.28 to 14.4 ± 1.06). Similar changes were observed in weight, BMI, hand-grip (HG), stand-long-jump (SLJ) and Sit-&-Reach (S&R), which are summarized in the table below (M±SD):

Differences between Posttest and Pretest in Selected Fitness Variables							
Group	Weight (kg)	Height (cm)	BMI	FMS	HG (kg)	SLJ (m)	S&R (cm)
Control	0.05 ± 1.50	0.02 ± 1	$0.13 \pm .49$	$0.70 \pm .81$	1.83 ± 1.69	$0.10 \pm .07$	2.42 ± 1.05
Training	-0.92 ± 2.04	$0.06 \pm .3$	$-0.31 \pm .66$	4.10 ± 1.36	4.11 ± 2.17	$0.18 \pm .06$	4.42 ± 1.19
Effect size	-.26	.089	-.66	.84	.51	.49	.67
F	7.386*	5.177	6.886*	18.649***	41.83***	1.045	2.153***

* $p < .05$, ** $p < .01$, *** $p < .001$.

CONCLUSIONS: The FMS based training can effectively improve FMS and other physical fitness of college pilot trainees.

KEY WORDS: exercise intervention, randomized controlled trial, college students

3002 Board #48 May 31 3:30 PM - 5:00 PM Low-volume High-intensity Interval Training On Cardio-metabolic Health And Adherence-related Psycho-perceptual Responses In Overweight/obese Middle-aged Adults

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High-intensity interval training (HIIT) has been proposed as a time-efficient protocol to improve metabolic health. However, its practical efficacy in terms of cardio-metabolic and adherence compared with higher-volume moderate-intensity continuous exercise (MICE) remains unclear.

PURPOSE: To compare the training effects between low-volume HIIT and higher-volume MICE on cardio-metabolic and psycho-perceptual responses in overweight/obese middle-aged men.

METHODS: Twenty overweight/obese men (mean age: 48.0 ± 5.7 years) were randomly assigned to undertake either HIIT ($n=10$) or MICE ($n=10$) training for 8 weeks (3 sessions/week). HIIT sessions consisted of ten 1-minute intervals of exercise at 80-90% HR_{max} separated by 1-minute active recovery. MICE sessions involved 50-minute continuous exercise at 65-70% HR_{max} . Health-related variables including cardiovascular fitness (VO_{2max}), body composition and cardio-metabolic blood markers were assessed before and after the intervention. Adherence-related psycho-perceptual variables including enjoyment and self-efficacy were also assessed after the intervention. Paired-sample t-tests were used to compare changes within a group before and after the intervention. Analyses of Covariance were used to compare the group difference in outcome variables after controlling for baseline values.

RESULTS: Both groups showed similar VO_{2max} increase over the 8-week intervention (HIIT: 32.5 ± 5.6 to 36.0 ± 6.2 ; MICE: 36.3 ± 6.0 to $21.5 \pm 40.2 \pm 5.1$ mL $kg^{-1} min^{-1}$, both $p < 0.05$). Both groups had significant fat% loss (HIIT: 24.5 ± 3.4 to 23.2 ± 3.5 ; MICE: 23.0 ± 4.3 to 21.5 ± 4.1 , both $ps < 0.05$) and there was a trend favoring MICE ($p = 0.054$). Compared to the baseline, MICE group significantly decreased weight, body mass index (BMI), waist circumference and glycated hemoglobin whereas HIIT increased high-density lipoprotein after the intervention. However, these variables did not differ significantly upon group comparison. The self-efficacy and enjoyment responses were found similar between HIIT and MICE (both $ps > 0.05$).

CONCLUSIONS: Our findings suggest that low-volume HIIT elicits a similar improvement of cardiovascular fitness and adherence-related psycho-perceptual responses as traditional higher-volume MICE in overweight/obese middle-aged men.

3003 Board #49 May 31 3:30 PM - 5:00 PM Features of Gaseous Metabolism during Exercise Tolerance Testing in Overweight Women

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(No relevant relationships reported)

PURPOSE: To reveal differences of gas metabolism indexes between overweight and normal weight women when they did exercise under different load, instruct overweight women to do exercise scientifically.

METHODS: Women between 20 and 30 years were divided into normal weight (NW) group ($N=15$, BMI= $18-23.9 kg/m^2$) and overweight (OW) group ($N=15$, BMI> $>24 kg/m^2$). After the baseline test, using modified Bruce treadmill protocol, the air metabolism indexes of two groups were determined by Cortex MetaMax 3B portable gas metabolic analyzer, including VO_2 , minute ventilation (MV), breathing frequency (BF), expiratory end-tidal CO_2 concentration (ETCO₂), expiratory end-tidal O_2 concentration (ETO₂), arterial blood carbon dioxide partial pressure (PaCO₂), VCO₂, oxygen pulse and maximal voluntary ventilation (MMV), etc.

RESULTS: Most of indexes such as VO_2 , VCO₂, and MV rose gradually with the load increase during exercise tolerance testing except for ETO₂ and PaCO₂. PaCO₂ and VCO₂ of OW group at grade 4 and grade 5 was significant lower than NW group by 5.6 mmHg and 0.6L/min separately. ETCO₂ of OW group at grade 3 and 4 were significant lower than NW group about 0.5% and 0.6% respectively. During recovery stage, most of indexes decreased gradually, while ETO₂ presented a rising trend. During the recovery stage, ETCO₂ of OW group was significantly lower than NW group (5.3% vs 5.8%), while MMV, MV and oxygen pulse were significantly higher than NW group. MMV of OW group at 2, 3 and 4 minutes were significant lower than NW group by 1L/min, 1L/min and 0.9L/min; MV of OW group were significant lower than normal weight group by 17.8L/min, 20.1L/min and 16.9L/min. The oxygen pulse of OW group during whole 5 minutes recovery period were significantly higher than NW group by 2.7L/min, 3.9L/min, 3.9L/min, 2.9L/min and 2.0L/min. The gaseous metabolism between two groups was significantly different when they did 7.1 and 10.2 METs exercise.

CONCLUSIONS: Although there was no difference in gas metabolism between overweight and normal weight women in resting state, the respiratory function of overweight women was weaker than normal weight women during exercise, especially at the intensities of 7.1 and 10.2 METs. After exercise tolerance testing, the recovery rate of gas metabolism in overweight adult women was slower than that of normal weight women.

3004 Board #50 May 31 3:30 PM - 5:00 PM Effects of two Different Stretching Methods Program on Range of Motion in Militaries

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(No relevant relationships reported)

The proprioceptive neuromuscular facilitation and stretching methods are commonly applied in warm-up routines, often with the aim of injury prevention. **PURPOSE:** to investigate the effect of a 12-week program of flexibility training on range of motion (ROM) of shoulder and lumbar spine joints in male militaries. **METHODS:** 90 young male militaries (17.02 ± 1.24 years old), of a universe of 500 students from Air Cadets Preparatory School, were randomly assigned in 3 groups with 30 subjects each one: stretching (SG), proprioceptive neuromuscular facilitation (FNP) and control (CG). The ROM was measured by goniometry based on LABIFIE protocol in three moments: before, during (6-week) and after training (12-week). The experimental groups performed 3 sets with 5 seconds rest intervals, 5 times a week, for shoulder horizontal flexion (SHF), shoulder horizontal extension (SHE) and lumbar spine flexion (LSF). The scale of perceived exertion in the Flexibility (PERFLEX) (0 - 110) was used to control the intensity in both groups, SG (31 - 60) and FNP (61 - 80). The exercise duration was 5 seconds for the SG and 8 seconds for each phase (contraction-relaxation) for the FNP. **RESULTS:** There were no significant differences among 3 groups in the ROM baseline values. The comparative analysis of ROM rates, defined through one-way ANOVA combined with Tukey post-hoc test, showed significant differences in the following movements to the FNP: SHF ($\Delta\% = 4.6$, $p < 0.001$); SHE ($\Delta\% = 8.6$, $p < 0.002$); LSF ($\Delta\% = 56.1$, $p < 0.001$). **CONCLUSION:** It was concluded that the program of flexibility training by FNP resulted in higher rates of development of ROM when compared to the stretching.

- 3005** Board #51 May 31 3:30 PM - 5:00 PM
Step Count Targets Corresponding to China Physical Activity Guidelines for the Preschool Children
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Chinese Preschool Children (3-6 years old) Physical Activity Guidelines (2018 ed) recommends that preschool children should accumulate at least 180 minutes of physical activity (PA) at any intensity throughout the day, including no less than 60 minutes of Moderate-to-Vigorous PA (MVPA).

PURPOSE:

Step count(SC) targets corresponding to these recommendations to assist parents and childcare workers, who will guide children to achieve the PA goal.

METHODS:

903 preschool children were instructed to wear the ActiGraph GT3x accelerometers sensor for more than 4 days, including at least 3 workdays and 1 weekend, for at least 8 hours per day. Sedentary Behavior (SB), Light PA (LPA), Moderate PA (MPA), Vigorous PA (VPA), MVPA, Total PA (TPA) and SC were obtained by GT3x. Receiver operating characteristic curve (ROC) was applied to analyze the thresholds for SC associated with MVPA and TPA, as well as sensitivity and specificity. The statistical analysis was performed by SAS JMP 13.

RESULTS:

The survey obtained valid data from 795 participants. The total wearing days were 4520, with the wearing time of 765.16±122.96min. The time of SB, LPA, MPA, VPA, MVPA, TPA and SC was 470.27±150.24min, 245.66±74.52min, 42.99±20.53min, 16.27±12.50min, 59.26±30.91min, 304.93±94.65min and 8005±3160 steps, respectively. In 4520 days, 43.94% of MVPA reached to 60min and 90.44% of TPA reached to 180min. Only 3 days which contained 60min or more MVPA did not reach to 180min of TPA. The consistency test result was Kappa = 0.9987 (P<0.0001). Thus, the evaluation of MVPA was more valuable.

The study also carried out ROC analysis of SC and MVPA which reached to 60min or not. The result showed the Area Under Curve was 0.8671. The maximum Youden index was 0.5900, corresponding to the SC of 7686 steps. The specificity was 0.8505 and sensitivity was 0.7395. When setting the SC standard as 8000, which is close to 7686 steps, the consistency test result was Kappa = 0.5715 (P<0.0001), and it was acceptable.

CONCLUSION:

Based on the data, we suggest that SC target of 8000 steps per day can be used to determine whether Chinese preschool children meet the PA recommendations by the national guideline.

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- 3006** Board #52 May 31 3:30 PM - 5:00 PM
Online Walking- Really? Comparing Online Activity Courses With Traditional Face To Face Courses.
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As female students enter college they are given many opportunities to be physical active including fitness classes and student gym memberships. Despite many benefits and opportunities, many female college students are not achieving the recommended 10,000 steps per day (Clemente et al, 2016). Activity trackers provide additional short and long term motivation for becoming physically active (Fritz, 2014). An online activity tracker based course possesses unique opportunities to increase student autonomy and exercise self-efficacy. Both of which are related to physical activity levels. Findings will provide valuable insight into benefits and drawbacks of online activity courses. **PURPOSE:** This study sought to examine effects of an online fitness course on psychosocial aspects of physical activity (i.e. exercise self-efficacy and intention to be physically active) in female college students. **METHODS:** Participants (N=42, mean age = 20.1 ± 1.5 years) college undergraduate students. Study consisted of three groups. Experiential group contained 14 students enrolled in online walking. Control group one had 14 females students enrolled in face to face activity course and the other contain 14 students who never took an activity course. Each group was given a survey measuring exercise self-efficacy and intention to exercise at the start of the semester and then 15 weeks later.

RESULTS: Two 3(group) X 2 (time) RMANOVA were run to test the interactions. There were significant group by time interactions for both intention to continue exercising [F (2, 39) = 9.26, p <.001, η_p^2 = .27] and exercise self-efficacy [F (2, 39) = 23.03, p <.001, η_p^2 = .17] and both indicated large effect sizes (Cohen, 1969). The group by time interactions indicated that participating in activity courses whether online or face to face positively affected students' intention to exercise as well as their exercise self-efficacy. Control group had no significant changes.

CONCLUSIONS: The results of this study provided two valuable insights. First, this study provided evidence of the effectiveness of online courses in influencing students' intention to continue exercising and exercise self-efficacy. Second, these results demonstrated students can receive similar benefits from online courses as they receive from face to face activity courses.

- 3007** Board #53 May 31 3:30 PM - 5:00 PM
Health-Related Fitness Knowledge, Physical Activity, and Instructional Practices Among Male and Female Physical Educators
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Lifelong physical activity (PA) is an important outcome of physical education (PE) programs. To effectively promote student PA, educators must possess adequate health-related fitness knowledge (HRFK), utilize effective instructional practices related to HRFK, and model a physically active lifestyle. Research among US adults shows that females tend to be less physically active than male counterparts, however, no research has documented gender differences in HRFK nor instructional practices related to HRFK.

PURPOSE: To determine the relationship of HRFK, PA, and HRFK instructional practices among female and male physical educators.

METHODS: A three-part questionnaire was administered to physical educators (N = 796; 409 female) from seven US states. Part 1 of the questionnaire included the *International Physical Activity Questionnaire* (I-PAQ), measuring vigorous, moderate, and light PA min/wk. Part 2 included 10-items from *PE Metrics* Standards 3 & 4 Assessment, measuring participants' HRFK. Part 3 included the *Physical Education Curriculum Analysis Tool* (PECAT) to determine the extent to which participants teach and assess student HRFK. Survey responses were adapted to a 5-point likert scale. One-way ANOVA along with post-hoc t-tests were conducted and gender comparisons made.

RESULTS: Female physical educators scored significantly higher in HRFK (85% HRFK, F[2,794]=4.17, t=2.85, p=.002 [r=.102, d=.21]), and reported less weekly minutes of vigorous PA (142.2 min/wk, F[2,794]=2.78, t=1.98, p=.024, [r=.08, d=.14]) than male counterparts (82% HRFK, 157.5 min/wk vigorous PA). Females also reported significantly greater teaching of HRFK (14.8 vs. 13.9, F[2,794]=3.09, t=2.37, p=.009, [r=.09, d=.17]) and assessment of HRFK than male physical educators, approaching significance (9.7 vs. 9.3, F[2,794]=1.24, t=1.57, p=.058, [r=.06, d=.11]). No differences in moderate and light PA were observed.

CONCLUSIONS: In spite of participating in less weekly vigorous PA, female physical educators in the study demonstrated greater HRFK and emphasized teaching and assessing HRFK more, thus may be more effective in promoting health-related fitness and lifelong student PA.

- 3008** Board #54 May 31 3:30 PM - 5:00 PM
An Educational Intervention Expands Sports Nutrition Knowledge in Division II Athletic Staff
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College athletic staff are confronted with numerous day to day perils in attempting to advance the performance of their athletes with suitable nutrition playing a dynamic role in that task. Having adequate nutrition knowledge is key to providing satisfactory and appropriate information to improve performance. The ideal providers of such knowledge are Registered Dietitians with a specialty in Sports Dietetics who may not be obtainable or have scarce contact to athletes on a smaller, less resourced Division II campus. **Purpose.** First establish the knowledge base of those that have regular contact, who consistently provide nutrition education to athletes and formally explore if 3 nutrition education sessions can advance that knowledge. **Methods.** Division II athletic staff were asked 20 sports nutrition knowledge questions focusing on macronutrients, micronutrients, supplements, weight management, eating disorders, and hydration relating to sport performance in an online pre-survey. Three nutrition education sessions focusing on the survey material were administered to athletic staff by a Registered Dietitian. Succeeding education, post-surveys (same as pre-surveys) were taken online. Total percent correct finalized survey results. A Likert scale range measured self-efficacy, 1-not at all confident to 4-very confident. Pearson correlations and linear regressions were utilized to compare pre-/post-survey results and self-efficacy. **Results.** Twenty-six pre-surveys were completed (39.7±13.6 yo). There were no relationships with pre-surveys to age, gender, or title of participants. Ten pre-survey participants (41.7±12.9yo) likewise completed post-surveys. Percent total scores improved from pre-surveys (64.5±6.9) to post surveys (76.0±9.4), p=0.017. Self-efficacy increased from pre-surveys (2.7 ±0.4) to post-surveys (3.0±0.4), p=0.012. No differences in knowledge were seen between gender, title, or education level, in pre- vs

post-survey results. **Conclusion.** Educating an athletic staff with 3 nutrition education interventions amplifies their knowledge base and self-efficacy; regardless of gender, title, or education level. This study warrants the need for further research to examine the implementation of this new knowledge base from the athletic staff to the athletes.

3009 Board #55 May 31 3:30 PM - 5:00 PM
Gender Differences in Golf Performance After Various Warm-ups

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Distinct injury differences exist between genders in golf, however, performance improvement benefits have not been studied.

PURPOSE: To examine golf performance differences by gender following individual and combined warm-up components.

METHODS: Sixty-five (31 male, 34 female) proficient golfers performed 5 baseline swings, followed by 10 swings after seven randomly ordered warm-up combinations (aerobic exercise (AE); stretching (ST); specific activity (SP); aerobic exercise & stretching (AE+ST); aerobic exercise & specific activity (AE+SP); stretching & specific activity (ST+SP); and all 3 components (ALL)), on non-consecutive days. Club and ball flight characteristics were measured.

RESULTS: Clubhead speed (CHS) improved following AE, SP, AE+ST, AE+SP, ALL ($p \leq 0.001$), ST, and ST+SP ($p \leq 0.05$). Carry distance (CD) improved after AE, AE+ST, AE+SP, ALL ($p \leq 0.001$), SP, ST ($p \leq 0.01$), and ST+SP ($p \leq 0.05$). Significant improvements were also seen in ball speed (BSPEED) for AE, AE+ST, AE+SP, ALL ($p \leq 0.001$), SP, and ST ($p \leq 0.01$), however, ST+SP showed non-significant increases. For launch angle (LA), AE, ST, SP, AE+SP, and ALL (female) showed non-significant increases, whereas ST+SP, AE+ST, and ALL (male) showed non-significant decreases. Finally, in backspin (BSPIN), AE, ST, SP, AE+SP, ST+SP (male), and ALL (female) showed non-significant increases, whereas AE+ST, ST+SP (female) and ALL (male) had non-significant decreases.

CONCLUSION: There were no significant gender differences following a warm-up. AE was the most valuable element to complete for performance improvement, with the greatest increases seen after AE+SP, AE, and ALL. ST significantly decreased CD, BSPEED, and CHS, however, ST+SP showed significant increases in CD and CHS, suggesting that 30 seconds of SP off-sets any negative effects of static stretching. Performance also significantly increased with AE+ST, suggesting that pre-warming the body may also negate any harmful effects of static stretching. The overall reliability was high (0.831-0.989), suggesting golfers had consistent swings, thus the performance changes were a result of the warm-up components. This was further supported by significant changes in CHS and BSPEED but not LA or BSPIN, indicating that CD improved solely as a result of increased BSPEED attributed to increased CHS.

3010 Board #56 May 31 3:30 PM - 5:00 PM
Actions of The Nasf-ab In a City of The Extreme North of Brazil

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PURPOSE: Analyze if the teams the Núcleo Ampliado de Saúde da Família e Atenção Básica (NASF-AB) - Extended Core of family health and primary health care - of Sistema Único de Saúde do Brasil (SUS) - Unified Health System - of Brazil, of the city of Macapá in the State of Amapá, It's act in accordance with what is proposed by the Ministry of health.

METHODS: The present study is a descriptive and explanatory research. It includes both qualitative and quantitative character. Which is used the monthly reports of the teams of the Extended Core of family health and primary health care from May to September 2018. The reports used to analyze belongs to 8 teams of NASF-AB that exist in the city of Macapá in the State of Amapá, how that teams work through matrix support each of which is composed of six distinct areas professionals among there are the Physiotherapist, social worker, nutritionist, psychologist, speech therapist and physical education professional.

RESULTS: The results obtained from the documentary survey allow a good analysis about NASF-AB professionals' actions. It was analyzed 3 among 9 available which are health actions, individualized care and home visits accompanied with the Estratégia Saúde da Família (ESF) - The family health strategy. The analysis took into account all the professionals that compose the teams and their actions of the

selected items. Among the data obtained it is essential to emphasize that of all health actions only 7.5% of them had participation of the physical education professional, while the psychologist was 23.8%. When analyzing the number of individualized care in absolute terms there is a large difference between the number of attendances of the psychology professional, which was 1625 individuals, and the social work professional, which in 5 months took care of 632 users.

CONCLUSION: The research evidenced that the attendances made by the NASF-AB teams, among the 3 items analyzed, It is below the expected level of what should be, especially when it's considered that the teams should work using the matrix support, which probably does not occur. If a chosen area is taken into account and the population selected It is understand that the population reach is still restricted. In front of exposed believes that should provide greater training for these professionals.

3011 Board #57 May 31 3:30 PM - 5:00 PM
A Seven Day Healthy Summer Camp Improved Body Composition And Lipid Profile In Obese Children

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PURPOSE: To investigate the effects of lipid profile and anthropometric measures in obese children based on a seven day participation at a health education camp (KIDS).

METHODS: Twenty children were enrolled in the KIDS (12 girls; 8 boys; 9.97±1.27 yrs.; 52.5±10.3 kg; 143.6±10.94 cm). The KIDS team was composed by a Physical Educator, Nutritionist, Psychologist, Physiologist and a Pedagogue which developed the multidisciplinary activities for parents and children. The parents attended the KIDS on the first two days to raise awareness about the healthy habits for the whole family. The children stayed for another five days. The blood sample for lipid profile and anthropometric data were collected before and after KIDS. The Student t test was applied to compare pre and post KIDS data. The level of significance was set at $p < 0.05$. **RESULTS:** The results are presented at table 1. **Table 1-** Anthropometric data and lipids profile (Mean±SD) before and after seven-day KIDS (n=20).

Parameters	PRE	POST	Δ (%)	p
BW (kg)	52.52±10.27	51.85±9.76	-1.13	<0.000
BMI (kg.m ⁻²⁽⁻¹⁾)	25.23±2.35	24.94±2.24	-1.13	<0.000
ΣST (mm)	64.85±15.0	58.53±12.28	-9.22	<0.000
BF (%)	45.11±8.18	41.65±6.71	-7.25	<0.000
FATM (kg)	24.05±7.40	21.94±6.45	-8.77	<0.000
LBM (kg)	28.47±5.46	29.91±4.83	+5.05	<0.000
TC (mg/dL)	161.15±32.45	130.74±27.0	-23,0	<0.000
TG (mg/dL)	130.32±96.0	50.05±19.86	-50,8	<0.026
LDL-C (mg/dL)	93.22±26.37	48.42±10.3	-26,5	<0.000
HDL-C (mg/dL)	46.79±11.50	69.89±22.0	+5,3	<0.000

BW-Body weight; BMI-Body mass index; ΣST-Skinfolds thickness sum (Subscapular and Tricipital); BF-Body fat; FATM-Fat mass; LBM-Lean Body Mass; TC-Total Cholesterol; TG-Triglycerides; LDL-C-Low Density Lipoprotein Cholesterol; HDL-C-High Density Lipoprotein Cholesterol. **CONCLUSIONS:** A seven-day health educational summer camp with multidisciplinary team and parent involvement induced a significant improvement in the lipid profile and anthropometric data of obese children. Financial support: CNPq # 430012/2016-0

3012 Board #58 May 31 3:30 PM - 5:00 PM
Recommendations for the Implementation of Physical Activity Intervention Evaluations in Leisure Centres

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Introduction: Conducting physical activity research in a real-world setting, such as leisure centres (LC's), faces many barriers. Because of this, most applied research has a limited scope of both setting and population. This research explores the barriers and possible solutions for implementing research into real-world settings.

Methods: During January 2018, a multicentre Randomized Controlled Trial aimed at increasing PA levels and member retention rates of LC's was piloted. The research was conducted at six different LC across England. In February and March of 2018, semi-structured telephone interviews with 12 total staff from the different LC's were conducted. Interviews were meant to gather feedback on the implementation of research study processes in the LCs and staff were prompted to reflect on specific barriers and success to the research implementation process. Data were analysed thematically using NVivo.

Results: Feedback indicated that communication between exercise professionals (EP), the sales staff, LC staff, and research team was impaired, largely due to the compartmentalized nature of the LCs and busy working hours. It was criticised that both recruitment procedure and delivery of intervention sessions were described in the same manual, therefore confusing staff as to which procedure was to be carried out by the sales team or EP's. Additionally, compared with sales teams, EPs were overall more confident in recruiting research participants.

Discussion: Based on these qualitative interviews, primary suggestions to aid the implementation of intervention studies in the leisure industry include 1) the necessity of appointing a study manager per LC, 2) scheduling regular conference calls between research staff and LCs to aid the intra- and inter-organisational exchange of information, and 3) the involvement of EPs in study recruitment and intervention delivery. To improve the staff's understanding of all study processes, the distribution of separate manuals for the recruitment procedures and intervention delivery is suggested. **Conclusion:** These recommendations can aid research implementation into real-world settings, and eventually translate into higher rates of LC use and increased PA at the population level.

3013 Board #59 May 31 3:30 PM - 5:00 PM
The Effect of Foam Rolling and Vibrating Foam Rolling on Exercise-Induced Muscle Fatigue

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PURPOSE: To evaluate the effectiveness of foam rolling (FR) and vibrating foam rolling (VFR) on the rehabilitation of exercise-induced muscle fatigue (EIMF).

METHODS: Sixty-six male college students (age: 24.5±2.5 yrs) were randomly divided into three groups: a control group (n=22), a FR group (n=22) and VFR group (n=22). All subjects performed a bout of bottom-up squats for obtaining EIMF. All subjects were measured for peak torque (PT), peak torque/body weight (PT/BW), average peak torque (APT) and total work (TW) by using an isokinetic test system and do the Visual Analogue Scale (VAS) before, 0.5h, 24h, and 48h after the squats. The only difference among groups was that the FR group and VFR group performed a 1-min FR exercise protocol and VFR exercise protocol separately before each post-EIMF protocol measurement (at 0.5h, 24h, and 48h). The data was analyzed by one-way ANOVAs with LSD post-hoc tests, and independent t-tests.

RESULTS: See below table for all results. At 0.5h after the EIMF protocol, PT, PT/BW, APT and TW significantly decreased in FR group, VFR group and control group (all p<0.01), and there were no significant group differences in these variables. At 24h after the EIMF protocol, T, PT/BW, APT and TW tended to be higher in the FR group and VFR group than in the control group, and there were significant group differences between FR group, VFR group and the control group (p<0.01), although there were no significant group differences between FR group and VFR group (P>0.05). At 48h after the EIMF protocol, PT, PT/BW, APT and TW were significantly higher in the FR group and VFR group than in the control group (P<0.01, p<0.05), there were significant group differences between FR group and VFR group (P<0.05).

CONCLUSIONS: Foam rolling and Vibrating Foam Rolling resulted in a faster recovery in muscle strength and muscle work following a bout of bottom-up squats.

In the same condition, the VFR seems to be better in the recovery in muscle strength and muscle work following a bout of bottom-up squats than the FR. The potential mechanism needs to be further investigated.

3014 Board #60 May 31 3:30 PM - 5:00 PM
Moving Beyond Healthcare To Health: A Preliminary And Descriptive Statistical Report On The Health Peers Programme In The War On Diabetes In Singapore In 2017

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INTRODUCTION: The Health Peers Programme illustrates how healthcare providers from multiple disciplines work together to pilot a community health programme in partnership with community stakeholders supported by government health initiatives in the early intervention of diabetes. **PURPOSE:** To determine the impact of a multidisciplinary community health programme focusing on early intervention of diabetes in individuals who are at risk or who have been diagnosed with diabetes.

METHODS: 137 volunteers were trained as Health Peers in 2017 through a structured programme developed by a sports physician, a dietician and a clinical psychologist to coach those at-risk or diagnosed with diabetes. Each health peer reached out to at least 2 residents in a housing estate within 6 months. An outreach included an initial house visit with face-to-face interactions and two subsequent contact sessions, involving face-to-face interaction sessions, online text messaging or teleconversation. The competency and confidence of the Health Peers to conduct health coaching were assessed post-training. A survey was conducted at 6 months post-outreach to assess the extent of translation from knowledge and awareness, to lifestyle changes by the residents. **RESULTS:** All Health Peers showed improvement in their competency post-training. Their confidence levels in health coaching showed increasing trends throughout the period of assessment. 88.9% of the residents reported an overall positive experience when interacting with the Health Peers. All of them reported that they would consult the Health Peers for assistance in their health goals. 87.3% agreed that the Health Peers have impacted their knowledge and awareness of diabetes and healthy living. 83.3% made positive changes to their eating habits and exercise based on the national recommendations after 6 months of health coaching. **CONCLUSION:** A successful and sustainable community health programme must aim to appeal and evoke ownership of its participants to champion chronic disease management and prevention by engaging them through their own experiences. This is achieved through a dynamic and structured programme developed by various expertise within the healthcare profession in collaboration with community stakeholders and supported by government health initiatives.

3015 Board #61 May 31 3:30 PM - 5:00 PM
Effect of 6-week Hypoxic Training on Plasma Metabolites in Overweight Females

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Overweight female population in China ranks first in the world. Overweight is a risk factor for many diseases. Hypoxic training can reduce body weight and improve metabolism. However, the mechanism of weight loss in hypoxia remains unclear.

PURPOSE: To examine the effect of hypoxic training on plasma metabolites in overweight females. **METHODS:** 40 overweight females (age: 31.30±5.15 years, body mass index: 30.11±4.35 kg/cm²) were selected and grouped into hypoxic training group (HT, n=20) and normoxic training group (NT, n=20). All subjects underwent a 6-week training, which included resistance training and endurance training for 30 minutes each, 3 times a week. Resistance training: dumbbells with 12RM, 8 actions, 2 groups for each action. Endurance training: treadmill with slope 0° at 60%-70% maximum heart rate. The HT group was trained under normobaric hypoxia (16% O₂). The NT group was trained in normoxia. The diet was not restricted. Body composition was detected before and after training. Plasma metabolites were analyzed by using liquid chromatography/mass spectrometry and principal component analysis. **RESULTS:** After training, the body fat and serum total cholesterol in HT group reduced more than that in NT group on average (8.37% vs 3.60%, p=0.035; 4.95% vs -14.28%, p=0.005). The metabolic characteristics were significantly different between HT and NT group, there were 50 endogenous metabolites (VIP>1 and p<0.05), of which 33 were increased and 17 were decreased. Major metabolites that changed with hypoxic training included sphingosine, sphingomyelin, phosphatidylcholine, L-valine, linoleic acid and oleic acid. **CONCLUSION:** Hypoxic training has a marked effect on the plasma metabolites in overweight females, which can improve the lipid metabolism by regulating the metabolic pathway of linoleic acid. These findings may lead to a better understanding of the mechanism of hypoxic training in weight loss.

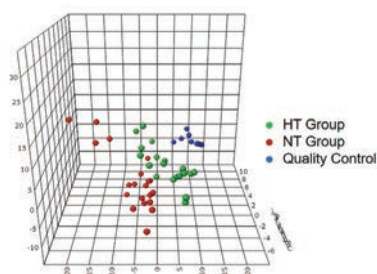


Figure 1. PLS-DA model of LC/MS metabolomics data for post-training between HT and NT group

3016 Board #62 May 31 3:30 PM - 5:00 PM
Top Down 1RM Testing May Facilitate Higher and More Reliable Maximal Strength Values Than Traditional <Bottom Up> Methodologies

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PURPOSE: Accurate determinations of individuals' maximal strength (1RM) are critical when evaluating the effectiveness of exercise interventions involving progressive resistance training. 'Bottom-up' testing methods (BT), involving progressions from low to maximal loads, are commonly employed in clinical and laboratory environments. Concerns about the reliability of this method in novice exercisers suggest that a different technique may be more effective. This study compared the reliability and effectiveness of BT testing to that of 'top down' 1RM testing (TDT), in which the initial testing load is greater than individual's 1RM and loads are progressively reduced until a successful repetition is completed. **METHODS:** 70 healthy adults (age = 45.03 ± 25.64 y) with diverse strength training experience were randomized into a reliability testing trial ($n=33$) or an optimal method trial ($n=27$) following a familiarization visit designed to introduce subjects to the pneumatic chest press (CP) and leg press (LP) and to determine their approximate 1RM using a sub-maximal method. Subjects in the reliability trial performed either TDT or BT 1RM testing on 3 occasions separated by at least 3 days, while subjects in the optimal method trial performed each method once in random order on different days. **RESULTS:** No between-group differences were identified at baseline with respect to age, BMI, previous training experience, or predicted leg and chest press 1RM for either trial. For the reliability trial, no significant between-group differences were identified in coefficient of variation over the three testing days for either the CP or LP. However, the BT group produced significantly higher CP and LP 1RM values on the second testing day (Cohen's $d=-.67$, $p=.014$; Cohen's $d=-.70$, $p=.011$, respectively). For the optimal method trial, no order effect across days was identified between BT or TDT. However, significantly higher CP 1RM values were obtained using TDT (Cohen's $d=.92$, $p=.015$). Untrained individuals in this sample obtained significantly higher LP 1RM values using TDT (Cohen's $d=2.72$, $p=.001$) and older individuals obtained significantly higher CP values (Cohen's $d=1.37$, $p=.028$) using TDT. **CONCLUSION:** TDT may produce higher and more reliable 1RM values than BT across a wide spectrum of ages and experience levels.

3017 Board #63 May 31 3:30 PM - 5:00 PM
Comparison between Caloric Expenditure Sitting on a Standard Chair, Stability Ball, and Balanced Active Sitting

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Chronic sedentary behaviors can be detrimental to health and increase the risk of mortality. Products, such as stability balls and active balanced sitting chairs, have recently emerged as a way to reduce sedentary behaviors in office settings. **PURPOSE:** To determine if differences in caloric expenditure and heart rate exist between a standard chair (SC), a stability ball (SB), and an active balanced sitting chair (ST). **METHODS:** Participants ($n=20$) performed a 10 minute reading task while sitting on a standard chair, a stability ball, and an active balanced sitting chair. All three conditions were randomized for each participant. Caloric expenditure and heart rate were monitored via a portable metabolic cart and a heart rate strap, respectively. Conditions were compared using a repeated measures ANOVA and significant comparisons were assessed through Bonferroni post-hoc analyses. **RESULTS:** Heart

rate response was greater on the ST (84 ± 15 bpm) when compared to the SC (75 ± 12 bpm; $p<0.01$) and SB (73 ± 12 bpm; $p<0.01$). Total caloric expenditure on the ST (27.4 ± 7.07 kcal) was greater than SC (16.55 ± 3.07 kcal; $p<0.01$) and SB (16.85 ± 2.54 kcal; $p<0.01$); however, no difference existed between SC and SB. Caloric expenditure per minute was greater on the ST (2.73 ± 0.71 kcal) versus the SC (1.64 ± 0.28 kcal; $p<0.01$) and SB (1.69 ± 0.26 kcal; $p<0.01$). Additionally, the ST required increased MET values (2.35 ± 0.49 METs) than the SC (1.437 ± 0.28 METs; $p<0.01$) or the SB (1.50 ± 0.33 METs; $p<0.01$). No significant differences were observed between the SB and SC for any of the comparisons. **CONCLUSION:** The ST produced a greater heart rate response and caloric expenditure than the SC or SB, indicating that active balanced sitting may be a feasible way to reduce sedentary office behaviors. Consistent with previous literature, there were no differences in heart rate or caloric expenditure between the SB and the SC during any condition. These results suggest that active sitting, which includes a strong balance component, may be crucial to increasing energy expenditure beyond that of sitting on a SC.

3018 Board #64 May 31 3:30 PM - 5:00 PM

Different Frequencies Of High-intensity Interval Training On Aerobic Fitness And Fatness In Overweight/obese Young Adults

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PURPOSE: To compare the effect of high-intensity interval training (HIIT) on aerobic fitness, body composition, and blood pressure.

METHODS: Forty-seven overweight/obese young men aged between 18 to 30 years were randomly allocated to non-interventional control (CON; $n=14$), three HIIT sessions weekly (HIIT $\times 3$; $n=14$), two HIIT sessions weekly (HIIT $\times 2$; $n=10$), and one HIIT session weekly (HIIT $\times 1$; $n=9$). Each HIIT session consisted of 12 \times 1-minute of 30-meter shuttle runs at 90% of heart rate reserve (HRR) and interspersed with 11 \times 1-minute bouts of jogging at 70% HRR. Aerobic fitness, body fatness, and blood pressure were examined before, after 4 weeks and 8 weeks of the intervention. Aerobic fitness was measured by 20-meter shuttle multistage run test, body fatness was measured by bioelectrical impedance analyzer, and blood pressure was assessed by electronic sphygmomanometer.

RESULTS: Aerobic fitness in all HIIT groups were significantly higher than CON at post-test. Percent body fat mass, absolute body fat mass, trunk fat mass, and systolic blood pressure in all HIIT groups were significantly lower than CON at post-test. The change of aerobic fitness ($\Delta\%$ total running distance: $r=0.6$, $p<0.01$) was positively correlated with the exercise frequency of HIIT. The $\Delta\%$ percent body fat mass ($r=-110.5$, $p<0.01$), $\Delta\%$ absolute body fat mass ($r=-0.5$, $p<0.01$), $\Delta\%$ absolute trunk fat mass ($r=-0.4$, $p<0.01$) and $\Delta\%$ systolic blood pressure ($r=-0.4$, $p<0.05$) showed negative correlation with the exercise frequency of HIIT.

CONCLUSIONS: Dose-response in the improvement of aerobic fitness, reduction of body fatness, reduction of systolic blood pressure among different exercising frequencies of HIIT were observed. HIIT, even with lower frequency (once weekly), improved aerobic fitness, body fatness, and blood pressure in overweight or obese young adults.

3019 Board #65 May 31 3:30 PM - 5:00 PM

The Experiences of College Students Enrolled in a Fitness Walking Class with Shelter Dogs

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Many four-year colleges and universities no longer require physical activity courses as part of student curricula but continue to offer elective physical activity courses. These elective courses are important given the benefits associated with physical activity, the low levels of physical activity found within the college student population, and the importance of establishing lifelong physical activity habits at earlier life stages. College and universities also stress the importance of community engagement within their courses. In the physical activity context, service-learning curricula has been used to teach responsibility, life skills, and values to students suggesting that addressing the physical activity needs of others, such as shelter dogs, within activity-based courses may benefit multiple entities. **PURPOSE:** The purpose of this study was to examine the experiences of students enrolled in a service-learning fitness walking course in which students walk local shelter dogs.

METHODS: Data were collected over six full semesters and three summer sessions. During this time, the course was offered twelve times and a total 66 reflection papers

were submitted. These papers were guided by five questions constructed to assess the objectives of the course. Adopting a grounded theory approach, the papers were inductively analyzed first using open coding, followed by focused and axial coding. **RESULTS:** One central theme emerged under which several subthemes was identified. The central theme was the importance of walking to shelter dog physical and emotional well-being. As one subtheme, students described feeling motivated and obliged to attend class regularly so the dogs could get physical activity. Other subthemes included the importance of walking for humans, the importance of patience, enjoyment of interacting with the dogs, learning about the physical activity needs of dogs, and deconstructing stereotypes of shelter animals. **CONCLUSIONS:** The results of this study suggest that students enjoyed engaging in regular walks for the wellbeing of the shelter animals. While students did acknowledge that they were also getting physical activity, this was secondary. Findings suggest that multiple entities can benefit from service-learning physical activity courses and be sources of motivation for students.

3020 Board #66 May 31 3:30 PM - 5:00 PM
A Survey of HBCU Nutritional Habits, Attitudes About Health and Risk Perception

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PURPOSE: The purpose of this study was to explore nutritional habits, attitudes about health, and risk perception in an HBCU population of rural northeastern North Carolina. Specific targets of assessment included nutritional status, perceptions surrounding health risks, environmental risks and risk perception related to common diseases such as prediabetes (PD), high blood pressure (HBP), stroke, asthma, cancer and cardiovascular disease (CVD).

METHODS: A total of 300 university students, faculty and staff ($N = 300$, $M = 143$, $F = 157$, ages 18-65 yrs, $Mean = 23.39$ yrs, $SD = 8.40$ yrs), of any activity level, from all parts of campus were surveyed utilizing the REAP-S and RPS-DD instruments. SPSS correlations and Chi Square tests were used to analyze survey and demographic data.

RESULTS: A strong positive correlation was demonstrated between the beliefs of "I feel I have very little control over risks to my health" and "If I am going to get diabetes, there is not much I can do about it" ($N = 293$, $R = .524$, $p < .001$). Beliefs that exercising regularly could reduce risk strongly correlated to controlling weight gain ($N = 293$, $R = .737$, $p < .001$), as did eating healthy and reducing the risk of diabetes ($N = 292$, $R = .627$, $p < .001$). Increased consumption of sweets ($N = 295$, $R = .157$, $p < .007$) and processed meals ($N = 295$, $R = .125$, $p < .032$) correlated with beliefs related to a lack of control. A negative correlation was demonstrated between this perception and a willingness to make change ($N = 287$, $R = -.123$, $p < .036$), and beliefs that personal efforts would help control risk ($N = 294$, $R = -.192$, $p < .001$). Perceived risk for heart disease correlated with family CVD diagnosis ($N = 292$, $R = -.507$, $p < .001$), perceived cancer risk ($N = 287$, $R = .537$, $p < .001$), perceived HBP risk ($N = 283$, $R = .389$, $p < .001$), perceived stroke risk ($N = 289$, $R = .556$, $p < .001$), and perceived asthma risk ($N = 286$, $R = .340$, $p < .001$).

CONCLUSIONS: Findings suggest perceived control is a powerful indicator of perceptions of the effectiveness of positive health behaviors, and engagement in management behaviors. Family CVD diagnosis strongly impacted personal perceptions of risk for cancer, HBP, stroke, and asthma risk. Future research should evaluate effective interventions centered around healthy exercise and nutrition practices, with an emphasis on internal locus of control.

3021 Board #67 May 31 3:30 PM - 5:00 PM
Differences In Strategic Constructs Of The Transtheoretical Model Across The Levels Of Sitting Time

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Differences in Strategic Constructs of the Transtheoretical Model across the Levels of Sitting Time

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 The strategic constructs, such as processes of change, self-efficacy, and decisional balance, of the Transtheoretical Model (TTM) have been relatively neglected by researchers in spite of the fact that they potentially provide important insight into the content of behavior change interventions. As most criticisms of the TTM are targeted at the central organizing construct, the stages of change, due to its arbitrary stage

classification, the direct comparison between objective values attaching to a specific behavior and the strategic constructs is warranted. **PURPOSE:** To investigate the differences in strategic constructs of the TTM across objectively measured sitting time. **METHODS:** A total of 201 college students conducted a TTM questionnaire for sedentary behavior and worn an accelerometer for seven consecutive days in order to obtain objective sitting time. Multivariate analyses of variances (MANOVA) with post-hoc pairwise comparisons were conducted to determine mean differences in the strategic constructs across quintiles of sitting time. Tests for linear trends were conducted using orthogonal polynomial coefficients. A two-sided $P < 0.05$ was considered statistically significant. **RESULTS:** Compared with participants in higher quintiles of sitting time, 7 out of 10 processes of change (e.g., mostly consciousness raising [$\eta^2_p = 0.09$], followed by social liberation [$\eta^2_p = 0.08$], contingency management [$\eta^2_p = 0.08$], etc.) were used significantly more frequently by those in the lowest quintile ($p < 0.05$) with negative linear trends ($p_{trend} < .05$). No significant differences were found in the constructs of self-efficacy and decisional balance across the quintiles. **CONCLUSION:** Based on this preliminary analysis it appears that the use of certain processes of change would be more beneficial to reduce sitting time or to protect their current sitting time from relapse.

3022 Board #68 May 31 3:30 PM - 5:00 PM
Influence Of Non-cognitive Ability Scores On Physical Fitness Improvement: An Examination Using Longitudinal Data

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Recently, many activities have been conducted to improve physical fitness owing to the decline in children's physical fitness observed in Japan. Such activities have led to gradual improvements in physical fitness. With the commencement of a study to examine the educational effect of exercise promotion, this program entered a new stage. Specifically, we focused on motivation, perseverance, and positive attitudes that are emphasized in young children. These non-cognitive abilities are considered indispensable for future social success. A few studies have examined the relationship between physical fitness and non-cognitive abilities. Last year, we also presented findings of a study on the relationship between non-cognitive abilities and physical fitness of children using cross sectional data, and identified the need to examine the longitudinal relationship. **PURPOSE:** The present aimed to examine the influence of non-cognitive abilities on physical fitness improvement using longitudinal data. **METHODS:** We conducted physical fitness tests and a non-cognitive ability survey on 264 young children. Data were collected during the same period for 2 years. Participants were classified into the improved and non-improved groups based on the extent of change in their ranking in the class. Differences in non-cognitive ability scores in the first and second year were examined using a three-way ANOVA with physical fitness improvement, sex, and grade as factors. **RESULTS:** No significant interaction was confirmed between gender, grade, and physical fitness improvement in any year. A significant main effect of sex, grade, and physical fitness improvement was observed in the first year, and of sex and physical fitness improvement in the second year. Girls' non-cognitive ability score was significantly higher than that of boys. Among 4-year-olds, the non-cognitive ability score was significantly higher in the first year as compared to that in the second year. The non-cognitive ability score of participants in the improved group was significantly higher than that of participants in the non-improved group. **CONCLUSIONS:** The present findings confirmed that non-cognitive abilities have a positive effect on the extent of improvement in physical fitness.

3023 Board #69 May 31 3:30 PM - 5:00 PM
Breaking Up Prolonged Sitting Improves Cognitive Function In Qatari Females

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Within Qatar, 83% of the population participate in little or no physical activity (PA). A sedentary lifestyle is associated with impaired cognitive function. However, cultural barriers [i.e. Islamic traditional clothing (e.g. Abaya)], as well as the climate (i.e. hot and humid), reduce the ability of Qatari females to engage in PA. **PURPOSE:** Examine the effects of an ecologically valid PA intervention on cognitive function in Qatari females. **METHODS:** Eleven sedentary (sitting ≥ 7 h/day) females [median (minimum - maximum) age 27 (21 - 44) y; height 1.64 (1.57 - 1.74) m; body mass 57.8 (47.0 - 87.4) kg; body fat 36 (24 - 45) %] completed three trials. Trial one was a

familiarization. Trials two and three were identical, except in one visit the participants remained seated for 5-h (SIT), and in the other visit they interrupted their sitting time every 30-min with a 3-min walk (WALK) on a motorized treadmill at a moderate walking speed (rating of perceived exertion 12–14). Cognitive function was assessed using the Computerized Mental Performance Assessment System (COMPASS) at 15-min before baseline (-15-min), and then at 2.5-h and 5-h. The following tests were completed; serial-3 subtractions (2 min), serial 7 subtractions (2 min), simple reaction time (50 stimuli), rapid visual information processing [RVIP (5 min)], choice reaction time (50 stimuli), and Stroop (60 stimuli). The visual analogue scale for fatigue (VAS-F) was completed at the same time intervals. Linear mixed models were used to examine differences in COMPASS and VAS-F for condition (SIT, WALK), and time (-15-min, 2.5-h, 5-h). Data is reported as effect size; $\pm 90\%$ confident limit. **RESULTS:** There was a greater number of RVIP correct scores in WALK compared to SIT (0.84; ± 0.66). There was a quicker reaction time (RT) for RVIP in WALK compared to SIT (-0.66; ± 0.70). RVIP false was lower in WALK compared to SIT (-0.51; ± 0.73). Stroop RT was quicker in WALK compared to SIT (-0.96; ± 0.05). RT for congruent Stroop was quicker in WALK compared to SIT (-0.92; ± 0.68). VAS-F was lower in WALK compared to SIT (-0.40; ± 0.68). **CONCLUSION:** Interrupting prolonged sitting with moderate intensity walking offers an ecologically valid intervention to enhance cognitive function in Qatari females. Supported by Qatar University CHSS SEED grant (CHSS-SF-16-2).

3024 Board #70 May 31 2:00 PM - 3:30 PM

The Effects Of Regenerative Injection Therapy Compared To Corticosteroids For The Treatment Of Lateral Epicondylitis

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BACKGROUND: The lateral epicondyle is a common site for chronic tendinosis, a condition characterized by overuse and degeneration of a tendon due to repeated microtrauma. This leads to pain and functional limitations. There is a growing interest in non-surgical forms of treatment for this condition including provision of corticosteroid injections and regenerative injection therapy (provision of autologous blood and platelet rich plasma injections).

PURPOSE: The study objective was to compare the effectiveness of corticosteroids compared to regenerative injection therapy for the treatment of chronic tendinosis at the lateral epicondyle (i.e. lateral epicondylitis).

METHODS: Researchers systematically reviewed randomized controlled trials published in English language from 2008–2018. Databases used included PEDro, Scopus, Pubmed, and CINAHL. Ten articles met our selection criteria as an RCT level of evidence with a total of 682 patients. Sackett's ratings adapted to include PEDro scores helped assess study quality. Analyzed results focused on pain, function and follow-up time. Primary outcome instruments used included Visual Analog Scale, (VAS) and Disabilities of the Arm, Shoulder and Hand, (DASH).

RESULTS: The corticosteroid groups demonstrated greater benefits in the short-term follow up (36 months; level 1A) and the regenerative injection therapy groups (both autologous blood and platelet rich plasma) demonstrated greater long-term improvements lasting for a period of about 2 years (1A level). One hundred subjects were randomized to receive corticosteroid (n = 49) or platelet rich plasma (n = 51) injections in a double blind RCT. A greater proportion of people reported a reduction of pain and DASH scores by >75% (clinically significant) in the platelet rich plasma group at the 6 months and one-year assessment period.

CONCLUSIONS: Regenerative injection therapy results in greater long-term pain relief and improved function for people with lateral epicondylitis.

3025 Board #71 May 31 3:30 PM - 5:00 PM
Evaluation of Intervention Effects of Different Exercise Modes on Non-alcoholic Fatty Liver Disease

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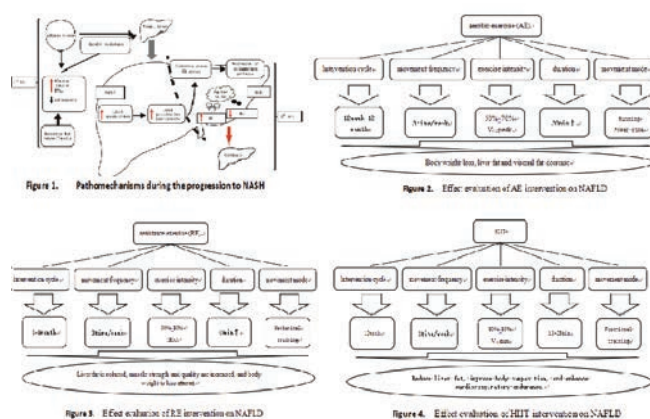
(No relevant relationships reported)

PURPOSE: Based on the analysis of more than 1000 documents in the past 5 years and visiting physical activity experts, coaches and athletes, this paper discusses aerobic exercise (AE), resistance exercise (RE), and high-intensity interval training (HIIT) in non-alcoholic fatty liver disease (NAFLD). Discuss The main differences of intervention methods, intervention time, and intervention effects among the NAFLD people, To explore the targeting and dose-response relationship of different exercise models intervention in NAFLD.

METHODS: (1)Through searching in Pubmed, Web of science and other databases, articles were selected for analysis according to the corresponding inclusion criteria and exclusion criteria. (2)Expert survey. (3)Interview method.

RESULTS: (1) AE, RE and HIIT can reduce hepatic steatosis and improve liver histology in NAFLD people, but their intervention effects are different. AE stands out in reduce body weight; RE stands out in reduce hepatic fat, decreases insulin resistance (IR) and increases muscle strength; HIIT has a significant effect in reducing hepatic fat and enhancing cardiovascular fitness. (2) the frequency, duration, and intervention period of AE and RE are similar; achieve the same or better intervention effect, HIIT only requires the 1/3 exercise time of the previous two. (3) People of different age, gender, physical fitness and disease degree have different choices in sports mode. Scientific monitoring and medical supervision are necessary conditions for improving the relationship between the dose and effect of exercise.

CONCLUSIONS: RE may be more effective than AE in patients with poor cardiovascular fitness, sarcopenia, and NAFLD who are unable to tolerate or participate in AE; HIIT has certain advantages in the time-effect and dose-effect due to less exercise time and smaller amount of exercise, This is easy for the NAFLD people to accept, and it will facilitate long-term adherence in the future.



3026 Board #72 May 31 3:30 PM - 5:00 PM

Visualization Analysis of International Research of Physical Activity Promoted built environment

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(No relevant relationships reported)

Background: Recently, studies regarding the relationship between the building environment, physical activity, and health have flourished in the areas of public health promotion among urbanized countries. (Chen, 2014). The researchers found that land use structure, residential density, and street connectivity were positively correlated with the amount of daily moderate physical activity (Frank, 2005). Although the importance of building environment to promote physical activity has been emphasized, very little is known about the development trend and “hotspots” in this field.

Purpose: Through sorting out the process of studies focused on international physical activity promoting-type built environment, this paper aimed to reveal the basic characteristics and research “hotspots” in this field through software analysis and to provide suggestions for future research.

Methods: Based on the literature about international physical activity promoting-type building environment from the Web of Science, The researchers searched 3,678 research papers and references in the field of health promotion during 2004–2018 and used Citespace Version 5.2 (Chen, 2018) for bibliometric analysis and visualized analysis.

Results: The results revealed that: (1) current studies mainly come from western countries (i.e., primarily the United States, Canada, and Australia); (2) the research “hotspots” focus on different forms of physical activity, obesity, and body mass index control in built environment.

Conclusion: Transportation planning and management, urban planning, and behavioral science have focused on building environments that can promote physical activity. Majority of the research has mainly emphasized the relationships between health and built environment and physical activity assessments. While facing the serious problem of childhood obesity, it is important to consider building environment construction as one of the main solutions.

3027 Board #73 May 31 3:30 PM - 5:00 PM
Health and Wellness Coaching as a Promising Strategy to Better Health and Quality Of Life

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Health and wellness coaching (HWC) is a promising strategy and potentially highly effective approach for weight loss in short term and healthy behavior change. As a partnership process between the coach and the client, it emphasizes behavior change to better client health. Coming up as a new approach that focus on behavioral change without a diet prescription, HWC seems to be likely to promote body weight loss and improve quality of life. **PURPOSE:** the aim of this study is to present and evaluate HWC in promoting changes in body composition and to improve the self-assessment of quality of life. **METHODS:** 13 subjects completed the intervention. Body composition (Bodpod®) and quality of life (WHOQOL-bref) were assessed at baseline (P1) and after 12 weeks of HWC (P2). 12 HWC sessions were completed, which were held weekly (1 hour each) + 36 Physical Activity sessions (1 hour each, 3 times a week). No diet was prescribed during the whole process. Data was collected at the School of Physical Education and Sport, University of São Paulo. **RESULTS:** In P2, HWC sessions were associated with reductions in body weight (-2,16 kg) and fat mass (-1,91 kg). From P1 to P2, we also observed little reduction in fat free mass (-0,25 kg). Great improvement in all aspects of self-rated quality of life was also shown (physical health, psychological domain, social relationship, environment and overall quality of life). These outcomes emphasize the effectiveness of HWC in promoting fat loss and behavioral changes with high impact in quality of life. **CONCLUSIONS:** HWC was able to promote weight loss, fat loss, to maintain fat free mass and to improve quality of life in a 12 week program, combined with an exercise program. Therefore, the strategy was effective in promoting better health, once it empowers individuals to take actions for their own health.

3028 Board #74 May 31 3:30 PM - 5:00 PM
Power Outputs During Performance of a Simple Transfer Task

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(No relevant relationships reported)

PURPOSE: The Gallon Jug Shelf Test (GJST) is a validated assessment of an older persons' capacity to transfer moderately heavy objects from a knee-high to a shoulder high shelf. Since power is a major determinant of performance during activities of daily living, we calculated power during the performance of the GJST.

METHODS: Subjects performed the GJST in a three-dimensional motion capture laboratory while standing with both feet on force plates. The task was performed in an open unit with immovable shelves to allow visualization of movement. The work done during when lifting a stationary gallon jug from low shelf to high shelf was calculated as shown in equation (1). $\Delta Work = m(a+g) \times \Delta h$ (1) Where: m: the mass of the gallon jar (kg); a: the jar's average acceleration (m/s^2); g: gravitational acceleration ($9.81 m/s^2$); Δh : difference in height between the bottom and top shelves (m). The power was calculated as the change in the work over the change in time (equation 2). $\Delta Power = \Delta Work / \Delta t$ (2) Where: Δt : the time spent lifting the jar between the two shelves (s). **RESULTS:** A mixed ANOVA was used to examine differences in work and power among trials and across repetitions (reps). For work, a Huynh-Feldt analysis revealed a significant difference across repetitions ($p=.050$, $\eta^2=.068$), while pairwise comparisons revealed significantly less work by the fourth (rep 2: $Mdiff=.016 \pm .005$; rep 3: $Mdiff=.012 \pm .005$) and fifth repetition (rep 2: $Mdiff=.01 \pm .007$; rep 3: $Mdiff=.014 \pm .007$) ($p<.05$). Similarly, a trend toward significance for differences in power across sets was detected ($p=.067$, $\eta^2=.064$). Pairwise comparisons showed significant declines in power between repetition 2 and repetitions 4 ($Mdiff=.002 \pm .001$; $p=.004$) and 5 ($Mdiff=.002 \pm .001$; $p=.015$), and between repetitions 3 and 4 ($Mdiff=.001 \pm .001$; $p=.004$; $p=.029$).

CONCLUSIONS: The GJST is a viable test of object transfer power and work that can also be used to evaluate fatigue in older persons.

3029 Board #75 May 31 3:30 PM - 5:00 PM
Differences In Male Vs Female Regional Body Composition Changes With Resistance Training

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Purpose: The purpose of this study is to analyze the effects of resistance training on regional body composition in normal-weight males and females.

Methods: A total of 31 (n=14 males) young volunteers were randomized to intervention (9 females, 7 males) and control groups (8 females, 7 males). Females had a body mass index (BMI) of $22.6 \pm 1.95 \text{ kg/m}^2$, and percentage of body fat (%BF) of $32.3 \pm 7.8 \%$; males had a BMI of $22.95 \pm 1.55 \text{ kg/m}^2$ and %BF of $18.14 \pm 6.22 \%$. Body composition measurements were recorded using a dual-energy X-ray absorptiometry (DXA), and a maximal strength test was used on both upper and lower body at pre and post intervention. Left and right trunk, arms, and legs lean body mass (LBM) and body fat (BF) were recorded and percentage of change (%Δ) was calculated for each variable. The resistance training protocol consisted of 3 sessions per week for 3 weeks, using 7 exercises (i.e. bench press, barbell back squats, leg press, sit-ups, dead lifts, barbell rows, and jump squats) consisting of 10 repetitions per exercise for 3 sets.

Results: Non-parametric tests showed a statistically significant difference in exercising males ($p=0.001$) in left leg %ΔLBM ($3.05 \pm 1.68 \%$) when compared to controls ($-2.32 \pm 2.14 \%$). No statistically significant differences were found in any of the body composition variables for females in the resistance training group compared to the control group.

Conclusions: Our results suggest that males and females exhibit different regional body composition changes in response to the same resistance training program. Further research is needed to increase the understanding of sex-related differences in resistance training-induced regional body composition changes.

3030 Board #76 May 31 3:30 PM - 5:00 PM
Impact Of Sit-to-stand And Treadmill Work-station Use On Self-reported Musculoskeletal Pain.

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Purpose: This study examined the effects of a one year work-station intervention on perceived musculoskeletal pain. **Methods:** Sixty-six sedentary overweight office workers (mean \pm SD: age = 45.3 ± 12.3 years, BMI = $32.4 \pm 5.8 \text{ kg/m}^2$) participated in this 12-month study. Participants were cluster randomized to a control (C), (N = 21), a sit-stand desk (D), (N = 23), or a treadmill desk (T), (N = 22) group. Group T was asked to accumulate 2 h of walking and 1 h of standing at the workstation in bouts of 10 to 30 min daily. Group D was asked to accumulate standing for 3 h/day in bouts of 10 to 30 min. Group C did not receive a workstation that enabled behavior change at work and was encouraged to meet the federal physical activity guidelines during the study. All participants self-reported regional musculoskeletal pain using the Modified Nordic Musculoskeletal questionnaire at baseline and month 12. Musculoskeletal regions included the lower back, upper extremity (neck and shoulders), wrist and forearm, and lower extremity (knees, ankles, and feet). Random intercept logistic regression models accounting for repeated measures and the effects of cluster randomization were used to determine change in the likelihood (odds ratio-OR) of self-reporting the presence or absence of pain. Post-hoc pairwise comparisons with Tukey-Kramer corrections (for multiple hypotheses testing) were conducted to determine the location of any significant change. **Results:** There were no significant between group differences in self-reported OR for musculoskeletal pain at baseline. The 12-month intervention did not result in a significant change in self-reported pain in the two experimental conditions in any region. Participants within Group D had a significantly lower likelihood ($p = 0.027$; effect size = 0.10) of self-reporting upper extremity pain at month 12 (OR = 1.29) compared to baseline (OR = 1.78). **Conclusion:** While workstation interventions to decrease sedentary behavior yielded no reductions in self-reported pain over 12-months, increasing daily accumulated standing and/or walking time did not introduce new musculoskeletal pain in seated office workers. These findings may help alleviate concerns associated with change in musculoskeletal pain when introducing ergonomic solutions to break continuous workplace sitting.

- 3031** Board #77 May 31 3:30 PM - 5:00 PM
The Effect Of 10-week Walking Program On Self-regulation And Exercise Adherence In Sedentary Workers
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PURPOSE: The present study examined changes in self-regulation and self-efficacy in sedentary employees participating in a 10-week walking intervention.

METHODS: 68 sedentary employees were enrolled in a 10-week walking intervention. Subjects were randomly assigned (based on initial BMI and gender) to one of three groups consisting of two walking protocols: intermittent walking (Age = 46±9, BMI= 30.33±5.79 kg/m²) continuous walking (Age = 48±9, BMI= 30.53±6.17 kg/m²) or control group (Age = 42±10, BMI= 27.66±5.11 kg/m²). The two experimental groups received self-paced walking programs that were time and intensity matched, as well as, a mobile health intervention with weekly strategies to improve self-efficacy and self-regulation skills via text messages, e-mails and videos. The control group received a self-pace walking program only. All groups completed a self-regulation and self-efficacy measured by questionnaire and walking behavior measured by a wrist worn accelerometer at baseline, week 6 and week 11.

RESULTS: Results from the mixed ANOVA showed group and time interaction $F(4,130)=8.017, p<.001$, and a large effect $\eta^2=.198$. The continuous group significantly improved overall self-regulation and its sub-scales from pre-test to week 6 and post-test ($p<0.05$). Self-efficacy decreased significantly from pre-test to week 6 ($p=.047$) and post-test ($p=.008$) for all groups. Walking activity changed significantly $F(4,130)=2.526, p=.044, \eta^2=.072$, with the continuous walking group significantly increasing walking from pre-test to week 6 ($p=.033$), and a significant higher percentage of change compared to the control group from pretest to post test ($p=0.042$).

CONCLUSIONS: For sedentary employees a continuous walking program is a better approach to improve self-regulatory skills and may provide a more feasible approach to prescribing exercise in sedentary office employees. Intermittent physical activity may have some positive impact on self-regulatory skills, however the amount of time and frequency of the bouts need to be tested to determine a feasible approach to include physical activity and meet daily obligations as well.

- 3032** Board #78 May 31 3:30 PM - 5:00 PM
Self-efficacy To Reduce Sedentary Behavior: Differences Between Depressed And Healthy Populations
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 (No relevant relationships reported)

Excessive sedentary behavior (SB) is associated with increased health risks, including risks of poor mental health, such as depression. Previous research demonstrates depressed individuals exhibit increased barriers to health-related behaviors, such as exercise, compared to non-depressed individuals. Examining differences in self-efficacy to overcome barriers to reduce SB in depressed versus non-depressed populations is necessary to design effective SB interventions. **Purpose:** To examine how self-efficacy for overcoming barriers to reduce SB differs between depressed and non-depressed adults. **Methods:** Participants with self-reported major depressive disorder (MDD, $n=144$) and healthy adults ($n=1,243$) completed an online survey regarding self-efficacy to overcome barriers to reduce sedentary behavior on a Likert scale ranging from 1 (not at all confident) to 10 (100% confident). Questions examined barriers related to social norms, time, fatigue, motivation, pain/health, resources/environment, and mood. Barriers were compared between depressed and healthy adults with independent-samples t-tests and effect sizes (Cohen's d). **Results:** Participants with MDD reported significantly lower self-efficacy compared to healthy individuals ($p<0.05$) for overcoming each barrier. The largest difference between groups was seen for mood ($d=0.75$). Patients with MDD also reported lower self-efficacy for overcoming barriers related to motivation ($d=0.48$), fatigue ($d=0.45$), environment/resources ($d=0.43$), pain/health ($d=0.34$), social norms ($d=0.23$) and time ($d=0.20$). For MDD, self-efficacy to overcome barriers was lowest for mood while social norms was the lowest for healthy adults. **Conclusion:** As confidence in overcoming barriers for reducing SB differs between depressed and healthy adults, intervention strategies that are effective in healthy adults may not be effective for those with depression. It may be necessary to consider the relatively larger impact of mood, motivation, and fatigue on confidence to reduce SB in depressed populations. Future research is needed to examine how addressing low self-efficacy for overcoming different barriers influences the ability to reduce SB in those with depression.

- 3033** Board #79 May 31 3:30 PM - 5:00 PM
Research and Commercial Utilization of Wearables Among Healthy Adults: An Exploratory Comparative Analysis
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 Reported Relationships: **Z.H. Lewis:** Salary; Beachbody.

Electronic activity monitors, commonly known as wearables, have proliferated both in research and in consumer use. However, there is limited reports on how wearables are operationalized in physical activity interventions in comparison to how they utilized by consumers. **PURPOSE:** To describe and evaluate the findings of two studies that evaluated the use of wearables among generally healthy individuals. **METHODS:** Study 1—Medscape, Medline, PsycInfo and Cochrane databases were searched in 2017. Included studies were assessed using an intensity scale that measured the extent of wearable usage. The intensity scale assessed duration, personalization, reach, and frequency of the wearable within the intervention with a higher intensity score reflecting higher usage. Study 2—Participants ($n=33$, 78.8 % Female, 51.5% aged 18-24 years, 56.3% White, 27.07±6.7 kg/m²) were recruited to participate in an online survey. Participants were eligible if they were an adult and if they owned a wearable device aimed to promote physical activity. The intensity scale utilized in Study 1 was used in Study 2. Independent T-Tests were performed to compare intensity scores between Study 1 (effective interventions only) and Study 2. **Summary of RESULTS:** Study 1—22 citations, reporting on 25 unique interventions arms, met the inclusion criteria. Of these, 7 found significant group differences in physical activity and/or weight loss outcomes. These studies utilized several wearable features (86.7%) and allowed participants to interact with the wearable at their own discretion (51.1%). Study 2—72.7% and 42.4% reported positive physical activity and weight outcomes after using their wearable. Participants often use their device daily (87.9%) and use multiple wearable features (75.8%). The intensity scores from Study 2 (18.2±2.7) were higher than Study 1 (15.4±3.9) ($t=-5.6, p<0.05$). In particular, consumers reported higher frequency of use than effective research interventions ($t=-5.7, p<0.01$). **CONCLUSION:** Wearables are not utilized similarly within interventions as they are with commercial consumers. Interventions should consider more mandated use of the wearable in the study design to reflect the consumer experience. This will aid in determining the effectiveness of wearables to promote physical activity and weight loss.

- 3034** Board #80 May 31 3:30 PM - 5:00 PM
Exploring the Physical Activity Counselling Practices of Foundation Doctors: A Qualitative Study
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 (No relevant relationships reported)

Purpose: Physician have an enormous role in physical activity (PA) promotion for the purpose of prevention and management of non-communicable diseases. Thus, this study explored the PA counselling practices of medical doctors when in their foundation year as this is the time that serves as a bridge between medical school and specialty/general practice training.

Methods: A qualitative study was undertaken amongst 11 Foundation Doctors (FD) in the Manchester University National Health Service (NHS) Trust using a purposive sampling approach. In-depth interviews were conducted, transcribed verbatim and analysed thematically

Results:

Codes	Sub-Themes	Overarching themes	Quotes
FD PA levels	PA Practise	PA COUNSELLING ATTITUDE AND PRACTISE	'In secondary care I will say the PA advice is more of the physios role because we don't have time. I think we get them medically fit for discharge while the therapy team can encourage physical activity'
Involvement of other health professionals	PA Role Perception Belief		
PA Recommendations and Guidelines Health Benefits of PA Exercise and/PA type	Knowledge about PA		
Clinical Settings	Level of Care		
Patient Body Size	Obesity and PA counselling	BARRIERS	'We are very busy, often staying late. I think it is put lower down the priority order compared to other jobs'
Lack of Undergraduate Teaching and Role Model	Limited Knowledge and Guidance		
Patients Knowledge about PA and Health	Public Awareness	FACILITATORS	Lot of people think PA is important but they have not really thought about talking to patient about it. So highlighting it in a teaching session might bring FD to a consciousness of it and hopefully inculcate it in practise'
Foundation Teaching Sessions Clinical Settings	Favourable setting		

Conclusion: FD PA counselling practise is low and attitude was particularly poor while in the hospital setting. Lack of training and support from consultants were major hindrances noted. Unexplored opportunities exist for foundation doctors to champion PA both in primary and secondary care

3035 Board #81 May 31 3:30 PM - 5:00 PM

Are Fitness Club Members More Likely To Meet Physical Activity Guidelines Than The General Adult Population?

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PURPOSE: There is a need for research examining if having a fitness club membership is associated with meeting the physical activity recommendations. Hence, the aims of the present study were 1) to assess total physical activity level at onset and after 12 months of fitness club membership and 2) investigate if having a fitness club membership is associated with increased physical activity and higher prevalence of meeting current physical activity recommendations than the general population. In addition, we wanted to identify demographic and social-economic variables and compare this in participants with high and low exercise involvement.

METHODS: The participants (n=250) answered an electronic questionnaire at inclusion covering demographic and social-economic factors. Self-reported exercise involvement at the fitness club was obtained after three, six and 12 months. Total physical activity level was measured by ActiGraph GTIM in a sub-cohort (n = 125) at inclusion and after 12 months. Adherence to current physical activity recommendations was defined as ≥ 150 minutes/week of moderate to vigorous physical activity (MVPA) in bouts of ≥ 10 minutes.

RESULTS: At both time-points, more than half of the participants had low physical activity level. No significant changes in total physical activity level were found from inclusion to 12 months. Although, daily bouts of MVPA increased with 8.9% ($p = \geq 0.05$). Muscle-strengthening activity were reported by 54.4% (in mean 1.9 (± 1.0) days/week) and 44.3% (in mean 1.5 (± 1.0) days/week) at inclusion and after 12 months, respectively. The prevalence of meeting 150 minutes of weekly MVPA increased with 9.9% from inclusion to 12 months, with no significance changes ($p = \geq 0.05$). After three, six and 12 months, few differences in demographic and socio-economic variables were shown between participants with high and low exercise involvement.

CONCLUSIONS: Fitness club members have higher prevalence of meeting the current physical activity recommendations compared to the adult population. Although,

more than half of the participants had low physical activity level at both inclusion and after 12 months, suggesting that a fitness club membership in itself might not be sufficient to meet the current physical activity recommendations.

3036 Board #82 May 31 3:30 PM - 5:00 PM

How Best to Use Your Limited Cardiovascular System Training Equipment Budget: A Case Study

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PURPOSE: The Student Life and Wellness Center (SLWC) at Utah Valley University (UVU) spent \$300,540 on its current fleet of 46 pieces of cardiovascular system training equipment (cardio equipment). UVU students pay for gym equipment from student fees. SLWC managers want to know how to use their cardio equipment budget and gym space efficiently to benefit students most. **METHODS:** All the cardio equipment was purchased from Life Fitness (Rosemont, IL). The equipment reports usage data to Life Fitness, and we retrieved that data from their Halo Fitness Cloud. All the equipment has been in use for 24 months except the treadmills which have only been in use for 3 months. **RESULTS:** Overall use (distance, hours, and workouts) was compared. Use/month/dollar was compared, in order to best understand the value and popularity of each device.

Equipment	Price	Distance/month	Distance/month/dollar	Hours/month	Hours/month/dollar	Workouts/month	Workouts/month/dollar
Number	\$	Miles	Miles	Hours	Hours	Number	Number
Treadmill (15)	\$6,880.23	261.722 @ *	.038 @ *	54.662# *	.008*	231.267# *	.034+@ *
Elliptical (12)	\$5,710.30	211.143 @ *	.037 @ *	37.699+ *	.007 *	133.333+ *	.023 *
Upright Bike (6)	\$5,999.00	513.352+##	.086+##	35.400+ *	.006 *	148.667+ *	.025 *
Recumbent Bike (7)	\$6,499.00	534.197+##	.082+##	41.834 *	.006 *	180.286 *	.028 *
PowerMill Climber (4)	\$6,999.00	569.440+##	.081+##	77.990+## @*	.011+## @*	402.000+## @*	.057+## @*
FlexStrider Trainer (2)	\$9,665.00	31.580+## @	.003+## @	5.415+## @	.001+## @	31.500+## @	.003+## @
+, p<.05 compared to Treadmill #, p<.05 compared to Elliptical ., p<.05 compared to Upright Bike		@, p<.05 compared to Recumbent Bike ., p<.05 compared to PowerMill Climber *, p<.05 compared to FlexStrider Trainer					

DISCUSSION: Powermills are the most used equipment in our sample: whether measured as distance, hours, or workouts. They are also the best overall value. FlexStriders cost the most money and were used the least. **CONCLUSION:** Through simple analysis of automatically-recorded data, UVU can use student money effectively. Students will have the equipment they like to use, and less student fees will be needed as costly unpopular equipment will not be purchased in the future. Gym managers should be able to serve their clientele better with similarly-simple analyses.

3037 Board #83 May 31 3:30 PM - 5:00 PM

Utilizing Technological Devices to Enhance Prevention of Type II Diabetes Mellitus

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(No relevant relationships reported)

PURPOSE: To evaluate the inclusion of technology, a Fitbit Flex and smartphone, into the popular lifestyle modification program: the Diabetes Prevention Program - Group Lifestyle Balance Program (DPP - GLB). The DPP - GLB Program has shown great success in reduction of progression toward T2DM. However, it was unknown how integrating technology would affect overall program outcomes, which included the attainment of 150 minutes of physical activity (PA)/week and weight loss trending toward 7%.

METHODS: Men and women over the age of 40, and at risk for prediabetes, were recruited. The study included an initial four weeks of baseline PA testing, followed by 12 weeks of lifestyle intervention. Individualized weight loss and PA goals were set. Participants self-randomized to the control (N = 11) or the technology group (N = 13). Session participation was high. Technology participants missed 8.3% of sessions, while control participants missed 18.2% of sessions.

RESULTS: Participants were aged 66.24 (SD = 7.38) years. At baseline, 21% of participants were overweight, and 79% were obese. Using a generalized estimating

equation to estimate average weight lost, participants lost 0.46 lbs/week. One hundred percent of technology participants lost weight, while 73% of control participants lost weight. Only 7.7% of technology participants reached the 7% weight loss goal, while 27.2% of control participants reached the 7% weight loss goal. Both groups lost similar amounts of weight in averages, with technology participants losing an average of 7.35 lbs and control participants losing an average of 7.79 lbs. At study conclusion, 37% of participants were overweight, and 63% were obese. Although statistical significance was not found, we believe clinical significance was found. The majority of participants (63%) self-reported inactivity during the initial meeting. Technology participants averaged PA tracking for 72.5 days while the control group averaged 47.7 days of PA tracking of 77 days available.

CONCLUSIONS: Monitoring PA with technology can reinforce positive lifestyle changes to encourage users and increase activity due to instant feedback from the device. Participants can be successful with weight loss by going through the GLB Program, with or without technology, reinforcing the importance of lifestyle modification.

3038 Board #84 May 31 3:30 PM - 5:00 PM
The Correlative Relationship Between Fitness Goals and Wearable Usage: An Observational Double-Blind Study

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Background:

Wearable devices, such as Fitbits, Apple Watches, and numerous fitness devices, have become an increasing trend in those attempting to improve and/or monitor their physical activity. These devices incorporate various features that may elicit behavior change, however there is limited information on which features are utilized most. In addition, there is limited information on whether the usage of wearables varies by fitness goals. The present study observes wearable users and examines any correlative relationships between wearable usage and individual fitness objectives.

Methods

Consenting males and females ages 18 and older who owned any variation of wearable devices were given a 15-minute survey containing questions regarding the type of wearable owned, wearable usage, fitness activity, fitness goals, and opinionated questions. Descriptive statistical analysis using means and frequencies were utilized to describe the sample. Spearman correlation analyses were used to determine the relationship between the participant's reported fitness goal and reported usage of various wearable features. All analyses were conducted using IBM SPSS Version 25.

Results

Of the participants to complete the survey (n=33), the majority were female (78%) and were between 18 and 24 years old (51.5%). Most participants worked out 3-4 times a week (37%) and used their wearable daily (87.9%). Participants reported that their primary fitness goal was to lose weight (42.4%), build muscle (21.2%), lose fat (18.2%), and improve mobility (18.2%). The most prevalent features used were the virtual rewards/badges (69.7%), exercise alert notifications (62.5%), and goal-based challenges (42.5%). The correlation analyses showed a weak correlation between the fitness goal and reported device utilization (r<1.0 on all utilization variables).

Conclusion

Our preliminary analyses show weak correlations between reported fitness goal and usage of wearables. These results suggest that how individuals use their wearable device (which impacts the exposure to embedded behavioral change techniques) negligibly impacts and is negligibly affected by their fitness goal. However, more research is needed to further evaluate the relationship between these variables.

3039 Board #85 May 31 3:30 PM - 5:00 PM
The Effects of a Pilot Translational Health In-School Program on Physical Fitness and Health Outcomes

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Low levels of physical activity and physical fitness are associated with adverse medical conditions including type 2 diabetes and cardiovascular disease. Significant declines in physical activity are most notable in children as they transition to adolescence in middle school making this a critical age to promote a physically active lifestyle that confers health benefits. Several existing programs have used multiple courses and activities to promote active lifestyle behaviors in middle school adolescents. We theorized that a single in-school elective course may be an effective strategy to promote health outcomes in adolescents. **PURPOSE:** To examine the effects of a multidimensional translational health in nutrition and kinesiology (THINK) in-school

pilot program encompassing nutrient/exercise physiology education, laboratory experiences, and structured physical activities on physical fitness, physical literacy, and nutrition knowledge.

METHODS: Participants from a public middle school were enrolled in the THINK elective course (n=33, 22 males; 11 females; 11.97±0.03 yrs). The program was administered two hours/day, two days/week for 16 weeks. Participants were evaluated at baseline and post-intervention for physical fitness, elements of physical literacy, and nutrition knowledge. **RESULTS:** THINK students evidenced a 5.88 mmHg reduction in mean arterial pressure (p=0.05), along with the following improvements in physical fitness: a 4.55 lb increase in muscular strength, a 72.19 ft increase in distance covered during the NIH 2-minute walk test, a 2.34 in increase in lower body power, and 3.64 increase in the number of sit-ups performed in one minute (p≤0.01 for all). There were no significant changes in BMI or flexibility. Additionally, THINK students exhibited significant increases in nutrition and kinesiology (p<0.01) signifying a better understanding of the value of physical activity and nutrition for health promotion/disease prevention. **CONCLUSIONS:** A multidisciplinary THINK program employing kinesiology/nutrition science education, laboratory skills, and physical activities in one course can result in significant improvements in physical fitness, physical literacy, and nutrition science education.

3040 Board #86 May 31 3:30 PM - 5:00 PM
Perceived Quantity of Physical Activity as a Reflective Measure in Muscle and Bone Strength

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Perception plays a powerful role in shaping health outcomes. An active lifestyle, provides mechanical load needed to strengthen and maintain both muscle and bone health. Many recommendations on the quantity of physical activity needed for health benefits exist however it is unclear if individuals perception of their activity habits relates to muscle and bone strength benefits. **PURPOSE:** To determine if those who perceived that they get the right amount or more than needed amount of exercise, have greater muscle and bone strength.

METHODS: 79 participants, 41 females and 38 males (age (yrs) 29.2 ± 10.8, height (cm) 166.5 ± 9.2, body fat % 24.6 ± 9.3) performed a relative grip strength (RGS) test using a hand grip dynamometer, 1 repetition maximum leg extension test (1RM), and a vertical jump test using a Vertec (PP). Bone Strength Index (compression) (BSIc) and polar Strength-Strain Index (SSIp) were measured using peripheral Quantitative Computed Tomography (pQCT). A questionnaire stated "Do you feel you get too much exercise, too little exercise, or about the right amount of exercise?" Welch's t-tests detected differences in muscle function and bone strength based on perception of exercise quantity (Above and Below).

RESULTS: 41 participants perceived they got the "right amount of exercise or above" (Above) and 29 participants reported that they got below the right amount of exercise (Below). Perception of the Above group resulted in greater muscle function tests compared to the Below group (Average PP: 11.5% (p=0.004), RGS: 5.7% (p=0.004). "Right amount of exercise or above" resulted in greater bone strength (SSIp) at both the radius (11.7% (p=0.055) and tibia (13.3% p=0.02).

CONCLUSIONS: Participants' perception on quantity of exercise reflected their bone and muscle strength. Those who perceived that they get the appropriate or a higher amount of exercise had greater bone and muscle strength values compared to participants who perceived they exercised less. Perception of getting the "right amount of exercise or above" compared to "below right amount of exercise" was a good indicator of greater bone and muscle strength.

3041 Board #87 May 31 3:30 PM - 5:00 PM
Investigating the Relationship Between Social Media Use and Reported Rates of Exercise

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Purpose: Social media has a large impact on body image and confidence. This study aims to gather information and examine correlations on the relationship between social media use and reported rates of exercise.

Methods: An observational study of participants (n=33) that own a wearable fitness device was conducted. Approximately 79% of participants were female, 52% of participants were aged 18-24, 30% aged 25-34, 12% aged 35-54, and 6% aged 55 and older. Participants completed a questionnaire asking them to describe their exercise and social media habits. Participants classified themselves as having an intermediate

(51.5%), advanced (33.3%) or beginner (15.2%) proficiency in exercise. Descriptive statistics with means and frequencies were used to identify trends in social media use and exercise frequency. The relationship between social media use and exercise frequency were assessed through Spearman Correlation and Chi-Squared procedures. All analyses were conducted using IBM SPSS Version 25.

Results: Participants reported exercising once a week (3.0%), 1-2 times per week (24.2%), 3-4 times per week (39.4%), 5 or more times per week (30.3%), or not currently exercising (3.0%). The preferred exercise type was aerobic (69.7%), followed by resistance (21.2%) and balance (9.1%). No participants reported posting their exercise to their social media accounts but 27.3% follow a fitness model or blog. There was a strong correlation between exercise frequency and following a fitness model or blog ($r=-0.3$, $p=0.05$) but the direct relationship was nonsignificant ($\chi^2=5.4$, $p=0.3$).

Conclusion: Our results suggest that there is a correlation between people who follow fitness models or exercise blogs and exercise frequency. Our research also suggests that there may be an underlying mediating variable driving this relationship. We plan to conduct a focus group to ask specific questions regarding social media's influence on exercise. Future research should look at the mediating relationship between social media use and exercise frequency.

3042 Board #88 May 31 3:30 PM - 5:00 PM
Incarcerated Young Women's Exercise and Sleep Behaviors: A Needs and Feasibility Study

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Incarcerated young women (ages 16 to 21 yo) are at high risk for future drug abuse. Both regular exercise and adequate restorative sleep have been shown to reduce drug use and other harmful behaviors. Existing programs for incarcerated youth to reduce future drug use do not address healthy lifestyles or incorporate Positive Youth Development models. Implementing such a program requires understanding these young women's current physical activity and sleep attitudes and behaviors.

PURPOSE: Determine whether wearable technology can be applied in a close custody setting. Establish current attitudes and behaviors related to sleep and physical activity of incarcerated young women. **METHODS:** Incarcerated young women completed an anonymous survey concerning physical activity and sleep attitudes and behaviors, using a 5-point agreement response scale. 46 of approximately 75 young women consented to participate. Descriptive statistics are presented. A convenience sample of 9 young women wore a Fitbit for a week. **RESULTS:** No regular physical activity program is provided for these young women. However, the majority felt that they were "built for exercise" and "have the skills for exercise." There was strong agreement that "when active they enjoy it" at 4.2 ± 0.8 . The majority of girls felt that they "needed more sleep." And being "sleepy" significantly correlated with self-reported being "grumpy" (p less than 0.001). Girls do not have access to computers, and we were able to implement a system of recharging and downloading the wearable units that was feasible and acceptable for staff. Girls used the Fitbits as directed. Only 2 of 9 girls achieved the goal of at least 8 hours sleep per night, despite the prescribed lights out and awakening times that should allow more than 9 hours sleep each night. Only one girl achieved more than 10,000 steps each day. **CONCLUSION:** Incarcerated young women's sleep and physical activity do not meet recommended guidelines. Both are domains where these high-risk emerging adults still can make choices despite close custody. A Positive Youth Development program to enhance these behaviors and increase their self-efficacy for health choices could add to existing programs to deter future drug use and other harmful behaviors. Supported by the Paul R. Vogt endowment and Ramona and Thomas McDonald donations.

3043 Board #89 May 31 3:30 PM - 5:00 PM
Listening To Music While Exercising Increases The Risk For Noise-Induced Hearing Loss

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(No relevant relationships reported)

Music has an ergogenic effect on exercise performance, improves motivation, decreases exertion, and delays the onset of fatigue. However, loud sound levels from music can cause permanent damage to the inner ear resulting in noise-induced hearing loss (NIHL).

PURPOSE: The purpose of this study was to assess the risk of NIHL among students utilizing campus recreational facilities and examine whether music used as a motivator was associated with increased risk for NIHL.

METHODS: One hundred and nineteen students were recruited from the main fitness center on college campus. Physical activity level was recalled using a modified short version of the International Physical Activity Questionnaire. Music intensity levels

were assessed by a sound pressure level mannequin with a built-in microphone. Thirty second samples were taken in 5 second intervals using participant's personal listening devices. Average, minimum, and maximum sound levels were recorded in decibels (dBA). The estimated risk for NIHL was established based on the average sound level and duration of exposure using NIOSH criteria. Participants indicated whether music was a motivator during a workout. Descriptive statistics were performed for all variables. Chi-square analyses evaluated relations between risk for NIHL, gender, and music as a motivator. T-tests assessed the difference in average loudness level and gender.

RESULTS: Participants were college students (51.3% males, 48.7% females). Majority of participants (89.1%) used music as motivation while exercising (93.4% male and 84.5% female, $p>0.05$). Twenty four percent of participants were at risk for NIHL, approaching statistical significance for gender (29.5% males vs 19% females, $p=0.056$). The average sound levels for the participants were 88.8 ± 10.3 dBA and statistically significant for gender (90.9 ± 10.6 dBA for males, 86.5 ± 9.4 dBA for females, $p=0.017$).

CONCLUSIONS: Every fourth college student listening to music while exercising was at risk for NIHL. NIHL is an avoidable cause of permanent hearing impairment. Recommendations for safe use of personal listening devices during workouts include keeping volume at a safe level, below 85 dBA, and limiting time spent using the device during workouts.

3044 Board #90 May 31 3:30 PM - 5:00 PM
Connected Health Exercise Consultation Case Study: A Weight Management Strategy Post Gastric Bypass Surgery

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Weight regain is not uncommon post gastric bypass surgery (GBS). A connected health (CH) platform has the potential to improve adherence to lifestyle recommendations to support long-term weight management.

Purpose: Describe the process of delivering a CH intervention to support in-person exercise consultations in a case study example. **Methods:** A sedentary 59-year old female (18-years post GBS) with a BMI=37.9 kg/m² was assessed at baseline, 12 and 24-weeks with the 6-minute walk test (6-MWT), 17-item Block Brief Dietary Fat Intake Screener and the 10-item Block Fruit-Vegetable-Fiber Screener. An activity monitor worn on the wrist tracked the daily physical activity (PA) level and a chest strap Heart Rate monitor recorded structured exercise (SE) over the 24-weeks. Bluetooth technology downloaded PA and SE related data to a smartphone using a fitness application with CH capability. The CH intervention consisted of two 30-minute in-person exercise consultations (Week 1 and 4) plus six follow-up telephone calls (Weeks 5-24) with individualized feedback and guidance from a clinical exercise physiologist. Short-term progressive PA and SE goals were negotiated over the 24-week period with an initial prescription (Weeks 1-4) of 8,000+ steps/day and SE on 2+ days/week (60-90 minutes/week). **Results:** The mean daily step count was 12604 and 14630 steps/day and the mean SE minutes were 106 and 90 minutes/week for Weeks 1-12 and Weeks 13-24 respectively. Baseline, 12, and 24-week 6-MWT distances were 514.6, 567.7, and 630.9 meters, predicted daily values for total fat were 87.1, 75.1, and 72.7 grams, fruit/vegetable servings were 4.8, 2.6, and 4.4/day and dietary fiber were 12.5, 7.1, and 10.2 grams respectively. Body weight was 94.6, 80.6, and 71.6 kg respectively. **Conclusion:** In this case study example, the subject demonstrated adherence to using wearable technology to track PA related behavior and participate in this CH intervention. **Future directions:** CH may provide a process to remotely deliver weight management support between in-person clinical visits. Research is required to evaluate the impact of CH interventions in a bariatric patient population. Supported by Mayo Clinic and Arizona State University Project Honeybee

3045 Board #91 May 31 3:30 PM - 5:00 PM
University Staff Physical Activity Inventory (USPAI)

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The work-related environment has been implicated as a factor involved in the declines of physical activity (PA) in the United States and abroad. Although, the collective literature would suggest that reductions of risk for multiple chronic health conditions has been associated with physically active lifestyles meeting or exceeding 150 minutes/week. Staff in a University setting may experience unique work-related challenges that may inhibit his-or-her ability to achieve recommended daily levels of PA. Few studies exist; however, that have evaluated PA among University staff members. **PURPOSE:** To explore self-reported levels of PA among staff members at Biola University.

METHODS: Eligible survey respondents (N = 320) were men (n = 108, 40.3 ± 13.1 years of age, 168.0 ± 8.5 cm in height, 74.8 ± 14.3 kg in weight, and an average body

mass index (BMI) of 26.4 ± 4.7 kg/m² and women ($n = 212$, 39.7 ± 13.3 years of age, 164.2 ± 8.1 cm in height, 69.8 kg in weight, and an average body mass index (BMI) of 26.03 ± 6.5 kg/m²) who reported being staff members from Biola University. Participants completed the International Physical Activity Questionnaire (IPAQ), using the Survey Monkey® platform. Workers were grouped by type of job (administration, staff and facilities). Total daily sitting time and metabolic equivalent (MET) minute activity-specific (leisure, household, occupational, and transport) and total weekly PA were calculated. **RESULTS:** A Multivariate Analysis of Variance MANOVA revealed significant ($p < 0.05$) main effects for job type, total minutes of PA per week, and grand total PA per week. Post-hoc analyses revealed facilities had significantly greater minutes of work PA and total weekly PA than staff and administration. There was no significant ($p > 0.05$) difference between job types in quantity of leisure, transport, and household PA. An independent T-test was employed to evaluate gender differences for total minutes of work PA and overall minutes of weekly PA. Significant ($p < 0.05$) differences were observed for gender and total work PA, but not for overall PA. Men were significantly more active at work than women. **CONCLUSION:** Mean weekly minutes of overall PA exceeded minimal weekly recommendations among all job titles and sexes.

3046 Board #92 May 31 3:30 PM - 5:00 PM
Physical Therapy Students Knowledge And Attitudes of Nutrition

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(No relevant relationships reported)

PURPOSE: Physical therapy has incorporated health promotion as a part of practice, which includes nutrition. A search of university curriculum within the state of Texas revealed no nutrition courses within entry-level doctoral physical therapy programs or at prerequisite level. Furthermore, little research has been conducted on the knowledge and attitudes of nutrition in physical therapists. Therefore, the purpose of the present study was to determine knowledge and attitudes of nutrition in current physical therapy students. **METHODS:** Subjects included doctoral physical therapy students from across the range of years of study in professional preparation programs. This research was conducted online (Qualtrics), which included a Nutrition Knowledge Test (NKT) (32 possible points) and an attitude scale (55 possible points). The survey was disseminated by doctoral physical therapy program directors to students and analyzed using ANOVA. **RESULTS:** A complete sample of $n = 605$, the mean NKT score was 22.43 ± 3.43 (70.1%). Though there was no correlation between attitudes and knowledge of nutrition ($.026, p = .526$), physical therapy students revealed high regard for nutrition with the mean attitude score being 47.13 ± 4.32 (85.7% agreeableness with positive nutrition statements). There was also a significant difference in NKT scores when comparing groups who had taken a nutrition course and those who had not, 22.81 ± 3.56 and 21.66 ± 3.46 ($p < .001$), respectively. Those individuals who had completed 3 or more nutrition courses showed the largest improvement on the NKT (~7%). Additionally, the Midwestern region presented with the most students' programs having a nutrition course, held the highest NKT scores (22.67 ± 3.19), highest regard towards nutrition (47.44 ± 4.22) and were most satisfied with level of understanding of nutrition (69.8%). It is important to note that though there was an increase in NKT scores with increase in nutrition courses, the difference was only 2.36 points on the NKT. **CONCLUSION:** Based on relatively small changes in NKT and desires expressed during this survey, integrating nutrition competencies within current required courses may be the most appropriate intervention.

3047 Board #93 May 31 3:30 PM - 5:00 PM
Relationship Between Socialization and Weight Changes Using Among Individuals That Use Wearable devices

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Over the past few years, the use of fitness-tracking wearable devices, or wearables, has increased. They have many features that allow users to monitor their activity, measure pulse rate, and communicate their progress with other users. Accessible and streamlined user interfaces assist individuals in weight management while sharing their results with others in their social groups. Prior research has shown evidence for a positive association between weight loss and in-person socialization during workouts. However, research on virtual socialization within wearable devices and changes in weight is limited.

PURPOSE: To investigate the relationships between socialization and changes in body weight after wearable use.

METHODS: Individuals that owned a wearable device were eligible for this observational study. Surveys were completed electronically via Qualtrics Online Survey Platform. Participants accessed the survey through social media, email, and in-person recruitment ($n=33$, 78.8% Female, 51.5% aged 18-24 years, 56.3% White, 27.07 ± 6.7 kg/m²). Data was analyzed using SPSS Version 25. Chi-square tests and Spearman correlations were used to evaluate the relationship between changes in weight and in-person socialization (e.g. work out buddies) or device socialization (e.g. interactions with likes, comments, leaderboards, etc.).

RESULTS: Participants reported both an increase (33.3%) and a decrease (66.7%) in weight since using their wearable. There was prevalent use in the various socialization techniques (in-person = 42.4%, likes and comments = 30.3%, and leaderboards = 27.3%). In accordance with previous studies, there was a moderate association between in-person socialization and weight loss ($r = -0.49$, $p = .02$). There were no significant associations between changes in weight and usage of leaderboard features ($r = -0.18$, $p = 0.42$) or likes and comments features ($r = -0.07$, $p = 0.77$).

CONCLUSIONS: Our analysis did not find a significant relationship between reported weight change and virtual socialization. However, there was a moderate relationship between reported weight change and reports of working out with a partner. Due to the small sample size, no definite conclusions can be drawn but future research should continue to investigate in-person versus virtual socialization on weight outcomes.

3048 Board #94 May 31 3:30 PM - 5:00 PM
Exercise is Medicine Programs: Public versus Private Healthcare Provider Interest and Needs

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(No relevant relationships reported)

Purpose: Park Prescriptions (ParkRx) incorporating healthcare provider referrals for park-based physical activity (PA) are a type of Exercise is Medicine (EIM) program to improve patient physical and mental health through outdoor PA. This study explored public vs private healthcare provider 1) PA counseling practices, 2) knowledge/interest in ParkRx, and 3) barriers and resources needed to implement ParkRx programs. We anticipate private providers to be more receptive to ParkRx.

Methods: An e-survey was administered in Spring/Summer 2018 to healthcare providers in Kansas, Missouri and North Carolina. Participants were recruited via flyers, emails, community-healthcare partnerships, and snowball sampling techniques. Modified validated survey items examined PA counseling practices, knowledge/interest in ParkRx programs, and barriers and resources needed. Descriptive statistics and independent samples t-tests explored study objectives including differences by public (i.e., Hospital, HMO, VA) versus private (i.e., consultant; solo/group) practice.

Results: Providers ($n=223$) were mostly public (57.4%) versus private (42.6%). The majority of providers ask about patient PA habits (75.0%) in a lot/all of check-ups ($M=5.0, SD=1.5$). However, private providers ask about PA habits and provide verbal counseling more often than public providers, $t(168.4)=-2.10$, $p=0.038$, $t(168.10)=-3.20$, $p=0.002$ respectively. Very few providers give written PA prescriptions (10.8%). Few providers knew about ParkRx programs (13.9%), but 81.6% expressed interest in program development. Public providers were more willing to implement a ParkRx program $t(181.9)=2.40$, $p=0.017$. When implementing ParkRx, public providers place greater importance on evidence of park-based PA $t(221)=2.40$, $p=0.017$, evidence of patient interest $t(221)=2.30$, $p=0.022$, a patient portal with PA resources $t(221)=2.84$; $p=0.005$, and incorporation into EHR electronic $t(178.9)=2.55$, $p=0.012$.

Conclusions: Healthcare providers underutilize written PA prescriptions and awareness of EIM programs such as ParkRx is limited. EIM initiatives should target both public and private healthcare providers, but remain cognizant of differences in implementation needs.

3049 Board #95 May 31 3:30 PM - 5:00 PM
The Effects of Sit To Stand Workstations on Perceived Leisure

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(No relevant relationships reported)

With the increase in sedentary behaviors, workplaces are using new ways to improve activity by giving employees the option to stand while working. However, research has not fully examined the impact of workplace wellness initiatives on participants' perceived freedom to participate in leisure activities. **PURPOSE:** The purpose of this study was to evaluate the effects of a sit-to-stand (STS) workstation intervention on leisure function over 12 months. **METHODS:** Faculty and staff volunteers from a university ($N=24$) were randomly assigned to a control group ($n=11$) or STS group ($n=13$). STS participants were required to stand at the desk for a minimum of two hours per workday. The Leisure Diagnostic Battery (LDB)-Function was used to assess perceived freedom in leisure. The LDB includes a 25-item survey regarding social comfort, environment, decision making, and communication with others. A

repeated measures ANOVA was used to analyze results. **RESULTS:** Two outliers were removed from analysis. All assumptions were met. A significant difference occurred between groups ($F_{2,22}=5.14$, $p=.01$). A significant time effect did occur from pre-test to 6 ($p=.02$) and pre-test to 12 months ($p=.02$). The main effect for group was not significant ($p>.05$). The CG decreased by .05 points from baseline to 6 months and increased by .09 from 6 to 12 months ($p>.05$). A dependent t -test revealed the STS group significantly decreased by .26 points from baseline to 12 months ($p=.00$). **CONCLUSION:** The STS group decreased feeling less free to engage in leisure activities from baseline to 12 months. Similar to current research, this data demonstrates that workplace interventions may not improve leisure activity participation. However, this study only measured self-reported freedom in leisure. Future research should objectively measure leisure activity participation.

ACKNOWLEDGEMENTS: This project was funded by the University of Central Oklahoma, Research and Sponsored Programs office.

3050 Board #96 May 31 3:30 PM - 5:00 PM
Associations Between Neighborhood-level Measures Of Socioeconomic Status And School-reported Health-related Physical Fitness.

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(No relevant relationships reported)

PURPOSE:

We previously reported pervasive musculoskeletal fitness deficits and high obesity prevalence at a proxy predominantly Hispanic elementary school in Corpus Christi, Texas. It's unclear whether these are linked with neighborhood level measures of socioeconomic status (SES). This study investigated associations between school-reported health related physical fitness and neighborhood-level measures of SES, i.e., area deprivation index (ADI), median household income, park density, and number of park amenities that support physical activity (PA).

METHODS:

The study sample consisted of 41 elementary and middle schools in Corpus Christi Independent School District (student enrollment is 79% Hispanic). Percentages of students who achieved healthy fitness zone (HFZ) classification on FitnessGram® outcomes in 2016-2017 was generated from Texas Education Agency database. School zip codes, corresponding median household incomes, park density, and park amenities that support physical activity were retrieved using Google search engine, US Census Bureau American FactFinder tool, and Geographic Information System (GIS) mapping tools, respectively. ADI was obtained using Neighborhood Atlas. Park density was the ratio of the number of parks to land area (in square kilometers) of respective zip codes. Land area was measured using GIS tools. Linear regression models and resulting standardized beta coefficients informed the magnitudes of associations between outcomes. Statistical significance was set at $p < .05$.

RESULTS:

Median household income was negatively associated with the percentage of students who achieved HFZ on the measure of cardiorespiratory fitness ($\beta = -.406$; $p = .006$; 95% CI [-0.00, .000]). The number of park amenities that support physical activity ($\beta = .524$; $p = .000$; 95% CI [.003, .008]) and ADI ($\beta = -.420$; $p = .004$; 95% CI [-0.27, -.005]) were positively and negatively associated with the percentage of students who achieved HFZ classification on BMI, respectively.

CONCLUSION:

The current findings suggest that park authorities should invest and ensure equity in the number park amenities that support physical activities across neighborhoods with low and high deprivation indices. The association between median household income and cardiorespiratory fitness warrants further investigation.

3051 Board #97 May 31 3:30 PM - 5:00 PM
Medical Students' Knowledge and Attitudes to Physical Activity and Health and to Physical Activity Counseling

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PURPOSE: Physical activity (PA) counseling in the health care setting is regarded as a promising avenue to increase population level PA. Equipping future physicians with the necessary knowledge is crucial. The aim of this survey was to assess the knowledge on and attitude towards PA and health, as well as PA counseling at a large German Medical School.

METHODS: a 15-item online survey was conducted. The study has been approved by the University Ethics Committee.

RESULTS: 145 students (106 females, 73%) returned the questionnaire. 118 (81%) reported not knowing the WHO PA recommendations. Only 15 (10.3%) respondents could identify the recommendations correctly. 108 (74%) reported having learnt

anything on the health effects of PA. 106 (73%) wished more information on this topic. 97% and 96% of respondents considered PA to be important or very important in the prevention and therapy of chronic diseases respectively. 99% judged PA counseling to be physicians' task. Weekly reported PA was as follows: 9 (6%) no exercise, 19 (13%) > 1 hr, 47 (32%) 1-2 hrs, 41 (28%) 2-4 hrs, and 29 (20%) < 4 hours. 32 (22%) respondents were in the entry phase of their studies, 87 (60%) in the midphase and 26 (18%) in their final, practical year. Gender was not associated with the importance of PA in prevention and therapy, with physicians' PA counseling role and with perceived need for more information on PA and health. High overall PA volume was only associated with physicians' PA counseling role (Spearman's rho, .224, $p > 0.01$). The importance of PA in therapy was associated with the importance of PA in prevention (Spearman's rho, .595, $p > 0.01$). PA counseling as physicians' role was associated with PA in prevention (Spearman's rho, .402, $p > 0.01$) and PA in therapy (Spearman's rho, .406 $p > 0.01$) respectively. **CONCLUSIONS:** Medical students are interested in learning about the health effects of PA, consider PA important in the prevention and therapy of chronic diseases, and see PA counseling as physicians' task, with no difference between males and females and students according to their study phase. Also no association was found between respondents' PA and health related views and their volume of PA. A self-selection bias in respondents cannot be ruled out.

3052 Board #98 May 31 3:30 PM - 5:00 PM
Comparison Of Energy Expenditure Of Overground And Motorized Treadmill Running In Healthy Chinese Young Adults

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PURPOSE: Overground and motorized treadmill running are popular types of exercise training. Compared to motorized treadmill running, overground running has no external motor and depends on subject's own motor to acceleration and deceleration. However, it is still unexplored for the difference of cardiometabolic demands of overground running when compared with treadmill running at the same speed. The purpose of this study was to compare the oxygen consumption at the same speed of overground and treadmill running in Chinese young adults. **METHODS:** 40 healthy Chinese young adults (21 male, 24.8±2.04 years; 19 female, 23.8±1.95 years) volunteered to participate in the study. After the anthropometric data collection, body composition assessment, 6 min running bouts energy costs of different speed (7km/h, 8km/h, 9km/h) of overground and treadmill running were measured. The energy costs of subjects were measured by a portable gas analyzer (MetamaxTM 3B, German). Overground trials were completed in an indoor sports stadium, and treadmill (Rodby RL3500E, Sweden) running were completed in the same stadium to minimize environmental influences on performance. The variables including heart rate, oxygen consumption ($\dot{V}O_2$) and RPE were collected within 6 minutes during each overground and treadmill running test. **RESULTS:** The gross overground running metabolic energy cost of male at 7km/h, 8km/h and 9km/h was higher when compared to the treadmill testing mode (0.242 ± 0.02 vs. 0.225 ± 0.02 ml/kg/m, $P < 0.01$; 0.249 ± 0.02 vs. 0.219 ± 0.02 ml/kg/m, $P < 0.01$; 0.244 ± 0.02 vs. 0.215 ± 0.02 ml/kg/m, $P < 0.01$). We also found significant differences of female between the two modes with the treadmill being lower (0.231 ± 0.02 vs. 0.217 ± 0.02 ml/kg/m, $P < 0.01$; 0.232 ± 0.02 vs. 0.213 ± 0.01 ml/kg/m, $P < 0.01$; 0.228 ± 0.02 vs. 0.207 ± 0.01 ml/kg/m, $P < 0.01$) at speed of 7 km/h, 8km/h and 9km/h. **CONCLUSIONS:** The results demonstrate that, for all experimental velocities in men and women, the energy cost of overground running is higher than the treadmill running. It is critical that these differences are taken into account when prescribing training intensities on whether the overground running or the treadmill running to a training protocol.

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3053 Board #99 May 31 3:30 PM - 5:00 PM
Comparison of Progressive Single and Multiple Sets of Resistance Training on Muscle Strength and Power

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Controversial research findings have yet to determine whether single or multiple sets of resistance training protocol is more effective than the other. **PURPOSE:** To compare the effects of low volume progressive single set and traditional multiple sets of resistance training on muscle strength, power, and field tests in the upper and lower

body. **METHODS:** Total 20 participants were randomly assigned to single set (ST, $n=10$), and multiple sets groups (MT, $n=10$). The ST group trained for one set with a maximum of six reps. The first rep started at 70% of one repetition maximum (1RM) and increased by 5% after each rep until they reached 90% of their 1RM and then the last rep was performed at 100% of 1RM. The MT group trained at 70% of 1RM for 10 reps with 3 sets. Both groups trained 3 times per week for 8 weeks using the squat and chest bench press. 1RM squat, 1RM bench press, anaerobic power, vertical jump, and medicine ball throw in upper and lower body were measured at baseline and after 8 weeks of training. Two-way repeated measures ANOVA were used to determine an interaction effect between trial and treatment groups factors for each dependent variable. Main effects of trials and the treatment groups were also tested. **RESULTS:** There was no significant interaction effect between trial and treatment groups for all dependent variables. Main effect results show that both ST (percentage change = 20%, $p < .001$) and MT (24.05%, $p < .001$) groups significantly increased 1RM squat, compared to their baseline. 1RM bench press was also increased in both ST (6.82%, $p < .005$) and MT (13.9%, $p < .002$) groups. No significant differences in 1RM squat and 1RM bench press were found between the two training groups. Anaerobic power in ST (22.8%, $p < 0.001$) and MT (8.6%, $p < .002$) groups was significantly increased, compared to their baseline. However, there were no significant differences in anaerobic power of upper body. Vertical jump in ST (13.54%, $p < .001$) and MT (6.43%, $p < .049$) groups was significantly increased, compared to their baseline. There was no significant increase in the medicine ball throw from both groups. **CONCLUSIONS:** The results imply that low volume progressive single set training (ST) protocol is as effective as traditional multiple sets training (MT) protocol for increasing muscle strength and power.

3054 Board #100 May 31 3:30 PM - 5:00 PM
Effects of a Multifactorial Exercise Intervention on Falls Risk Factors: Comparing Age and Falls History

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In the US, older adults experience an estimated 29 million falls per year resulting in 7 million injuries. Multifactorial exercise interventions (INT) are effective in reducing falls risk. Yet, it remains poorly understood how age and previous history of falls impacts INT aimed to reduce falls risk.

PURPOSE: To compare the effects of a multifactorial exercise INT on time (pre, post), age group (50-59, 60-69, 70-79, 80+ years), and faller status [fallers (1 or more falls in past year), non-fallers] on right & left leg strength (RLS & LLS), foot & hand reaction time (FRT & HRT), 30 second sit-to-stand (STS), and timed up and go (TUG).

METHODS: One hundred eighty-three older adults (71.0±6.6 years, 1.7±1 m, 81.5±17.2 kg) participated in a multifactorial INT, Stay Active and Independent for Life (SAIL). Participants met for 1h, 3x/week for 10 weeks; exercises included aerobic, balance, strength, and stretching exercises. RLS & LLS (normalized to body mass), FRT & HRT (ms), STS (number of repetitions) and TUG (s) were assessed pre- and post-INT. A 2 (time) x 4 (age group) x 2 (faller status) MANOVA was conducted to assess differences among factors. Post-hoc analysis was conducted for significant interactions ($\alpha < 0.05$).

RESULTS: Main effects were attained for time and age group ($p < 0.05$). Participants were stronger (RLS, pre=24±.08, post=.28±.09; LLS, pre=.23±.08, post=.27±.09) and improved leg endurance (STS, pre=12.36±3.22, post=14.54±4.01) after INT. FRT was faster from pre (306.6±49.8) to post (299.6±43.6). For age group, 60-69 had greater RLS and LLS (.26±.10, .26±.09) than 70-79 (.25±.09, .24±.08). In 60-69 (14.32±3.94) group, STS was higher than 70-79 (12.96±3.4) and 80-90 (11.66±3.87). TUG scores were faster for 60-69 (7.00±1.52) compared to 70-79 (7.73±1.54) and 80-89 (9.09±2.12). No other statistically significant differences were found ($p > 0.05$).

CONCLUSION: In line with previous literature, SAIL was effective at reducing falls risk factors, supporting SAIL to be an effective INT. Multifactorial INT are an effective strategy to combat falls as they target multiple risk factors. Outcomes of 60-69 age group suggest INT should be adjusted for advanced age. However, including falls efficacy and quality of life may give more insight into improvements. Supported by grant from Potomac Health Foundation.

3055 Board #101 May 31 3:30 PM - 5:00 PM
Virtual Reality Exercise on College Students' Mood and Rating of Perceived Exertion

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PURPOSE: This study examined differences in college students' mood and rating of perceived exertion (RPE) during immersive virtual reality (VR), non-immersive VR, and traditional biking sessions.

METHODS: Forty-nine college students (34 females; $M_{age}=23.6$) completed three separate 20-minute biking exercise sessions: 1) immersive VR biking on VirZoom VR bike using PlayStation 4; 2) non-immersive VR biking on Gamercize bike using Xbox 360; and 3) traditional biking on Spirit Fitness XBU55. Their mood was assessed via the Brunel Mood Scale (anger, confusion, depression, fatigue, tension, and vigor) during each session. RPE was evaluated by the Borg Rating of Perceived Exertion every 4 minutes. Repeated measures ANOVA was used to compare the mean differences in mood and RPE among these 3 exercise sessions.

RESULTS: Overall, significant differences were observed between biking sessions for mean RPE [$F(2, 98) = 3.58, p = 0.03, \eta^2 = 0.07$] and all mood variables [$F(2, 96) = 3.84 - 278.56, p < 0.05, \eta^2 = 0.07 - 0.85$], except for tension ($p > 0.05$). Post hoc Bonferroni comparisons indicated immersive VR had significantly higher anger compared to non-immersive VR (1.09 ± 0.21 vs $1.5 \pm 0.66, p < 0.01$); non-immersive VR had significantly higher confusion compared to immersive VR (1.51 ± 0.69 vs $1.26 \pm 0.53, p = 0.01$) and traditional biking (1.51 ± 0.69 vs $1.20 \pm 0.4, p < 0.01$), respectively; immersive VR had significantly lower depression compared to traditional biking (1.07 ± 0.18 vs $1.34 \pm 0.68, p = 0.03$); both immersive VR (1.86 ± 0.72 vs $2.47 \pm 0.87, p < 0.01$) and non-immersive VR (1.81 ± 0.74 vs $2.47 \pm 0.87, p < 0.01$) had significantly lower fatigue compared to traditional biking; immersive VR had significantly higher vigor compared to non-immersive VR (3.70 ± 0.93 vs $1.30 \pm 0.47, p < 0.01$) and traditional biking (3.70 ± 0.93 vs $1.15 \pm 0.38, p < 0.01$), respectively; immersive VR had significantly lower mean RPE compared to traditional biking (10.18 ± 1.84 vs $12.86 \pm 2.13, P < 0.01$).

CONCLUSIONS: Findings suggest a commercially-available VR-based exercise bike (VirZOOM) may be a motivating interesting and enjoyable physical activity promotion tool for healthy young adults.

3056 Board #102 May 31 3:30 PM - 5:00 PM
High Intensity Interval Training in a Natural Setting: An Intrapersonal Perspective

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High intensity interval training (HIIT) is an extremely challenging workout associated with negative affect for participants (Ekkekakis et al., 2011; Foster et al., 2015). HIIT is often perceived as appropriate only for people who are experienced and relatively fit exercisers and as a poor option for deconditioned or previously sedentary exercisers (Hardcastle et al., 2014). Almost all HIIT research has been conducted in controlled, laboratory settings and focused on physiological adaptations. Little is known about the affective experiences of HIIT participants in real-life settings.

PURPOSE: To examine the experiences of HIIT participants in a real-life outdoor boot camp.

METHODS: Qualitative interviews were conducted with 16 boot camp participants whose length of time participating in HIIT ranged from two months to eight years.

RESULTS: Three main findings: 1. People of widely varying fitness levels, ages, body types, and exercise backgrounds were able to enjoy and successfully perform HIIT workouts. According to body mass index categories, 64% of study participants were either overweight or obese. Ages ranged from 26 to 58 years; 2. Participants reported the alternating intensity levels were motivating and allowed them to work at near maximal intensity for short intervals, knowing low intensity intervals would soon provide needed recovery. The ability to customize the intensity and duration of intervals made HIIT workouts easier to complete than moderate intensity workouts extending over long periods of time; 3. Social support within the boot camp was crucial to successful performance and enjoyment of HIIT workouts. Participants reported that social support enabled them to endure workouts at higher intensity levels than would have been possible if exercising alone.

CONCLUSIONS: HIIT is appropriate for people of varying fitness levels and exercise experience. Built-in recovery intervals motivate people to maximize effort during high intensity intervals. Social support during HIIT was central to participants' ability to complete difficult workouts.

- 3057** Board #103 May 31 3:30 PM - 5:00 PM
The Effect of a Behavioral Weight Loss Intervention With or Without Exercise on Depressive Symptoms
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Depressive symptoms have been associated with less weight loss in some behavioral weight loss interventions (BWL), and although it has been speculated that adding moderate-to-vigorous physical activity (MVPA) may improve outcomes, the relationship is not well understood. **PURPOSE:** To examine the relationship between weight loss, MVPA participation, and depressive symptoms over time in subjects enrolled in a BWL.

METHODS: Secondary analyses of depressive symptoms and weight loss in sedentary subjects ($n=379$; 45.0 ± 7.9 years; $BMI=32.4 \text{ kg/m}^2 \pm 3.8$) enrolled in a BWL and randomized to a reduced calorie diet (DIET, $N=104$), diet plus a moderate dose of MVPA (MOD-EX, $N=97$), or diet plus a high dose of MVPA (HIGH-EX, $N=102$) were completed. All groups reduced energy intake (1200-1800 kcal/day), received weekly intervention sessions (months 1-6), followed by 2 group and 2 telephone contacts per month (months 7-12). MOD-EX was prescribed unsupervised MVPA that progressed to 150 min/wk, and HIGH-EX was progressed to 250 min/wk. Depressive symptoms (CES-D) and weight were assessed at 0, 6, and 12 months.

RESULTS: Weight decreased [6mo: $-9.18 \pm 5.9 \text{ kg}$; 12mo: $-10.0 \pm 7.8 \text{ kg}$] and depressive symptoms modestly increased from baseline to 6 months [BL: 6.45 ± 2.34 ; 6mo: 7.05] ($p < 0.001$) and baseline to 12 months [BL: 6.45 ± 2.34 ; 12mo: 6.93] ($p < 0.05$), with no significant differences between randomized groups. There was a modest, yet significant correlation between baseline CES-D score and weight change at months 6 ($r = .126$) and 12 months ($r = .122$) ($p < 0.05$). Subjects who completed 6 months of the intervention ($n=337$) had significantly lower baseline CES-D scores compared to the non-completers ($n=42$) ($p < .05$), but there were no differences for 12 month completers ($p = .49$).

CONCLUSIONS: The data revealed an inverse relationship between baseline depressive symptoms and success in the BWL. This relationship was not different between DIET, MOD-EX, and HIGH-EX, indicating that exercise participation may not influence this relationship. While depressive symptoms increased slightly over time regardless of group assignment, the 6 month completers had lower baseline depressive symptoms than non-completers. Thus, baseline depressive symptoms may be an important marker of both success and attrition in a BWL.

- 3058** Board #104 May 31 3:30 PM - 5:00 PM
Cardiorespiratory Effects Of A Multicomponent Exercise Program On Individuals Diagnosed With Alzheimer's Disease: Pilot Study
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Dementia, particularly Alzheimer's disease (AD), is one of the major causes of impairment and dependence in the world. Besides the cognitive decline, that characterize AD, this neurodegenerative disease progresses along with functional impairment, and adversely affects physical conditioning. Recent guidelines reinforce the need to implement effective interventions to mitigate the impact of AD. Physical exercise could be significant in improving functional and cognitive performances in these individuals. Cardiorespiratory fitness has been directly associated with different health-related parameters, brain health, neurocognitive performance and ability to perform daily activities. Submaximal incremental treadmill tests have been used to measure aerobic fitness in healthy older adults and seems to be appropriate for those diagnosed with dementia. **PURPOSE:** The aim of this study was to evaluate the impact of a multicomponent exercise program on peak oxygen consumption. **METHODS:** According to the 2011 *NINCDS-ADRDA* criteria, and in a mild to moderate stage of disease, 15 community-dwelling individuals diagnosed with probable AD were referred from the Neurology Department of a Hospital Centre to participate in this study. VO₂ peak was measured through an incremental treadmill test using a modified Bruce protocol, designed for older individuals, previously tested with AD subjects. **RESULTS:** Results from Wilcoxon Signed Rank test revealed a slight increase on VO₂ peak [19,11(3,61); 20,60(4,40); $p=0,594$] and on time to reach it [5,58(1,48); 6,17(2,23); $p=0,575$] which may be explained by a potential benefit of exercise on peripheral factors such as muscular resistance and coordination, both essential to success on endurance tests. **CONCLUSIONS:** Data from both evaluation moments suggest that AD subjects cardiorespiratory fitness is under the established partners for independent healthy older adults. These results reinforced the importance to create cost-effective strategies, and to use gold standard evaluation instruments, to mitigate or prevent the physical conditioning decline, determinant to their autonomy on activities of daily living.

FUNDING: CIAFEL (UID/DTP/00617/2013) & "Body and Brain" (POCI-01-0145-FEDER-031808)

- 3059** Board #105 May 31 3:30 PM - 5:00 PM
Sedentary Time and Physical Activity Pattern in Women after an Interdisciplinary Program to Treat Obesity
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The result of interventions for body weight reduction is not rare disappointing. Adjustments in daily-life physical activities and in sedentary time in response to exercise may undermine the negative energy balance caused by the interventions, reducing their efficacy.

Purpose: To determine the effects of an interdisciplinary program (IP) to treat obesity on sedentary and physical activity (PA) time. **Methods:** A total of 14 obese women (39.33 ± 5.77 years and $BMI 34.14 \pm 2.99$) participated in a 16-week program consisting of 3 sessions/week lasting 2 hours each. Physical exercise was carried out for 1 hour in every session, followed by psychological, nutritional or physical therapy intervention. For sedentary time and PA determination participants wore an accelerometer for seven consecutive days before and during the last week (LW) of IP. The difference between Pre and LW values was determined by repeated measure one-way ANOVA. Pearson's correlation test was also performed. Significance was set at 5%. The protocol was approved by Unifesp Ethics Committee (#2.579.851). **Results:** Following IP, body weight change ranged from -5.90 to $+2.40 \text{ Kg}$. However, the program failed ($p > 0.05$) in promoting a significant mean reduction on body weight (Pre 94.06 ± 8.35 ; Post $93.07 \pm 8.56 \text{ Kg}$). Neither the time (min/day) spent sedentary (Pre: 568 ± 63 ; LW: 600 ± 75), in light (Pre: 257 ± 47 ; LW: 267 ± 64) or moderate/vigorous (Pre: 24 ± 10 ; LW: 24 ± 14) PA nor the number of steps/day (Pre: $6,392 \pm 1,530$; LW: $6,808 \pm 2,874$) changed in LW compared to the period pre-intervention ($p > 0.05$). The correlation between changes in body weight with changes in time in sedentary (-0.068), light (-0.233), moderate/vigorous (-0.292) PA and steps/day (-0.289) was also not significant ($p > 0.05$). **Conclusion:** Even though we did not find a significant correlation between variation in body weight and variation in time sedentary/active, the lack of change in sedentary and PA time despite the addition of 3 sessions of exercise/week suggests the occurrence of a compensation to minimize the increase in daily energy expenditure caused by exercise, contributing to the resistance to body weight reduction. Our results also demonstrate a failure in adopting a more active life style after participating in an IP.

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- 3060** Board #106 May 31 3:30 PM - 5:00 PM
Water Intake During Resistance Training Affects Arterial Stiffness In Normotensive Healthy Adults
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Resistance training (RT) may induce arterial stiffness (AS) which is associated with increased risk of myocardial infarction and stroke, the two leading causes of death in the developed world. However, there are a lot of variables and situations that can influence AS such as water intake (WI).

PURPOSE: To determine the influence of WI during RE on arterial stiffness. **METHODS:** Young adult men ($n = 17$, 23.1 ± 6.3 years old; $174.0 \pm 5.4 \text{ cm}$ height; $76.4 \pm 13.3 \text{ kg}$ weight) with at least 1 year of previous experience in RT and previously hydrated performed in two different occasions (one week interval between them) an RT session (3 sets, 8-12 repetition of 12 exercises for all major muscle groups at 70-80% of 1RM) with [WI session (500ml of water)] and without (NWI session) water intake. Aortic stiffness was measured before, immediately after, and 30 and 60 min after the RT session via Ankle-brachial pulse wave velocity (PWV). Repeated measures ANOVA was conducted to compare RT sessions differences (Rest, after, 30min, 60 min). Between-RT sessions differences at each moment were examined using appropriate post hoc analyses.

RESULTS: Increase in post-exercise PWV for the NWI session compared to rest was observed. Moreover WI values were lower than NWI for all post-exercise measures. Table 1. Pulse wave velocity (PWV) in meters per second (m/s) before, immediately after, 30 and 60 min after WI and NWI resistance training sessions.

RT session	Rest	After	30 min	60 min
No water	11.3±1.5	12.3±1.1	12.3±1.2	*12.5±1.0
Water	11.5± 0.6	*11.5±1.2	*11.3±1.2	*11.8±1.1

* Significant difference between no water and water sessions ($p < 0.05$). #Significant RT session by time interaction/difference in relation to Rest ($P < 0.05$). Results are presented in mean and standard deviation.

CONCLUSION: WI during RT may be beneficial to reduce the negative impact of RT on arterial stiffness. This was evidenced by the maintenance of PWV values after WI session and increased values after NWI. From this investigation alone we cannot determine whether WI is influencing the PWV measurement or which physiological mechanisms were influenced by WI.

3061 Board #107 May 31 3:30 PM - 5:00 PM Outcomes On Physical Activity Levels By Minimal Contact Intervention At A University Setting: Preliminary Results

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(No relevant relationships reported)

PURPOSE: To compare the effects of an intervention program of minimal contact using Whatsapp® and Fitbit® over the levels of physical activity on a university population.

METHODS: We designed a 12-week intervention program of minimal contact on a university population. Participants were randomly assigned into two groups: intervention (IN) and control (CO). From a total of 177 participants, 19 (11 men, 8 women, aged 18 - 32) completed the program and had the complete accelerometry information measured with the wGT3X-BT® accelerometer. The program consisted of messages sent by Whatsapp® every week based on The Canadian 24 hrs movement: sweat, step, sleep and sit. All the messages were based on the motivational self-determination theory. The participants also wear a portable Fitbit Flex® 2 for 12 weeks. We evaluated the moderate to vigorous physical activity (MVPA) levels and sedentary behaviors in minutes/day and percentage of weekly wearing time by accelerometry using the IPEN criteria. We compared the outcomes by group (t-test, U Mann-Whitney) and time (paired T-test, Wilcoxon).

RESULTS: Both groups met the recommendations of MVPA in high proportion (IN=83.3%, CO=85.7%, >150 min/w). There were no significant differences in MVPA nor sedentary levels between groups at baseline and after 12 weeks. MVPA (in time and percentage) and time in sedentary activities decreased, however, the percentage of sedentary activities increased in IN group but decreased in the CO group. Nonetheless, these differences were not significant. Sedentary behaviors were very high in both groups. Independently of the intervention and the assessment moment, subjects spent more of the 60% of the wearing time on sedentary activities (Table).

CONCLUSIONS: This intervention was not effective to increase MVPA levels or decrease sedentary behaviors. Probably more time is needed to improve the entire 24 hrs movement component and/or the minimal contact should be more supervised in this sample.

Table I. MVPA and sedentary behavior compared by group and time.						
	Pre			Post		
	Intervention (n = 12)	Control (n = 7)	p	Intervention (n = 12)	Control (n = 7)	p
MVPA (min/day)	46.7 ± 21.9	50.1 ± 23.4	0.755	45.9 ± 21.1	49.7 ± 18.5	0.698
MVPA (%)	5.6 ± 2.5	5.8 ± 3.0	0.966	5.5 ± 2.6	5.7 ± 2.4	0.862
Sedentary (min/day)	536 ± 67.5	573.1 ± 64.7	0.257	529.5 ± 76.0	558.8 ± 87.7	1.0
Sedentary (%)	63.6 ± 5.1	66.1 ± 6.8	0.383	64.6 ± 7.8	64.2 ± 3.1	0.904

Data expressed as mean ± standard deviation. There were no significant differences for pre vs post assessments ($p > 0.05$). MVPA: Moderate to vigorous physical activity; (min/day): Average daily time on that activity; (%): Percentage of the whole week spent on that activity.

3062 Board #108 May 31 3:30 PM - 5:00 PM

Using the Immediate Blood Pressure Benefits of Exercise to Improve Exercise Adherence

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A single exercise session evokes blood pressure (BP) reductions that are immediate and persist for ≥24hr, termed *postexercise hypotension* (PEH). Self-monitoring of PEH may foster positive outcome expectations of exercise, and thus, enhance exercise adherence among adults with hypertension. **PURPOSE:** To compare the efficacy of self-monitoring of exercise (EXERCISE) versus exercise plus PEH (EXERCISE+PEH) for exercise adherence and BP control among adults with hypertension. **METHODS:** Adults with high BP were randomized to EXERCISE (n=12) or EXERCISE+PEH (n=12). Subjects underwent supervised, moderate intensity aerobic exercise training for 40-50min/session, 3d/wk for 12wk, and were encouraged to exercise unsupervised at home ≥30min/d, 1-2d/wk. All subjects self-monitored exercise using a calendar recording method. EXERCISE+PEH also self-monitored BP before and after exercise. Adherence was calculated as [(# of exercise sessions performed ÷ # of possible exercise sessions) X 100%]. BP was measured pre- and post-training. **RESULTS:** Healthy, middle-aged (52.3±10.8y) men (n=11) and women (n=13) with hypertension (136.2±10.7/85.2±8.9mmHg) completed exercise training with 87.9±12.1% adherence. EXERCISE+PEH demonstrated greater adherence to supervised training (94.3±6.6%) than EXERCISE (81.6±13.2%; $p=0.007$). In addition, EXERCISE+PEH performed 32.6±22.5min/wk more unsupervised home exercise than EXERCISE ($p=0.004$), resulting in greater overall study exercise adherence (107.3±18.7%) than EXERCISE (82.7±12.2%; $p=0.002$). Post- versus pre-training, BP was reduced -7.4±11.3/-4.9±9.9mmHg ($ps < 0.025$) with no statistical difference between EXERCISE (-5.2±13.3/-3.6±6.1mmHg) and EXERCISE+PEH (-9.9±11.3/-6.1±6.9mmHg; $ps > 0.344$). **CONCLUSIONS:** This study is the first to demonstrate that PEH self-monitoring is an efficacious tool to improve exercise adherence among adults with hypertension. Future research among a larger, more diverse sample is needed to confirm these novel findings and determine whether EXERCISE+PEH translates to better BP control relative to EXERCISE self-monitoring alone.

3063 Board #109 May 31 3:30 PM - 5:00 PM Health and Fitness Improvements in Deconditioned Firefighters

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PURPOSE: To observe longitudinal changes in health and fitness among deconditioned professional American firefighters using High Intensity Functional Training (HIFT). **METHODS:** This HIFT was part of a credit-bearing educational experience (course-based) in which 13 undergraduate students participated in a service activity that met the needs of a community partner (Fire Services) and allowed them to gain deeper understanding of course objectives, knowledge and skills at a Committee on Accreditation for the Exercise Sciences accredited university, under the supervision of two ACSM exercise physiologists and one CSCS certified professors. Behavior change (BCG transtheoretical model), body composition (BC skinfolds, waist/hip ratio, circumferences), aerobic capacity (AC Bruce, step test), balance (BL, BESS), muscular strength (MS, handgrip), muscular endurance (ME, push-up, leg press), and flexibility (FX, seat-reach) measures were collected among 23 male firefighters (mean ± SD, age = 33.3 ± 10.2 yrs; height, 182.3 ± 6.5 cm; body mass index, 29.9 ± 4.9) at baseline, at 10 and 20 weeks. **RESULTS:** Measures of BCG, BC, AC, BL, MS, ME and FX significantly changed over time (RMANOVAs; $p < 0.05$). Follow-up post hoc analyses indicated that all measures significantly improved from baseline to the end of training ($p < 0.05$). **CONCLUSIONS:** The results of the current longitudinal HIFT suggest that measures of health and fitness among deconditioned U.S. firefighters significantly improved over 20 weeks. These results highlight the importance of (1) developing

an exercise programming that is designed for the active-duty firefighter population to maintain the beneficial adaptations in health and fitness and (2) including exercise science majors in relevant community experiential learning service activities.

3064 Board #110 May 31 3:30 PM - 5:00 PM
Effects of a Weight Management Intervention on Holiday Weight Change And Body Image in Inactive Overweight Midlife Postmenopausal Women

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INTRODUCTION: The holiday season is linked to weight gain which has also been related to distress about self-attitudinal aspects of body image (BI) inclusive of physical appearance and perceptions about physical fitness and health. The impact of a weight management intervention on holiday weight change and BI in midlife females has not been investigated.

PURPOSE: This study aimed to examine the effects of an 11-week weight management intervention on holiday weight change and BI in inactive overweight postmenopausal women. **METHODS:** Females (n=18; 54.7±3.9 yrs; BMI=30.5±4.5 kg/m²) completed an 11-week weight management program (supervised exercise with nutrition education) with three phases: 1) Pre-Holiday (PreH; 5 weeks), 2) Holiday Period (HP; Thanksgiving 2017 through New Year's Day 2018; unsupervised social media support only), and 3) Post-Holiday (PostH; 6-weeks). Weight and BI [Multidimensional Body-Self Relations Questionnaire subscales] were assessed at four times: 1) Baseline 1 (B1); 2) Follow-up 1 (F1; post PreH); 3) Baseline 2 (B2; post HP, baseline for PostH); and 4) Follow-up 2 (F2; final measure after PostH). Data analysis utilized one-way repeated measures ANOVAs and Pearson's correlations.

RESULTS: Weight change was highly variable from B1 to F2 (range=-6.0 to 5.1 kg) although no significant changes occurred (B1=79.5±12.7 kg; F1=79.2±12.4 kg; B2=79.9±12.8 kg; F2=79.9±12.4 kg; p=.33, ES_{B1-F2}=.03). Contrarily, Appearance Evaluation (B1=2.4±0.6, F1=2.5±0.8, B2=2.6±0.9, F2=2.7±0.8; p=.01; p=.004; ES_{B1-F2}=.52), Fitness Orientation (B1=2.7±.6; F1=3.0±.7; B2=2.9±.5; F2=3.0±.7; p=.013; ES_{B1-F2}=.43), and Health Orientation (B1=3.1±.7; F1=3.4±.6; B2=3.4±.6; F2=3.5±.6; p < .001; ES_{B1-F2}=.65), increased. No changes in the subscales of Body Areas Satisfaction, Overweight Preoccupation and Self-Classified Weight subscales were detected (all p ≥ .05). Change in weight was related to change in both Fitness and Health Orientation (B1 to F2; r=-.50; p=.03; and r=-.54; p=.02; respectively), but it was not related to changes in Appearance Evaluation (r=-.22, p=.37). **CONCLUSIONS:** Our preliminary pilot study suggests that the 11-week weight management intervention attenuated holiday weight gain while positively influencing body image in overweight midlife females.

3065 Board #111 May 31 3:30 PM - 5:00 PM
Association between Quadriceps Strength and Self-Reported Physical Activity in Individuals with Knee Osteoarthritis

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Limited quadriceps strength is common with knee osteoarthritis (OA) and may lead to activity avoidance and low physical activity (PA) levels. **PURPOSE:** To investigate the association between quadriceps strength and self-reported PA in individuals with knee OA. Secondary analyses evaluated the association between a change (Δ) in quadriceps strength and self-reported PA following a 4-week physical therapy intervention designed to improve lower extremity strength. **METHODS:** Ninety individuals with radiographic knee OA were enrolled in the current study (43% male; Kellgren-Lawrence grade: 2-4). Assessments occurred at baseline, post intervention, and 4 weeks after intervention completion. At each testing visit, participants completed the Physical Activity Scale for the Elderly (PASE), the Western Ontario and McMaster Universities Arthritis Index pain subscale, and a quadriceps maximal voluntary isometric contraction (MVIC) performed at 70° of knee flexion measured with an isokinetic dynamometer. Multiple regression analyses were conducted to assess the association between MVIC normalized to body mass (nMVIC - predictor variable) and PASE after accounting for age, body mass index, radiographic OA severity, and pain. **RESULTS:** For all participants at baseline, there was a significant association between greater nMVIC and greater PASE ($\Delta R^2=0.049$, $p=0.033$) after accounting for covariates. When stratified by sex, nMVIC was not associated with PASE (Males: $\Delta R^2=0.045$, $p=0.197$; Females: $\Delta R^2=0.011$, $p=0.432$). There was no association between the Δ nMVIC and Δ PASE following the intervention (Total: $\Delta R^2=0.043$, $p=0.072$; Males: $\Delta R^2=0.071$, $p=0.106$; Females $\Delta R^2=0.008$, $p=0.585$), or

4 weeks post intervention (Total: $\Delta R^2=0.001$, $p=0.845$; Males: $\Delta R^2=0.009$, $p=0.629$; Females: $\Delta R^2=0.002$, $p=0.773$). **CONCLUSIONS:** Although greater quadriceps strength was associated with greater self-reported PA, nMVIC only explained 4.9% of the variance in PASE. Post intervention, a change in strength was not associated with a change in PA. Therapeutic interventions aimed at increasing strength may not lead to a subsequent increase in PA. Future studies should investigate the influence of interventions incorporating PA and strength on health and physical function in individuals with knee OA.

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3066 Board #112 May 31 3:30 PM - 5:00 PM
Effect Of Hiit On Bmd And Body Composition For College Female Students With Eating Disorder

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(No relevant relationships reported)

Purpose: To study the effect of high intensity interval training (HIIT) on bone mineral density (BMD) and body composition for college female students with high risk of eating disorder for improvement of physical status. **Methods:** A total of 97 female college students (20.40 yrs) were invited to join the EDI-3 estimate, and 23 of them were judged to have high risk of eating disorder. The 23 students were randomly divided into two groups, the HIIT group (n=12) and the control group (n=11). The HIIT group performed 12 weeks HIIT program particularly designed for them: vehemently pedaling bike for 30 seconds and then resting for 10 seconds, repeating the circle for three times. The training was carried out every other day during the 12 weeks. In contrast, no intervening was taken for the control group during the 12 weeks. Before and after 12 weeks, BMD of total body of all subjects was detected by DEXA, and body composition was measured by BIA. **Results:** 12 weeks later, (1) the BMD of the HIIT group increased significantly ($p<0.05$), from 1.897±0.097 to 1.928±0.126 for the head, from 1.778±0.060 to 1.800±0.065 for the trunk, and from 1.943±0.066 to 1.962±0.128 for the legs. The total body showed a very significant increase ($p<0.01$), from 1.926±0.058 to 1.968±0.107 g/cm². (2) Their averaged weigh was increased from 58.863±6.698 to 60.463±6.651, muscle mass was increased from 38.650±3.144 to 39.125±2.92, and BMI also varied obviously ($p<0.05$). Moreover, the basal metabolism was increased from 1259.375±72.018 to 1269.50±66.345 for the training group students. However, fat mass had no change ($P>0.05$). **Conclusions:** 12 weeks HIIT for female college students with high risk of eating disorder could make their BMD and body composition to improve obviously.

3067 Board #113 May 31 3:30 PM - 5:00 PM
Impact Versus Resistance Training For Bone In Young Women: Preliminary Findings Of The OPTIMA-Ex Trial

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(No relevant relationships reported)

PURPOSE: The OPTIMA-Ex (Osteoporosis Prevention Through Impact and Muscle-loading Approaches to Exercise) trial aims to compare bone responses to two known osteogenic stimuli - impact exercise and resistance training in young women with lower than average bone mass.

METHODS: The trial is a three-arm, single-blind, single-centre, randomised controlled exercise intervention targeting healthy but sedentary women aged 18-30 years with lower than average bone mass (T-score ≤ 0). Participants were randomised to a 10 month, twice-weekly, either supervised high intensity impact training (IT), high intensity resistance training (RT) or home-based low intensity exercise (active control) (CON). Preliminary DXA (Medix DR) outcomes for lumbar spine (LS), dominant (D) and non-dominant (ND) femoral neck (FN); D and ND distal 1/3 radius (RAD) areal bone mineral density (aBMD) have been examined per-protocol, using repeated-measures ANCOVA adjusted for compliance, age, height, weight, total lifetime physical activity, dietary calcium and baseline values. DXA results are reported as mean difference ± SE, statistical significance set at $p \leq 0.05$.

RESULTS: A total of 51 women (age=22.2±3.6 years; height=1.64±0.62 m; weight=58.1±8.7 kg) have been randomised (IT=17, RT=17, CON=17) with no between-group differences at baseline. Follow-up data is available for 22 participants (IT=6, RT=8, CON=8). Compliance currently differs between groups (IT=66.5±17.2%, RT=67.3±12.3%, CON=87.5±13.7%; $p=0.011$). There are no between-group differences in aBMD at any site. However, there are significant within-group differences in our primary outcome of LS aBMD for both IT (0.046±0.020 g/cm²; $p=0.044$) and RT (0.049±0.018 g/cm²; $p=0.019$). Additional within-group differences are present for ND FN (0.031±0.012 g/cm²; $p=0.027$) and ND RAD (0.047±0.020 g/cm²; $p=0.036$) aBMD for RT. A significant within-group difference is evident for ND (0.057±0.023 g/cm²; $p=0.027$) and D (0.061±0.024 g/cm²; $p=0.029$) RAD aBMD for CON.

CONCLUSIONS:

Although minimal statistical power limits the conclusions that can be drawn from these preliminary data, results indicate both RT and IT improve spine bone mass, while RT may provide a broader osteogenic stimulus in young adult women with lower than average bone mass. Data collection is ongoing.

3068 Board #114 May 31 3:30 PM - 5:00 PM

The Feasibility and Efficacy of a Behavioral Intervention to Promote Appropriate Gestational Weight Gain

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Nearly half of all women gain above gestational weight gain (GWG) recommendations and physical activity (PA) has been shown to decline during pregnancy. Much work remains in understanding how to promote appropriate GWG and PA during pregnancy.

PURPOSE: This study assessed the feasibility and efficacy of a pilot behavioral intervention on GWG and PA behaviors. **METHODS:** Women ($n=45$) 14-20 weeks gestation enrolled in a behavioral intervention. Physicians 'prescribed' the intervention to low risk patients. The intervention included self-monitoring, support, and optional walking groups. Process evaluation measures regarding usage and acceptability of study components were obtained. PA was objectively measured at baseline and 35 weeks. The percentage of participants with appropriate GWG was calculated. Control data was obtained from the same clinic where participants were recruited. **RESULTS:** Overall, the intervention was acceptable to participants; attrition was low (6.7%), weekly contact was high (87%), and self-monitoring was high (Fitbit worn on 82% of intervention weeks; weekly weighing on 81%). Facebook (40% of weeks) and study website use (19%) was low, as was walking group attendance (7% attended a single group). Participants reported a lack of discussions about the study with their physician. Results showed no significant difference between intervention and control participants in the percentage who gained excess weight ($p=0.37$). There was a significant decrease in moderate-to-vigorous PA in intervention participants ($p<0.0001$). **CONCLUSION:** Continued efforts for promoting PA and appropriate GWG are needed. Although acceptable, the intervention was not efficacious. Future intervention research should consider/report feasibility and acceptability indices through process evaluation. Trainings for, or input from, prenatal healthcare providers on how to best encourage and support patients' engagement in healthy behaviors, such as PA, are warranted.

3069 Board #115 May 31 3:30 PM - 5:00 PM
Blood Lipid Profile Differences After a 12-Month Sit-to-Stand Workstation Intervention

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(No relevant relationships reported)

A reduction in sedentary behavior has been associated with improvements in metabolic health. Because a disproportionate number of working hours for office-based employees are spent engaged in sedentary behavior, an increase in workplace activity is substantiated. **PURPOSE:** The purpose of this study was to determine if the use of a sit-to-stand workstation (STS) effected blood lipid profiles following a 12-month intervention. **METHODS:** Participants of the study included volunteer faculty and staff of the University of Central Oklahoma who were randomly assigned to a control group (CG) or an intervention group (IG). A STS was provided to the IG with participants being instructed to stand at least 2 hours every work day. Blood lipid profiles were used to measure high-density lipoprotein cholesterol (HDL), low-density lipoprotein cholesterol (LDL), total cholesterol (TC), and blood glucose (BG) at baseline, 6, and 12-months of the intervention. The data was analyzed using a repeated-measures ANOVA. **RESULTS:** No significant differences were found between groups ($p>.05$). Small, non-significant improvements occurred for the IG in HDL and LDL over time and a significant change in BG across all groups took place over time ($F_{2,23}=8.05, p=.00$). Descriptive statistics can be found in Table 1. One outlier was removed from analysis. **CONCLUSION:** Significant differences did not occur between STS participants and those using a typical workstation; however, some benefits may be gained from breaking up bouts of sedentary behavior. Future research may examine the effects of longer standing time to ascertain the efficacy of the STS. Table 1

Blood Lipid Profile Statistics at Baseline, 6 months, and 12 months

	Intervention Group		Control Group	
	<i>n</i>	<i>M (SD)</i>	<i>n</i>	<i>M (SD)</i>
HDL pre (mg/dL)	13	60.54 (19.84)	11	58.64 (16.33)
HDL 6 months (mg/dL)	13	58.54 (17.13)	11	58.55 (15.69)
HDL 12 months (mg/dL)	13	60.69 (18.03)	11	63.27 (16.47)
LDL pre (mg/dL)	12	104.50 (46.25)	9	97.00 (20.06)
LDL 6 months (mg/dL)	12	105.67 (36.89)	9	96.78 (29.88)
LDL 12 months (mg/dL)	12	104.25 (46.38)	9	93.22 (35.35)
TC pre (mg/dL)	15	175.91 (24.08)	11	175.91 (24.08)
TC 6 months (mg/dL)	15	182.29 (36.95)	11	180.00 (26.26)
TC 12 months (mg/dL)	15	187.07 (39.53)	11	191.91 (23.91)
BG pre (mg/dL)	14	95.73 (8.66)	11	90.73 (10.08)
BG 6 months (mg/dL)	14	89.53 (5.88)	11	85.82 (12.05)
BG 12 months (mg/dL)	14	91.53 (11.51)	11	89.00 (11.22)

Note: M=mean, SD=standard deviation, n=population

3070 Board #116 May 31 3:30 PM - 5:00 PM
Effects of a Brief Lifestyle Intervention for Office Workers

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(No relevant relationships reported)

PURPOSE: Our study assessed the impact of a brief lifestyle intervention (LI) using a novel fitness application on body composition and fitness in office workers. **METHODS:** Insufficiently active office workers ($n = 22$) participated in a four-week randomized pilot trial. Individuals were randomized to either information-only control (CON; $n = 10$, age = 34.3 ± 14.6 years, 63.6% female, 80% white) or intervention (LI; $n = 12$, age = 37.6 ± 14.8 years, 91.7% female, 100% white) groups. CON was provided access to online physical activity and nutrition information with short assessments. LI was trained in-person on a mobile fitness application, that provided short (~2 minutes) daily workouts, alternating muscle groups each day; daily logging of waist circumference, and a tracking system for "treats" (i.e., high sugar/starch foods). In person measures were conducted pre- and post-intervention. Anthropometric measures included height, weight, body fat percentage, and waist circumference (WC). Fitness was measured via handgrip dynamometry (strength), sit-and-reach (flexibility), and 30-second chair stand test (muscular endurance). Independent-samples t-tests were used to examine group differences on baseline characteristics. Both within-group (paired-samples t-tests) and between-group (ANCOVA with baseline scores as covariate) changes scores were analyzed. **RESULTS:** No significant baseline differences were found between groups. Significant changes were found for LI on WC (mean $\Delta = -3.2 \pm 4.3$ cm; $t = 2.57, p < 0.05$), chair stand (mean $\Delta = 4.9 \pm 4.8$ repetitions; $t = 3.52, p < 0.01$), and flexibility (mean $\Delta = 2.9 \pm 3.6$ cm; $t = 2.84, p < 0.05$). Significant changes were found for CON for chair stand (mean $\Delta = 2.9 \pm 3.1$ repetitions; $t = 2.92, p < 0.05$). No significant between group differences were found for change scores. **CONCLUSION:** Our data suggest the novel fitness application could be a viable option to improve body composition and fitness among insufficiently active office workers. Future investigations should aim to validate our pilot study with larger sample sizes and consider additional measures of health and fitness.

3071 Board #117 May 31 3:30 PM - 5:00 PM
Muscle Damage and Inflammatory Response from Volume-Equated Resistance Exercise with Short vs Long Rest Interval

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(No relevant relationships reported)

Resistance exercise is considered the most efficient method for the improvement of muscular strength, power and endurance. However, it is not possible to explain in their entirety the mechanisms that bring the benefits of neuromuscular fitness levels. **PURPOSE:** The aim was to analyze the effects of rest period length between resistance exercise (RE) sets on inflammatory response (cytokines and leukocyte)

and muscle tissue damage. **METHODS:** Ten trained men with at least one year of consistent resistance training experience were selected to participate (26.40 ± 4.73 years, 80.71 ± 8.95 kg, 176.03 ± 6.11 cm, $9.86 \pm 3.25\%$ body fat, bench press relative strength: 1.27 ± 0.27 kg/kg-1 of body mass) and to perform two workouts sessions separated by one week. Each session consisted of five sets of 10 repetitions performed at 85% of 10 repetition maximum on barbell bench press followed by the leg press exercise, with either 1- or 3-minute of rest between sets. Circulating concentrations of creatine kinase (CK), lactate dehydrogenase (LDH), Interleukin 6 (IL-6), and tumoral necrosis factor alfa (TNF- α), were measured at pre-exercise (Pre), and post 3h (except for IL-6), 6h, 12h and 24h. The rate of perceived exertion (RPE) was recorded after each set on both visits. **RESULTS:** After the statistical analysis, we found increases triggered by the 1-minute of rest period length in CK main-effect for time-points ($p = 0.0001$) and rest conditions ($p = 0.0014$), occurring in from 6h to 24h post-exercise compared with the Pre-exercise. For CK the AUC did differ ($p = 0.0005$) between the 1-minute (4572.4 ± 1169.5 u/L.h⁻¹) and 3-minute (3330.1 ± 715.9 u/L.h⁻¹) rest conditions. In addition, we observed an increase in TNF- α for different time-points, mainly in 6h and 12h. Similarly, increases in IL-6 were observed for all post-exercise time-points (6h, 12h and 24h) compared to Pre-exercise data. For the RPE, the short rest period length demonstrated significant increases compared to the longer rest condition (SH, $p < 0.001$; LP, $p < 0.001$). **CONCLUSION:** The short rest condition promoted a greater overall damage of muscle tissue with a longer duration of the inflammatory process of this tissue. Supported by CAPES Brazil: 2.034.476.

3072 Board #118 May 31 3:30 PM - 5:00 PM
Exergaming Intervention in Sedentary Middle-Aged Adults Improves Cardiovascular Endurance, Balance and Lower Extremity Functional Fitness

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(No relevant relationships reported)

BACKGROUND: Interactive video game technology has been extensively utilized in rehabilitative settings. However, few studies have explored the potential benefits of interactive video games as an exercise instrument for middle-aged adults who do not have a gym membership or who otherwise cannot regularly make it to their local fitness center. Features of interactive "exergaming" (modeling proper exercise biomechanics, increasing self-monitoring of behavior, encouraging participants to set health-related goals, and rewarding regular use) may help promote physical activity and consequently improve balance, cardiovascular endurance and functional fitness. **PURPOSE:** To compare balance, cardiovascular health and functional fitness in relation to exercise tests in sedentary adults before and after exergaming ($n = 12$, 56+4 yrs, 162.1+10.9 cm, 79.2+19.1 kg, 39.6+7.7% fat mass). **METHODS:** Subjects initially underwent balance, cardiovascular endurance and functional fitness tests before engaging in exergaming for 20 min/3d/wk. After 8 weeks, balance, cardiovascular health and functional fitness were retested. **RESULTS:** Exergaming improved Single-Leg-Stand time (3.2 ± 0.4 s to 7.9 ± 1.4 s, $p < 0.05$), Sit-To-Stand repetitions (14.2 ± 1.7 to 16.8 ± 1.3 , $p < 0.05$) and YMCA 3-Minute Step Test heart rate recovery (103 ± 7.9 to 95 ± 3.2 , $p < 0.05$) while eliciting an habitual voluntary moderate-intensity exercise level in previously sedentary individuals. **CONCLUSIONS:** Exergaming increased cardiovascular endurance, balance and lower extremity functional fitness while meeting American College of Sports Medicine guidelines for moderate-intensity exercise. Exergaming should be considered a viable option for home exercise programs to meet ACSM physical activity recommendations and improve overall quality of life.

3073 Board #119 May 31 3:30 PM - 5:00 PM
Effects Of Yoga And Tai Chi On Mental Health, Pain, And Balance In College Students

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Psychological disorders affect up to 50% of college students. Mind-body exercises such as tai chi and yoga have been effective for decreasing mental distress and pain and improving balance, but little is known about these outcomes in the college-aged population.

Purpose: This primary aim of this study was to determine the effectiveness of yoga and tai chi on mental health, pain, and balance in college students. **Methods:** Participants included 46 undergraduate students (13 males, 33 females; age: $M = 23.9$ years, $SD = 7.4$) enrolled in a yoga class (15), tai chi class (16), or a lecture class for the control group (15). Measures of depression, anxiety, stress, pain, and balance were administrated at baseline (before the classes began) and at the middle (7 weeks) and end of the semester (14 weeks). A repeated-measures ANOVA was used with time

(baseline, mid, end) and Group (yoga, tai chi, control) to examine the effects of the interventions. In addition, focus group interviews were conducted at the end of study. **Results:** At baseline, the yoga group had higher anxiety and depression scores than the tai chi group. No other differences were apparent at baseline. Over time, yoga group showed decreased anxiety and depression from baseline to 14 weeks, and in depression from baseline to 7 weeks. Though no other significant differences were noted, there was a pattern of decreasing means across all measures of mental health and pain and improvement in balance in the yoga and tai chi groups. Additionally, focus group findings revealed students favored yoga over tai chi. Tai chi benefits included brief distraction from school and possibly improved sleep but was found to be boring and at times more stressful due to time being taken away from academic work and with learning the sequential steps. Yoga was the "bright spot" in the week and more students felt it decreased stress, minimized potential for anxiety attacks, served as a disconnect from the external world, improved pain and mobility and served as a way to connect with friends. **Conclusion:** The preliminary results suggest that implementation of yoga is acceptable and feasible in college students and has the potential of playing a protective or preventive role in promoting mental health.

3074 Board #120 May 31 3:30 PM - 5:00 PM
The Impact of Text Messaging on Baccalaureate Nursing Students' Physical Activity: Single Case Design

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PURPOSE: Find the effect of text messaging on physical activity (PA), physical fitness (PF), and physical activity self-efficacy (PASE) of nursing students.

METHODS: A single-case design, concurrent 4-randomized baselines across subjects, and an 8-week text-messaging intervention were used. Participants (Ps) were selected based on results from PA health risk factors, the International Physical Activity Questionnaire (IPAQ), the Physical Activity Appraisal Inventory-Adolescence and Young Adult Version (PAAI). Selected Ps had high or low PA and PASE, and low or moderate PA health risk. Ps (P1-P5: 1 male, 4 female, mean age = 21) were randomized to 5, 7, 10, or 13 day baselines (BL) and completed 3 or 4 BL PF tests and 4 PF retests in week 2 (W2), 4 (W4), 6 (W6), 8 (W8) of intervention. PF tests were resting and post-walk HR and BP, weight, height, BMI, waist-hip ratio (WHR), hand grip strength, VO_2 max from the treadmill 6-minute walk test (T6MWT). PA and PASE were measured by the IPAQ and PAAI at W4 and W8 of intervention. All Ps wore pedometers to measure objective PA throughout the intervention. The 2-SD-band method was used to compare BL data with W2, W4, W6, and W8 data. **RESULTS:** Self-reported PA increased from BL in P2, P3, P4, and P5 by 9.5, 2.9, 11, and 7.8 hrs, respectively. Statistically significant increases were noted in PF in 4 Ps. P1: Resting HR (BL-W6-W8 $\downarrow 9.3$ b/min); Resting SBP (BL-W6-W8 $\downarrow 8$ mmHg); WHR (BL-W6-W8 $\downarrow 4\%$), post-walk SBP (BL-W4-W6-W8 $\downarrow 16.7$ mmHg), distance traveled in T6MWT (BL-W4-W6-W8 $\uparrow 53.7$ m), VO_2 max (BL-W6-W8 $\uparrow 1.7$ mL/kg-min). P2: resting SBP (BL-W2-W6-W8 $\downarrow 9$ mmHg); WHR (BL-W6-W8 $\downarrow 0.04$); post-walk HR (BL-W2-W4-W6-W8 $\downarrow 6.8$ b/min), post-walk SBP (BL-W2-W6-W8 $\downarrow 22.5$ mmHg). P4: resting HR (BL-W6-W8 $\downarrow 5.8$ b/min); weight (BL-W6-W8 $\downarrow 0.5$ kg); post-walk -SBP (BL-W6-W8 $\downarrow 25.3$ mmHg). P5: WHR (BL-W2-W6-W8 $\downarrow 0.03$); post-walk HR (BL-W2-W4-W6-W8 $\uparrow 23.8$ b/min), post-walk SBP (BL-W4-W6-W8 $\uparrow 19.4$ mmHg); distance traveled in T6MWT (BL-W2-W4-W6-W8 $\uparrow 53.7$ m). PASE increased from BL in P1, P2, P3, and P5: 40, 100, 360, 710, respectively. **CONCLUSIONS:** The results suggested that text-messaging may be effective in increasing nursing students' PA, PF, and PASE.

3075 Board #121 May 31 3:30 PM - 5:00 PM
Effects Of Sit-to-stand Desk And Treadmill Workstations On Sedentary Behavior And Physical Activity

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(No relevant relationships reported)

Purpose: To compare the efficacies of treadmill and sit-to-stand workstations in decreasing daily sedentary behavior (SED) during a 12-month, cluster-randomized trial with an intent to treat design in sedentary overweight office workers. **Methods:** Sixty-six office workers (7 male, 59 female, age \pm SD = 45.3 ± 12.3 y, BMI \pm SD = 32.5 ± 5.7 kg/m²) were cluster randomized to one of 3 groups: (i) seated desk control (C) (N=21), (ii) sit-to-stand desk (D) (N=23), or (iii) treadmill desk (T) (N=22). Change in mean daily SED, standing and stepping time were measured using activPAL™ accelerometers adhered to the dominant thigh at baseline (B), month-3 (M3), month-6 (M6) and month-12 (M12). Inclusion in analyses required ≥ 4 valid accelerometer wear days (i.e., ≥ 10 h. of wake wear time). Missing mean daily SED, standing and stepping

hours were imputed using multiple-imputation. Between and within group differences in mean daily wake-time spent SED, standing, and stepping after M3, M6 and M12 were analyzed with random intercept mixed linear models accounting for repeated measures and clustering effects. Bonferroni corrections were used during pairwise post-hoc comparisons to correct for multiple hypotheses testing. **Results:** Mean monitoring time (i.e., mean sensor wear days and daily time) did not significantly vary between or within groups. There were no significant within group changes in mean daily SED time. Mean daily standing time significantly increased in group D from B to M3 (Mean \pm SD = 1.03 \pm 2.24 h [7.72%], $p = 0.03$, Cohen's D = 0.46), which was sustained through M12. Similarly, group T increased mean standing time from B to M3 (Mean \pm SD = 1.23 \pm 2.56 h [13.28%], $p = 0.025$, Cohen's D = 0.48), but these increases were negated at M12. Mean daily stepping time increased significantly in group D from B to M12 (Mean \pm SD = 0.81 \pm 1.61 h [2.65%], $p = 0.019$, Cohen's D = 0.50). No significant between group differences in SED, standing or stepping time were observed at M3, M6, or M12. **Conclusion:** Workstation-based workplace interventions may result in moderate short-term daily reductions in SED and increased physical activity among seated office workers. Sustaining these short-term behavioral improvements may not be achievable through passive environmental modifications alone, and may require additional active behavior change strategies.

3076 Board #122 May 31 3:30 PM - 5:00 PM
Impact Of 12 Week Pedometer Based Interventionson Long Termincrease In Physical Activity Inpreviously Sedentary Adults

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(No relevant relationships reported)

PURPOSE: Sedentary life style increases the risk of cardiovascular disease. In previous studies we have demonstrated that 12 week pedometer based interventions aimed at increasing physical activity by 10% each week to achieve a goal of 10,000 steps/day resulted in increase in moderate physical activity (MPA) among sedentary adults at the end of 12 weeks. We wanted to study if this increase in MPA has been sustained in the long term in these adults.

METHODS: A total of 55 adults aged > 50 years were randomized to be in three groups. Group 1 with no intervention, Group 2 received pedometer only and Group 3 with pedometer plus interactive motivational website which provides strategies to increase their physical activity by 10% each week for 12 weeks. A 7 day log of duration and intensity of physical activity using an accelerometer (Actigraph GTX3) were obtained in all the three groups at baseline, 12 and 52 weeks. Data was analyzed with repeated measures ANOVA including group, time, and interaction between group and time was conducted to account for repeated measurements over three time points. False discovery rate control under dependency of Benjamin and Yekutieli was employed to adjust for dependent multiple tests

RESULTS: There is no significant change in physical activity at the end of 12 weeks or 52 weeks in the control group. There is a statistically significant increase in amount of time spent in MPA, and amount of time spent in bouts (10 minutes of MPA) at the end of 12 weeks compared to baseline in Pedometer and pedometer + website group. These gains were however not seen at the end of 52 weeks with the exception of physical activity in bouts. There is statistically significant increase in the physical activity in bouts at the end of 12 and also at 52 weeks compared to baseline in both pedometer and pedometer +website groups.

CONCLUSIONS:

12 week pedometer based interventions have shown long term increase activity in physical activity in bouts at the end of 52 weeks.

3077 Board #123 May 31 3:30 PM - 5:00 PM
Barefoot Running As A Treatment For Plantar Fasciitis In The Runner: A Case Series

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PURPOSE: Plantar fasciitis is the most common running related injury associated with the foot and represents ~8% of all running injuries. The median recovery time for plantar fasciitis is ~5-months. Following the failure of conservative management for a female runner with plantar fasciitis, we trialled an alternate day treatment strategy of barefoot running on a grass surface (10 - 15 minutes). This approach was successful and was published as a medical case report. This abstract aims to describe the results of an emerging case series (n=4) using a similar approach. **METHODS:** Four amateur runners (2 male, 2 female, age 27-45 years) were diagnosed as having plantar fasciitis. In all cases, the failure of conservative management led to them being prescribed a

barefoot running intervention on grass. Patients were instructed to complete 10-15 minutes (dependent on pain tolerance) of barefoot running every second day and record pain scores using the visual analog scale (VAS) every morning. **RESULTS:** Mean pain intensity (scored out of 10) at the beginning of the intervention was 5.4 \pm 1.5 (range 3.5 - 7). After 6 sessions of barefoot running, mean pain intensity had reduced to 2.0 \pm 1.6 (range 2.0 - 4.0). All patients demonstrated an improvement in pain intensity after 4-sessions. Three patients sustained this improvement up to session 6 and one patient reverted to their original pain score (4). The two female patients demonstrated an immediate and sustained reduction in pain. The two male patients initially remained unchanged or increased pain intensity before improving.

DISCUSSION: The results of this emerging case series suggest that this intervention is at least well tolerated in runners with chronic plantar fasciitis. The fact that the intervention contains the activity known to worsen symptoms may suggest this approach has some promise. However, it is not possible to infer cause and effect from a case series and the improvements shown in this series may be due to other factors such as the passage of time or a reduction in fear avoidance behaviour.

3078 Board #124 May 31 3:30 PM - 5:00 PM

Aquatic High Intensity Interval Training Improves Cardiorespiratory Fitness of Sedentary Adults

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PURPOSE: The purpose of this study was to determine the effects of five weeks of aquatic high intensity interval training (HIIT) on cardiorespiratory fitness and body composition in sedentary young adults. **METHODS:** Eleven participants [9 female (20.0 \pm 0.71 yr), 2 male (23.5 \pm 2.12 yrs)] completed 18 sessions: A) a pre-program testing session; B) a familiarization session; C) 15 exercise sessions; and D) a post-program testing session. The participants completed 3 sessions per week for 5 weeks. Each session consisted of a 5-minute warm-up, 25 minutes of exercise, and a 5-minute cool down. The exercise portion consisted of 25 exercise intervals lasting 10-30 seconds and used combinations of 8-12 different exercises. Twenty-two standard aquatic upper body, lower body, and full body aerobic exercises, most of which utilized aquatic dumbbells or hand paddles, were used in an HIIT protocol during each exercise session. The HIIT intervals during the first week were 10 seconds and increased by 5 seconds each week ending with 30-second HIIT durations during the fifth week. The active recovery intervals were 50 seconds during the first week and decreased by 5 seconds each week ending with 30-second recovery durations during the fifth week. **RESULTS:** Significant improvements in body composition, submaximal and peak heart rate, submaximal VO_2 , and peak VO_2 occurred from pre- to post-program. **CONCLUSION:** To our knowledge, this is the first study to evaluate the effectiveness of standard aquatic aerobic exercises in a HIIT protocol. Improvements in cardiorespiratory fitness and exercise economy were observed in sedentary individuals. This form of exercise may be more tolerated in obese individuals or patients with physical limitations for land-based exercise.

Table 1. Data are mean \pm SD.

Variable	Baseline	5 weeks	p-value
Body Composition (% body fat)	32.55 \pm 5.57	30.55 \pm 6.31	0.004
GXT VO_2 Peak (mL/kg/min)	30.53 \pm 4.38	31.95 \pm 5.08	0.035
GXT Stage 1 VO_2 (mL/kg/min)	15.72 \pm 2.18	14.11 \pm 2.30	0.013
GXT Stage 1 HR (bpm)	138.91 \pm 5.58	136.64 \pm 5.22	<0.001
GXT Stage 2 VO_2 (mL/kg/min)	21.74 \pm 3.11	19.25 \pm 3.50	0.031
GXT Stage 2 HR (bpm)	169.18 \pm 5.72	164.45 \pm 5.56	<0.001
HR Peak (bpm)	198.91 \pm 3.45	192.00 \pm 5.22	<0.001

3079 Board #125 May 31 3:30 PM - 5:00 PM

Active Video Gaming: Appropriate Tool to Improve Fitness in Pediatric Renal Transplant Recipients?

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(No relevant relationships reported)

Renal transplanted children are at increased risk for cardiovascular diseases due to reduced cardiovascular fitness. **PURPOSE:** 1) To evaluate cardiovascular fitness, motor coordination, physical activity and health-related quality of life (HRQL) in pediatric renal transplant recipients and 2) to find out, if active video gaming provides a sufficient stimulus for an improvement in these items. **METHODS:** Twenty renal

transplant recipients (TX, 13.5 ± 3.4 yr; 152.0 ± 21.1 cm; 52.2 ± 20.5 kg) and 33 healthy controls, matched for sex, pubertal stage, regular physical activity and attended school (CON, 13.1 ± 3.2 yr; 157.2 ± 17.7 cm; 49.0 ± 15.9 kg) completed a cycling or treadmill spiroergometry, a motor coordination and a maximal hand grip strength test. HRQL was determined with a validated questionnaire and activity of daily life was recorded as steps per hour with a physical activity monitor. Thirteen patients out of TX (12.9 ± 3.4 yr; 152.1 ± 21.5 cm; 53.8 ± 22.2 kg) participated in a 6-week exercise video game intervention. They were instructed to exercise 3x/week at home and were contacted weekly for adherence. All tests were repeated after the intervention. **RESULTS:** Cardiovascular fitness ($\text{VO}_{2\text{peak}}$: 28.6 ± 7.8 vs. 41.7 ± 8.5 $\text{mL} \cdot \text{min}^{-1} \cdot \text{kg}^{-1}$; $P < 0.001$), motor coordination (MQ_{total} : 59.7 ± 17.5 vs. 105.8 ± 14.9 ; $P < 0.001$), physical activity (steps $\cdot\text{h}^{-1}$: 458 ± 171 vs. 687 ± 280 ; $P = 0.001$) and HRQL (75.0 ± 14.9 vs. 85.2 ± 7.58 ; $P = 0.017$) were significantly reduced in TX compared to CON. Maximal hand grip strength was similar in both groups. After six weeks of exergaming, daily physical activity significantly increased from 481 ± 176.5 to 602 ± 226 steps $\cdot\text{h}^{-1}$ ($P = 0.043$). However, compliance turned out to be low and cardiovascular fitness, motor coordination and HRQL remained unchanged. **CONCLUSION:** Cardiovascular fitness, motor coordination, physical activity and HRQL are markedly reduced in pediatric renal transplant recipients. Despite low compliance, six weeks of active video gaming provided a stimulus for an increase in daily physical activity in these patients, but did not improve fitness.

3080 Board #126 May 31 3:30 PM - 5:00 PM
Effect of Dual-Task Performance Among Young Adults

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Numerous studies have shown that dual-task demands involving exercise lead to a decline in performance on one or both tasks, but the direct effects of exercise intensity and type are less known. **PURPOSE:** To examine the dual-task performance of reaction time while standing or walking or fast-paced walking on a treadmill while completing tasks of varying complexities. **METHODS:** Using within-subject and a repeated measures design a total of 32 participants (Male= 21.03 ± 2.79 ; Female=17) performed six different conditions involving Go/No-Go (GNG) movement tasks while treadmill standing/walking/fast-paced walking (2 task - congruent/incongruent x 3 intensities). Dual-task reaction time was measured during GNG movement task required subjects to strike virtual stimulus that is green while avoiding the red target. The directions were then reversed to create an incongruent condition. All participants performed 3 minutes of each exercise condition on a Motek-instrumented V-gait treadmill integrated with a 180° virtual reality projection screen which created the environment of GNG task. **RESULTS:** A repeated measures ANOVA with a Greenhouse-Geisser correction showed that mean reaction time differed significantly between exercise conditions, $F(3.425, 106.177) = 14.157$, $p < .01$. Post hoc tests using the Bonferroni correction revealed that Go-task while walking condition was faster than Go-task while standing an average of .039 ($p < .01$), NoGo-task while standing an average of .074 ($p < .01$), NoGo-task while fast-paced walking an average of .031 ($p < .01$). There were no significant differences between Go-task while walking, fast-paced walking and NoGo-task while walking. **CONCLUSIONS:** This novel research methodology suggests that walking-induced physiological arousal may lead to improved dual-task performance over a standing position (Schaefer et al., 2010). Further study with group comparison is warranted.

3081 Board #127 May 31 3:30 PM - 5:00 PM
Implementation of Exercise Training Programs in Dialysis Patients

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PURPOSE:

To determine the effect of functional exercise guided by a kinesiologist in addition to the basic exercise program of cycling during dialysis on dialysis treatment adequacy (Kt/V) and physical performance of dialysis patients. **METHODS:** 29 dialysis patients participated in the study. We tested their condition with 6-minutes walking test (6MWT), 10 repetitions sit-to-stand test (STS10), handgrip strength test (HG) and with measurement of their Kt/V. We randomized patients in two groups - one experimental (EXP) and one active control group (CON). The exercise program for both groups was performed three times per week over the course of two months. The EXP group attended a guided functional exercise before the dialysis procedure and after that performed a cycling session during dialysis. CON participated in equal intradialytic exercise program as EXP without prior functional exercise. After two months we repeated the baseline tests. **RESULTS:**

27 patients completed the study. Both groups have a significant increase in 6MWT ((EXP (510.08 ± 68.69 m vs. 561.62 ± 94.98 m; $p=0.002$), CON (456.86 ± 78.86 m vs. 487.07 ± 76.16 m; $p=0.000$)) and in STS10 ((EXP (27.94 ± 5.98 s vs. 17.46 ± 4.52 s; $p=0.000$), CON (31.40 ± 7.80 s vs. 26.13 ± 8.85 s; $p=0.000$)) compared with baseline values. In HG there was a significant difference only in EXP (30.46 ± 8.4 kg vs. 36.00 ± 9.76 kg; $p=0.000$), with no significant difference in CON (baseline: 26.14 ± 4.87 kg vs. 26.79 ± 4.26 kg; $p=0.295$) when comparing with their baseline values. Both groups also increased their Kt/V score. EXP improve their score from 1.49 to 1.65 ($p=0.006$) and CON from 1.59 to 1.81 ($p=0.001$) When comparing both groups, we can see a greater increase in EXP in STS10 ($p=0.004$) and in HR ($p=0.000$) compared to the CON. There were no statistically significant difference between groups in 6MWT ($p=0.053$) and in Kt/V ($p=0.00$). **CONCLUSION:** Both types of exercise are effective in improving aerobic endurance and strength of lower limbs. However we believe that, if we want to improve various motor skills, cycling during dialysis alone is not enough. Our research showed us that functional training led by kinesiologist in dialysis centre is practical, feasible and effective in improving the physical function of hemodialysis patients combined with well established practice of intradialytic cycling.

3082 Board #128 May 31 3:30 PM - 5:00 PM
Maximal Oxygen Uptake Responders Versus Non-responders Show Differing Cognitive Responses to Movement-based Video Game Training

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There is evidence that aerobic exercise training improves cognitive control including working memory, attention, and goal management via improved brain perfusion, exercise-induced neurogenic factors, and structural adaptations. There is also evidence that cognitive training itself has beneficial effects on cognition via plasticity in neural networks and structural adaptations. However, it is unclear if these adaptations are found equally in those who experience increases in maximal aerobic capacity versus those that do not. **PURPOSE:** Determine cognitive adaptations associated with older adults performing 8 weeks of training on a video game (BBT) that combined cognitive and physical training. It was hypothesized that positive cognitive adaptations would be greater in participants increased maximal aerobic capacity as compared those who did not. It was also hypothesized that participants would show an improvement in cognitive function after the intervention regardless of whether maximal aerobic capacity improved or not. **METHODS:** Fifteen lightly active older (67.6 ± 4.4 yrs) participants completed 8 weeks of training, 3 days per week (24 sessions total) on BBT. Physical task difficulty was adaptive in the game based on real-time heart rate measurements. Cognitive task difficulty was adaptive and included task switching, selective attention and working memory challenges. Participants were assigned to either a maximal aerobic capacity responder group (Responders) who increased $\text{VO}_2 \text{max}$ ($n=7$) or a non-responder group (Non-Responders) that did not increase $\text{VO}_2 \text{max}$ ($n=8$). Cognitive assessments included behavioral and neural measures of working memory, sustained attention and goal management. **RESULTS:** Analysis of Covariance (ANCOVA) did not reveal any differences in post-test cognitive variables between Responders and Non-responders. However, when groups were combined, Paired T-Tests showed improvements in the following cognitive variables: Reaction Time Variability in working memory tasks ($p < .05$) and Impulsivity in attention-based tasks ($p < .05$). **CONCLUSION:** Participants who increased maximal aerobic capacity did not experience greater improvements in cognitive control variables as compared to participants who did not. However, the group as a whole did improve measures of cognition.

3083 Board #129 May 31 3:30 PM - 5:00 PM
Sex Differences In The Acute Effect Of Stair-climbing On Postprandial Blood Glucose Levels

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PURPOSE: To examine sex differences in postprandial glucose (PPG) during moderate intensity stair climbing of various durations following consumption of a mixed meal. The PPG response is strongly associated with cardiometabolic disease risk and women remain understudied in biomedical science. **METHODS:** Five males (24.0 ± 3.9 y) and nine females (23.7 ± 2.7 y) consumed a mixed meal containing 675 kcal (33% fat, 53% carbohydrate, 14% protein) and glucose levels were monitored for 1 hour. On three subsequent visits, participants consumed an

identical meal combined with either 1min, 3min, or 10min of stair-climbing, all ending 28 min after subjects finished the meal. Fingerstick blood glucose measurements were taken at baseline and every fifteen minutes thereafter for one hour.

RESULTS: All results were normalized for body weight. There was no difference in post-exercise PPG at 30min for any of the trials in men (Δ -0.05 \pm 0.12 to 0.28 \pm .23mg/dL/kg, p =0.69 to 0.29). In women there was a significant difference in post-exercise PPG at 30min for the 10min trial (Δ -0.537 \pm 0.074mg/dL/kg, p <0.001) but not for the 1min or 3min trials. There was no difference in glucose area under the curve (AUC) or incremental area under the curve (iAUC) for any of the trials in men (Δ -2.22 \pm 4.39 to 5.32 \pm 5.68 mg/dL/kg/min, p =0.64 to 0.40 and Δ -0.86 \pm 2.749 to 5.70 \pm 7.76 mg/dL/kg/min, p =0.77 to 0.38). In women there was a significant difference in AUC for the and iAUC for the 10min trial (Δ -11.45 \pm 2.22mg/dL/kg/min, p <0.001 and Δ -10.51 \pm 2.99mg/dL/kg/min, p <0.01) but not for the 1min or 3min trials. No interaction was seen between trial and sex for post-exercise PPG at 30min (p =0.65, η_p^2 =0.15), AUC (p =0.70, η_p^2 =0.13), or iAUC (p =0.80, η_p^2 =0.09).

CONCLUSIONS: Men and women showed a similar responses in PPG following moderate intensity stairclimbing of various durations.

3084 Board #130 May 31 3:30 PM - 5:00 PM
Club Fit!: A Physical Activity, Education, and Mentoring Service Learning Program

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INTRO: In the United States, obesity affects about 12.7 million children and adolescents, with minority and low-income populations at an increased risk. Development of a positive association and regular engagement in physical activity at a young age promotes the transition of these habits into adulthood. School-based physical activity programs benefit communities as well as students and schools. The implementation of a physical activity based service learning program provides a mutually beneficial partnership between pre-service teachers and the elementary students. **PURPOSE:** The purpose of this study was to determine the effect of a 9-week fitness intervention and education program for under-served 5th grade students. **METHODS:** Club Fit! consists of a 9-week program with bi-weekly 60-minute exercise sessions. Physical Education Teacher Education pre-service teachers (n =21) served as mentors to 5th grade students (n =35) enrolled at a local elementary school. The pre-service teacher/mentor to student/mentee ratio was 1:1 - 1:2. Pre-service teachers alternated leading lessons focused on health and skill-related physical fitness components, such as paddle tennis, yoga, jumping rope, and locomotor skills. Basic educational concepts from the components of physical fitness were incorporated, including comparing heart rate before and after activity and distinguishing between muscular strength and endurance. Each session concluded with journal questions reflective of the day's concepts and activities. Prior to the program, pre-service teachers trained to use the FitnessGram assessment protocols and Healthy Fitness Zone standards (HFZ). Four FitnessGram Performance Standards were assessed pre- and post-program: Back Saver Sit and Reach, One Mile Run, Curl-Ups, and Push-Ups. Paired t-tests were used to assess the pre and post values for all four FitnessGram Performance Standards. **RESULTS:** Students improved performance in all measured FitnessGram components: Back Saver Sit and Reach (Left: p =0.00922=, Right: p =0.00319); One Mile Run (p =2.279E-7); Curl-Ups (p =0.000261); Push-Ups (p =0.00159). **CONCLUSION:** Students improved in all four FitnessGram components and HFZ standards were met for all comparable components. The fitness intervention increased levels of health-related fitness.

3085 Board #131 May 31 3:30 PM - 5:00 PM
The Effect of Multimodal Training on Mobility in MCI Patients: A Pilot Randomized Controlled Trial

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Due a growing number of new cases of dementia and the lack of pharmacological treatment for prodromal stages of dementia, the study of non-pharmacological interventions becomes more necessary. Although Mild Cognitive Impairments (MCI) patients begins to show mobility decreases, especially in dual-task (DT), some studies exams if the physical exercises can improve this deficit. **PURPOSE:** To investigate the effect of multimodal training (MT) on mobility in single task (ST) and DT in elderly with MCI. **METHODS:** Fifteen MCI patients, aged \geq 60 years-old, participated in this pilot randomized controlled trial. At baseline, patients were submitted to three visits: (1) anthropometric measurements, anamnesis and neuropsychological tests; (2) cardiovascular test on treadmill; (3) mobility tests: 8-foot up and go (8UG) in ST and DT (motor and cognitive tasks). Ten participants were randomized and allocated

to an experimental group (EG = 5), with multimodal physical training, including aerobic exercises, strength, balance and stretching; or in a control group (CG = 5). After three months of intervention, both groups were reevaluated. An independent t-test and effect size (ES) analysis were performed through the deltas (post-pre) of the groups. **RESULTS:** The EG presented improvements in general mobility (SMD=0.71 [moderate], 95%CI=0.06, 1.37) and in all mobility tests compared to the CG (TS 8UG: SMD=0.62 [moderate], 95%CI=0.65, 1.90; coefficient of variability (CoV) 8UG: SMD=0.14 [trivial], 95%CI=-1.10, 1.38; DT 8UG: SMD=1.12 [large], 95%CI=0.23, 2.48; cost of DT (CDT) 8UG: SMD=1.09 [large], 95%CI=0.26, 2.44). **CONCLUSION:** MT has a positive effect on mobility in elderly patients with MCI, mainly in DT, contributing to the preservation of functional mobility in this group. Supported by CNPq (301483/2016-7) and FAPERJ (E-26/ 203.193/2016).

3086 Board #132 May 31 3:30 PM - 5:00 PM
The Role Of A Sit-to-stand Workstation And Its Effects On Work Productivity

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The prolonged sedentary nature of office work has been shown to induce high levels of discomfort, leading to decreased worker productivity. Many modalities, including ergonomic-adjustable chairs, treadmill desks, and light-activity promotion have been used as interventions to combat worker distress and productivity. The sit-to-stand (STS) workstation is another tool aimed at improving workers' focus and productivity. **PURPOSE:** Therefore, the purpose of this study is to evaluate the efficacy of a STS workstation on work productivity. **METHODS:** All participants were volunteer faculty and staff of the University of Central Oklahoma randomly assigned to a control (n =10) or STS workstation intervention (n =8) group. Both groups filled out the *Health and Work Performance Questionnaire* at the base-line, 6-month, and 12-month mark of the study to measure productivity. Absolute productivity is a subjective measure of an employee's work output. Relative productivity is a subjective comparison of the employee's work output to another employee in a similar position. The control group was instructed to continue their day as normal while the intervention group was instructed to stand at least 2 hours per work day, if possible. **RESULTS:** There was no interaction effect for absolute productivity ($F_{2,15}= .91$, $p=.42$) from baseline to 12 months with a moderate effect size (0.68). However, a decrease was seen in the control group from baseline (85 +/- 7.07) to post-test (73.08 +/- 28.07) with a strong effect size (1.69), while the STS workstation group increased from baseline (86.25 +/- .88) to post-test (88.75 +/- 8.35). Relative productivity showed no interaction effect as well ($F_{2,15}= .89$, $p=.44$) from baseline to 12 months. The control group saw a decrease from start (1.09 +/- .17) to finish (1.07 +/- .10) while the intervention group saw an increase from start (1.10 +/- .12) to finish (1.19 +/- .26). **CONCLUSIONS:** Overall, the STS workstation did not show a significant improvement in work productivity compared to the control group. However, a positive trend was seen in the intervention group towards perceived greater work production. **ACKNOWLEDGEMENTS:** This study was funded by the University of Central Oklahoma, Research and Sponsored Programs office and Areawide Aging Agency.

3087 Board #133 May 31 3:30 PM - 5:00 PM
College Students' Acute Sedentary Behavior, Step Counts, and Situational Interest during Virtual Reality

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PURPOSE: This study examined differences in college students' acute sedentary behavior, steps, and situational interest during immersive virtual reality (VR), non-immersive VR, and traditional stationary biking sessions. **METHODS:** Forty-nine college students (34 females; \bar{X}_{age} = 23.6 \pm 3.4 years; \bar{X}_{BMI} = 23.8 \pm 3.1 kg/m²) completed three separate biking sessions: 1) immersive VR bike (VirZoom VR bike, PlayStation 4); 2) non-immersive VR bike (Gamerize bike, Xbox 360); and 3) traditional stationary bike (Spirit Fitness XBU55 bike). Participants' percentage of sedentary time (%ST) and steps were tracked using ActiGraph GT3X+ accelerometers, with situational interest examined using the Validated Situational Interest Scale. One-way MANOVA examined differences for all outcomes between the three exercise sessions. **RESULTS:** Significant differences were observed for all outcomes between the three exercise sessions, $F(1, 135) = 67.9-277.2$, $p < 0.01$; $\eta^2 = 0.42-0.79$, except for %ST ($p > 0.05$). In detail, immersive VR resulted in significantly higher steps than non-immersive VR and traditional biking, respectively (2,033.8 \pm 423.4; 1,412.7 \pm 193.5; 1,546.4 \pm 288.0). Moreover, participants reported significantly higher situational

interest during immersive VR (3.5 ± 0.4) than non-immersive VR (2.1 ± 0.5) and traditional biking (1.7 ± 0.4). Specifically, immersive VR compared to non-immersive VR and traditional biking, respectively, observed significantly greater novelty (3.78 ± 0.4 ; 2.2 ± 0.7 ; 1.3 ± 0.4), challenge (3.7 ± 0.4 ; 2.9 ± 0.6 ; 2.3 ± 0.7), attentional demand (3.2 ± 0.6 ; 1.5 ± 0.7 ; 1.5 ± 0.5), exploration intention (3.7 ± 0.5 ; 2.3 ± 0.5 ; 1.9 ± 0.6), and instant enjoyment (3.1 ± 0.6 ; 2.2 ± 0.7 ; 1.3 ± 0.4). Noteworthy, non-immersive VR was observed to be significantly higher than traditional biking in all 5 subscales of situational interest as well.

DISCUSSION: Observations suggested immersive VR biking to promote greater steps and situational interest over non-immersive VR and traditional biking, with non-immersive VR observed superior to traditional biking for situational interest, suggesting VR biking may be an attractive exercise modality in this population. Future experimental designs assessing these outcomes are warranted.

3088 Board #134 May 31 3:30 PM - 5:00 PM
Effects of Resistance Training on Physical Fitness and Arterial Compliance in Normotensive Obese Women

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(No relevant relationships reported)

Purpose

The purpose of this study was to determine the short-term effects of resistance training (RT) on arterial compliance and physical fitness in obese women with normal blood pressure.

Methods

A total of 16 participants (10 control/6 intervention) were included in the analyses (age: 23.5 ± 4.1 years; body mass index: 33.6 ± 2.9 m/kg²). Pre- and post-intervention assessments included cardiorespiratory tests, arterial stiffness assessments, and leg press (LP) and bench press (BP) one repetition maximum tests (1RM). Trainings consisted of seven strength exercises performed at an intensity of 80% 1RM until 550 calories have been expended.

Results

Analysis of variance (ANOVA) showed significant interaction effects (time x group) in LP ($p=0.001$) and BP ($p=0.001$) tests. Further, pairwise comparisons showed significant increases in LP ($p<0.001$) and BP ($p<0.001$) total weight lifted in the RT group after the intervention (20.55 ± 12.22 kg and 6.1 ± 4.54 kg respectively), but not in the control group (-2.26 ± 8.96 kg and 0.58 ± 2.26 kg respectively). There were no statistically significant changes found for arterial compliance.

Conclusions

Short-term high intensity RT had positive effects on muscle strength in obese women with normal blood pressure with no negative effects on arterial compliance.

3089 Board #135 May 31 3:30 PM - 5:00 PM
Weekly Activity Maintained While Adding Training Among Post Bariatric and Obese Participants

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(No relevant relationships reported)

It is suggested that a barrier to weight loss during exercise training is associated with increased compensatory sedentary activity (CSA). While studies report a positive association between physical activity and improved weight loss in post bariatric (PB) and obese individuals, the effectiveness for the different types of physical activity interventions and CSA reported is often equivocal. **Purpose:** To evaluate if vigorous or moderate continuous exercise regimens maintain or increase energy expenditure of individuals during exercise training. **Methods:** Eight PB individuals [7 female, 1 male; Body Mass Index (BMI) = 34.95 ± 7.6] and ten obese individual [7 female, 3 male; BMI = 38.99 ± 6.5] participated in a supervised 12 week three days per week treadmill exercise training program. The PB high intensity interval group exercised at 80% of their age adjusted heart rate reserve (HRR) for 4 one minute intervals interspersed with 4 minute recovery bouts at 50% of the HRR for weeks 3 through 6. Exercise was increased to 6 one minute bouts at the same HRR intensity and recovery time for weeks 7 through 12. The obese continuous moderate intensity group exercised for 20 minutes at 60% HRR for weeks 3 through 6 and 20 minutes at 65% HRR for weeks 7 through 12. Both exercise interventions included a 2-week run-in to avoid injuries. Energy expenditure (MET-hrs) was measured using micro activPALs for the pre-exercise week and weeks 3, 9 and 12. **Results:** Overall, there were no significant differences between groups for MET-hrs for any week. MET-hrs increased ($p<0.05$) from the pre-exercise week (212.1 ± 4.96) during the intervention (week 3: 221.87 ± 8.01 ; week 9: 218.22 ± 11.19), and remained elevated post-intervention (week 12: 216.35 ± 7.5). Post-intervention MET-hrs had decreased from week 3, but were not significantly different from week 9 MET-hrs. There was 85% compliance for all

training sessions for both groups. **Conclusion:** Post Bariatric surgery patients increased METs from vigorous intensity exercise intervention similar to obese individuals in moderate continuous exercise training. Although METs for week 12 declined for both groups, it remained above baseline and appears there was no evidence of CSA for either group.

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3090 Board #136 May 31 3:30 PM - 5:00 PM
Efficacy of a Virtual Reality Fitness Program for Enhancing Muscular Fitness and Body Composition

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Reported Relationships: K. Delcastillo: Industry contracted research; The study was funded by an industry grant.

PURPOSE: The purpose of this study was to compare the effects of a time-efficient virtual reality (VR) training system versus a traditional exercise (TE) program on measures of muscular fitness, body composition, and enjoyment.

METHODS: Nineteen untrained young men (height: 175.8 ± 4.2 cm; weight: 81.9 ± 15.8 ; age: 23.3 ± 3.9) were randomly assigned to 1 of 2 experimental groups: A virtual reality (VR) protocol consisting of a computer-guided exercise-based program using a cable pulley resistance that took a half hour to complete ($n = 10$), or; a traditional exercise (TE) protocol, consisting of a combination of resistance training and cardiorespiratory training that took 1.5 hours to complete ($n = 9$). The training intervention lasted 8 weeks. Testing was carried out pre- and post-study for changes in measures of maximal muscle strength (1 repetition maximum [1RM] for the bench press and leg press), upper body muscular endurance (50% of 1RM for the bench press), and body composition (fat free mass, skeletal muscle mass, and body fat percentage) assessed via multifrequency bioelectrical impedance analysis. The level of enjoyment of the respective exercise programs was assessed post-study using the modified 8-item Physical Activity Enjoyment Scale.

RESULTS: Main effects for time were observed for 1RM bench press ($F = 71.030$; $p < 0.001$), 1RM leg press ($F = 64.021$; $p < 0.001$), upper body muscular endurance ($F = 43.059$; $p < 0.001$), lean body mass ($F = 5.345$; $p = 0.034$) and skeletal muscle mass ($F = 6.968$; $p = 0.017$). No main effects for time were noted with respect to changes in body fat. A time-group interaction was observed for tests of 1RM leg press ($p = 0.004$) and upper body muscular endurance ($p = 0.033$), with TE showing significantly greater increases compared to VR. No between-group differences were noted for any other outcome variable.

CONCLUSIONS: Despite greater improvements in some performance-related measures for TE, our findings suggest that the specific VR program studied is a viable strategy to improve muscular fitness and lean mass while requiring a limited time commitment in a young, untrained population. Moreover, participants in VR reported a high level of enjoyment with the program, which may help to foster long-term adherence.

3091 Board #137 May 31 3:30 PM - 5:00 PM
Student Engagement in Classroom Physical Activity Breaks

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(No relevant relationships reported)

Purpose: Students are sedentary for approximately 92% of the day. Classroom physical activity (PA) breaks are known to decrease sedentary behavior (SB). However, little consideration has been given to the environmental and behavioral factors influencing how students engage in classroom PA breaks. Therefore the purpose of this study was to understand how perceived classroom climate and sedentary behavior impact students' total moderate to vigorous physical activity (MVPA).

Methods: Students ($n=112$) housed in 1st and 2nd grade classrooms across two school districts participated in a one-day study protocol using a classroom climate survey and accelerometers to investigate student engagement in a five minute classroom PA break. Descriptive statistics, bivariate correlation analyses between variables and mediation analyses using linear regression were conducted to explore direct and indirect effects.

Results: Over half of the students were females (56.3%) and second graders (51.8%). Correlations were found between perceived classroom climate to sedentary behavior ($r = -.31$, $p = .001$) and total MVPA ($r = .34$, $p < .001$). Sedentary behavior was negatively correlated with total MVPA ($r = -.71$, $p < .001$). The mediation model explained 27% of the total MVPA variance ($p < .001$). Perceived classroom climate had a direct effect on sedentary behavior ($B = -.04$, $SE = .01$, $t = -3.09$, $p < .05$). Sedentary behavior had a direct effect on total MVPA ($B = -.45$, $SE = .06$, $t = -7.69$, $p < .05$). Student perceived classroom climate did not have a significant direct effect on total MVPA ($p = .09$) but did have significant indirect effect through sedentary behavior (indirect effect = .02, bootstrap $SE = .007$, 95% bootstrap $CI = .005$, .030), meaning that a participant who scores 1 point higher on perceived classroom climate survey, on average, .02 minutes higher on total MVPA through sedentary behavior.

Grade, sex, and PA break type were controlled in the analyses. **Conclusions:** Providing students with classroom PA breaks may not be enough. Student's PCC shape how they engage in classroom PA breaks. Teachers must develop a positive classroom climate where PA is encouraged and affirmed.

3092 Board #138 May 31 3:30 PM - 5:00 PM
Osteogenic Response After Six Months of High-Intensity, Low-Impact Exercise

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(No relevant relationships reported)

Purpose: Lagree Fitness exercise offers high-intensity, low impact workouts that combine resistance, endurance, core, and cardio training. These classes are offered as alternatives to traditional weight bearing resistance training; however, it is unknown whether this training method has osteogenic effects on bone similar to traditional resistance training. To provide such insight, we assessed changes in bone after six months of the high-intensity training using the Lagree Fitness Megaformer in men and women.

Methods: 31 healthy participants began a 6 month, 3x per week, 25 minute group lead, Lagree Fitness training course on the Megaformer. The data from 19 women and 4 men (45.1 ± 20.9 years of age), weight (150.5 ± 41.5 lb), height (66.5 ± 6.5 in) were analyzed; eight participants did not complete the course and were excluded from data analysis. All participants completed a lumbar spine, bilateral hip, and total body scan on a GE Lunar iDXA dual-energy x-ray absorptiometer at baseline and within 10 days of completing 72 training sessions.

Results: There were no significant osteogenic effects on lumbar spine bone mineral density (BMD) ($P=.102$), femoral neck BMD ($P=.519$), or total hip BMD ($P=.481$) in this sample. There was also no significant changes in total body bone mineral content (BMC). While there were no statistically significant changes in total body BMD ($P=.186$), total arm BMD ($P=.125$) and total leg BMD ($P=.111$), there were apparent positive increases that may be promising and suggests the necessity for further data collection with a larger sample. There were similar positive effects on total arm BMC ($P=.292$) with statistically significant increases in total leg BMC ($P<.035$). The increase from baseline of total arm lean mass (LM) ($P<.009$) was significant, and increases in total body LM ($P=.069$) approached significance. Change in total leg LM ($P=.382$) was not significant.

Conclusion: In the absence of weight bearing exercise, high-intensity exercise on the Lagree Fitness Megaformer provided significant increase in total leg BMC, and promising increases in BMC and BMD across other body regions. However, there were no significant osteogenic effects on the hips and lumbar spine typically of importance in osteopenic populations.

3093 Board #139 May 31 3:30 PM - 5:00 PM
Physical Activity Breaks in the College Classroom: Student Engagement Factors

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Most college classes require long periods of sedentary behavior and attention demanding tasks. College students, as emerging adults, are moving through a key developmental stage, in which it is critical to instill lifelong health behaviors. Physical activity breaks (PABs) in college settings are novel, but have been shown to be potentially beneficial regarding concentration and academic performance (Babkes Stellino, et al., 2017). **PURPOSE:** To explore college students' barriers to, and reasons for, engagement in a PABs intervention. **METHODS:** College students were invited to participate in video-led or live instructor-led PABs consisting of cardio-strength based exercises or yoga during a 6-week summer college course. Students were asked to write out the reason(s) they chose to engage in the PAB, or not, each day a PAB was offered. At the end of the 6-week course, students also completed an open-ended survey intended to understand their overall reasons for engagement, and barriers to participation in PABs. Basic thematic analysis was conducted to explore why students chose to engage in PABs or chose to opt out. **RESULTS:** Common reasons reported for engaging in PABs were enjoyment, needing a break from lecture, and contributing to the research. Enjoyment levels were higher when various modes of PABs were offered. Students mentioned a greater personal connection, and a desire to put forth more effort when a live instructor led the activity, particularly for yoga PABs. PABs were viewed as a break from class, and considered a valid exercise bout for some students. This was motivating for some students, but reported as a limitation for others who had already exercised or were going to exercise later that day. Not feeling well, being unprepared or just not wanting to participate, were reported as the main barriers to engagement in the PABs. **CONCLUSION:** It is important to understand what motivates college students to engage, or not, in PABs, in order to better tailor future

programs that will appeal to a greater majority of students. Findings will contribute to the continued exploration of the benefits that PABs can have for college students in the college classroom.

3094 Board #140 May 31 3:30 PM - 5:00 PM
Effects Of Exercise Intensity Provided In The Exercise Classes On The Establishing Exercise Habits

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(No relevant relationships reported)

We provided Japanese adult women who have not been having exercising regularly habits and through an exercise intervention (group exercise class like a fitness sports club) succeeded in establishing exercise habits. We considered that providing vigorous intensity exercise, presence or absence of a goal setting, and social support might be effective in establishing exercise habits. In particular, there are indications that low exercise intensity is preferable for establishing exercise habits. However, success experiences of difficult (vigorous intensity) exercise enhance confidence, which may contribute to establishing exercise habits in Japanese adult women.

PURPOSE: To examine the effects of differences in exercise intensity provided in the exercise classes on the establishing exercise habits and changing in self-efficacy of exercise and health-literacy related to behavioral changing such as health and exercise habits.

METHODS: We recruited 27 participants (volunteers) in this intervention (exercise classes). Participants were 20-64-year-old healthy Japanese women who have not been having exercising regularly habits, confidence in physical fitness, and athletic ability. They separated randomly moderate- to vigorous-intensity (2-8 METs) exercise class (MV group, n=14) and low- to moderate-intensity (2-4 METs) exercise class (LM group, n=13). We instructed 90 min/session some exercises 24 sessions (twice a week for 3 months) and lectured about association with health and physical activity (exercise) for both groups.

RESULTS: There were 4 participants (28.6%) in MV group and 5 participants (38.5%) in LM group who dropped-out. The establishing exercise habits after the 1-yr from the end of intervention were not significantly different between two groups (20%, 50%). Self-efficacy ($11.8 \pm 2.5 \rightarrow 11.5 \pm 3.4$ points, $8.8 \pm 3.5 \rightarrow 9.4 \pm 2.7$ points) and health-literacy ($18.3 \pm 2.9 \rightarrow 18.5 \pm 2.1$ points, $16.5 \pm 4.0 \rightarrow 17.0 \pm 5.1$ points) did not significantly different from baseline and differ significantly interaction between the two groups.

CONCLUSION: It was concluded that exercise intensity contributed little to increasing self-efficacy, health-literacy and establishing exercise habit. It may be important to definite goal setting (goal contents) or social support to improve them.

3095 Board #141 May 31 3:30 PM - 5:00 PM
Accuracy Of Dual Task To Distinguish Elderly With Alzheimer's From Healthy Controls

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(No relevant relationships reported)

Alzheimer's disease (AD) is the most prevalent dementia in the world. Indeed, the expectations are that this number will triple in the coming decades. Clearly, accessible interventions to prevent and treat the disease have been crucial, as well as, identify preclinical individuals. Despite clinical diagnosis are still focused on episodic memory deficits as the gold standard for AD, some studies suggest that because of the damages caused by the disease in prefrontal and temporal areas, along with, impairment in executive function AD could also have a motor signature that could be access through gait and Dual task (DT) tests. the accuracy of these tests to distinguish healthy from AD elderlies.

PURPOSE: To verify the sensitivity and specificity of DT and DT cost to distinguish elderly with AD from healthy controls.

METHODS: We evaluated older adults over sixty years old. DT performance was measured by gait velocity (m/s), DT cost (DTC = [(single task - dual task) / single task] $\times 100$) and the number of evoked words (DTanimals). We also included Sit to Stand, 8 Foot up and go and STEP test to measure functional capacity. Cognitive functions were evaluated through MMSE, RAVLT and Trail (A and B). T test and Mann-Whitney test were used to compare the two groups. The sensitivity and specificity of the tests were explored through the ROC curve. **RESULTS:** The final sample consisted of 82 participants, being 39 healthy elderly and 43 diagnosed with AD. There was a significant difference between the Healthy and AD groups in all DT variables and MMSE; DT ($p < 0.001$), DT cost ($p < 0.001$), MMSE ($p < 0.001$). Moreover MMSE (area = 0.974; sensitivity = 92.9%; specificity = 82.1%; $p < 0.001$) showed better accuracy than DT (area = 0.901; sensitivity = 80.5%; specificity = 86.8%; $p < 0.001$) and DTC variables (area = 0.816; sensitivity = 82.7%; specificity = 76.3%; $p < 0.001$). The cut-off point of DT was 9.55.

CONCLUSIONS: DT analysis was able to differentiate AD from Healthy elderly with great accuracy and a moderate sensitivity and specificity. Performance in dual task should be more investigated as a possible motor biomarker of AD.

3096 Board #142 May 31 3:30 PM - 5:00 PM
Effects Of Bingocize® On Quality Of Life, Fall Risk, And Health Knowledge In Community-Dwelling Older Adults

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(No relevant relationships reported)

Quality of life (QOL) is an important aspects of overall well-being in older adults. QOL is associated with functional, physical, and psychological health; all of which can be improved with increased physical activity. A high fall risk is associated with low physical function and QOL. One in four older adults experiences a fall each year, making it necessary to focus public health interventions towards decreasing fall risk and improving QOL in older adults. Bingocize® is a health promotion program designed to promote health, health knowledge, physical activity, and social engagement among older adults. **PURPOSE:** The purpose of this study was to determine the effects of the new version of Bingocize® on QOL and fall risk in community-dwelling older adults (N=36; mean age 73.63 ± 6.97). **METHODS:** Participants were clustered and randomly assigned to (a) experimental (n=19; participating in Bingocize® program, which included the bingo game, exercise, and health education) or (b) control (n=17; only played bingo). Each group completed a 12-week intervention that consisted of two 45-60 minute sessions per week. Pre and post data assessments included the TUG, 30-second chair stand, 4-staged balance, handgrip strength, WHOQOL-BREF, PANAS, and a health knowledge quiz. A mixed design analysis of variance (ANOVA) was used to compare intervention effects. Associations were significant at p≤0.05. **RESULTS:** There were no significant interactions for any of the variables, with the exception of positive affect (PA) (F (1,34) = 5.66, p = 0.02, power = 0.64) and handgrip strength (F (1,34) = 8.31, p = 0.007, power = 0.80). There was also a significant main effect for time for health knowledge. Post hoc analysis using independent samples t-tests were conducted on PA (t (33) = 2.39, p = 0.023, two-tailed) and handgrip strength (t (34) = 2.85, p = 0.007, two-tailed). **CONCLUSION:** Participating in the Bingocize® health promotion program can produce a meaningful and detectable change in handgrip strength and PA in community-dwelling older adults.

3097 Board #143 May 31 3:30 PM - 5:00 PM
Tailored Domain-Specific Sedentary Behavior Intervention on Reducing Sedentary Time

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(No relevant relationships reported)

PURPOSE: To continue the advancement of sedentary behavior intervention, it is important for researchers to design the intervention based on the theoretical model and contextual information of sedentary behavior. Therefore, the purpose of this study is to identify the feasibility of tailored domain-specific sedentary behavior intervention on reducing sedentary behavior time using contextual information of sedentary behavior. **METHODS:** A total of 43 adults (age ≥ 18) were participated in this study. A randomized controlled trial with a covariate adaptive randomization was used. Participants were randomly assigned to three groups: 1) tailored domain-specific intervention group; 2) standard intervention group; and 3) control group. Behavioral strategies to reduce sedentary behavior included educational meeting and materials, goal setting and feedback, and self-monitoring based on theoretical background for two intervention groups. Additionally, contextual information of sedentary behavior was given to tailored intervention group. Participants' sedentary behavior time was measured at baseline, 1st and 2nd intervention week by accelerometers, and contextual information of their sedentary behavior was obtained from the Sedentary Behavior Record instrument. Two-way (Group × Time) repeated measures analysis of variance was conducted for comparison for changes in total time spent in sedentary behavior among the three groups.

RESULTS: Thirty-six out of 43 participants who wore the Actigraph during at least 10 hours per day for at least four days were included in this study. There was a significant interaction between group and time, F(3.9, 63.6) = 3.94, G-G p = .007, η_p^2 = .193. Simple effect analysis results showed that sedentary behavior time at each time point were not significantly different for the control group, F(1.7, 18.9) = 0.48, G-G p = .597, η_p^2 = .042, and the standard intervention group, F(1.8, 20.1) = 1.76, G-G p = .198, η_p^2 = .138. The sedentary behavior time, however, differed among three times for tailored domain-specific intervention group, F(1.7, 18.8) = 14.00, G-G p < .001, η_p^2 = .560.

CONCLUSIONS: The tailored domain-specific sedentary behavior intervention using contextual information of sedentary behavior was effective, reducing sedentary behavior time for adults.

3098 Board #144 May 31 3:30 PM - 5:00 PM
Stage Ofbehavior Change In Regards Of Physical Activity, Health And Quality Of Life Among Health Professionals From Health Institutions

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(No relevant relationships reported)

Purpose: To analyze the factors associated to the stage of behavior change among professionals from health institutions. **Methods:** The sample consisted of 1054 professionals (247 male and 807 female). The dependent variable was the irregularly active group of the behavioral stage questionnaire (proposed by Prochaska, 1988). The independent variables were: gender, physical activity, steps number, sleep, negative mood, presence of diseases, health perception, and quality of life. **Statistical analysis:** Binary Logistic Regression Odds Ratio (OR) and its respective 95% confidence intervals (CI) were used to associate the study variables. **Results:** Factors associated with irregularly active behavior change were: gender, physical activity, sleep, negative mood, presence of disease, health perception and quality of life. On the other hand, steps number was not associated with the stage of irregularly active behavior change (see table below). **Conclusion:** The irregularly active group had a positive association with female sex, as well as a higher probability of belonging to groups that did not comply with the recommendation of physical activity, dissatisfaction with sleep, with a higher frequency of negative mood, with diseases, negative health perception and a low quality of life.

Factors associated with irregularly active stages of behavior change (Pre-Contemplative, Contemplative, Preparation) with gender, physical activity, factors related to health and quality of life

Variable	Significant (p ≤ .05)	OR	CI 95%	Variable	Significant (p ≤ .05)	OR	CI 95%
Sex				Quality of Life			
Male		1		Physical Domain			
Female		1.47	(1.07 – 2.01)	High		1	
Recommendation Physical Activity				Low	< .001	2.4	(1.81 – 3.19)
(≥ 150 min/week)		1		Psychological Domain			
(< 150 min/week)	< .001	6.24	(3.38 – 11.5)	High		1	
Step number				Low	< .001	2.1	(1.60 – 2.79)
(≥ 7000 steps)		1		Social Domain			
(< 7000 steps)	.58	2.2	(.97 – 5.33)	High		1	
Sleep satisfaction				Low	< .001	2.0	(1.53 – 2.79)
(Satisfied - Very satisfied)		1		Environmental Domain			
(Indifferent - Dissatisfied - Very Dissatisfied)	< .001	2.3	(1.75 – 3.18)	High		1	
Negative Mood				Low	< .001	2.4	(1.80 – 3.22)
(Never - Sometimes)		1		General Quality of Life			
Frequent - Very frequent - Always)	.04	1.8	(1.01 – 2.04)	High		1	
Presence of Disease				Low	< .001	2.8	(2.12 – 3.76)
No		1					
Yes	.001	1.5	(1.19 – 2.09)				
Health Perception							
Positive		1					
Negative	< .001	2.5	(1.66 – 3.77)				

3099 Board #145 May 31 3:30 PM - 5:00 PM
The Effect of a Foot Exercise Protocol on Intrinsic Muscle Volume

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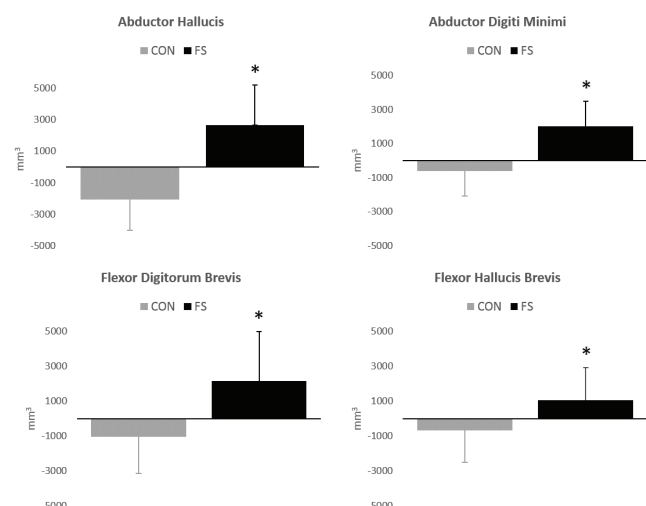
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(No relevant relationships reported)

Musculoskeletal injuries of the foot may be partially attributed to weakness of the intrinsic muscles, which are crucial to foot stability during dynamic activities. Perhaps because of their small size, the potential for strengthening these muscles is highly under-appreciated. Therefore, treatment of foot problems is often focused on externally supporting the foot rather than strengthening it. **PURPOSE:** To determine the effect of a foot exercise intervention on the volume of plantar intrinsic foot muscles.

METHODS: 34 recreational runners were randomly assigned to either a Control (CON) or Foot Strengthening (FS) group. The CON group was assigned to a placebo lower limb stretching protocol while the FS group performed a foot exercise protocol for 8 weeks. Running mileage and training pace were controlled weekly throughout the study for both groups. The right foot of all subjects was imaged using MRI at baseline (T0), as well as at week 8 (T8). Cross-sectional areas (CSA) of the whole length of the Abductor Hallucis (AbH), Abductor Digiti Minimi (AbDM), Flexor Hallucis Brevis (FHB), and Flexor Digitorum Brevis (FDB) were measured by a researcher blinded to both group assignment and time (T0 or T8). The Intraclass Correlation values for repeatedly measuring CSA for this tester was ICC_{3,1} = 0.97 (0.96-0.98). **RESULTS:** There was a significant difference in volume and CSA for all muscles measured for the FS group between T0 and T8 (p<0.05). Muscle volume in the FS group increased

by 22.4% for the AbH, 17.1% for AbDM, 17.7% for FHB, and 8.8% for FDB. No changes were noted in the CON group. **CONCLUSION:** The foot exercise protocol significantly increased the volume of intrinsic foot muscles in a healthy and physically active population of recreational runners. This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior - Brasil (CAPES) - Finance Code 001, FAPESP 2015/14810-0.



Changes in muscle volume in the CON and FS groups (positive indicates an increase in size and negative indicates a decrease in size). * Significant difference from CON ($p < 0.05$).

3100 Board #146 May 31 3:30 PM - 5:00 PM The Effect Of Exercise Training And Increasing Non-exercise Physical Activity On Glyca Levels

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(No relevant relationships reported)

Purpose: Aerobic training has been shown to have a beneficial effect on GlycA, which is a marker of inflammation. However, it has not been previously reported if an intervention with aerobic training and increasing non-exercise physical activity can further reduce GlycA. Thus, the purpose of the present study is to determine the impact of the combination of aerobic training and increasing non-exercise physical activity on GlycA levels compared to aerobic training alone in obese adults. **Methods:** Obese adults ($N=30$) were randomized to an aerobic training, (AERO), aerobic training and increasing non-exercise physical activity, (AERO-PA) or a control (CON) group for 6 months. Both exercise groups performed supervised aerobic training (50%-75% VO_2 max) at a dose of 12 kcal per kg per week. Along with exercise training, the AERO-PA group had the goal of increasing non-exercise physical activity ~3,000 steps above baseline levels. Archived blood samples were obtained at baseline and at follow-up and subsequently analyzed by LipoScience for GlycA after the completion of the study (LabCorp, Morrisville, NC). An ANCOVA was used to evaluate the change in GlycA across the intervention groups with adjustment for the baseline value. Person correlations were run to evaluate the change in GlycA with weight, body composition, and fitness variables. **Results:** Significant within groups reductions in GlycA were observed in the AERO (-43.1 $\mu\text{mol/L}$, CI: -74.1 to -12.2) and the AERO-PA groups (-31.2 $\mu\text{mol/L}$, CI: -61.2 to -1.1), but this change was not significant compared to the CON group (-15.4 $\mu\text{mol/L}$, CI: -41.8 to 11.0). The change in GlycA in exercisers was not associated with the change in fitness ($r=-0.18$, $p=0.47$), waist circumference ($r=-0.37$, $p=0.13$), weight ($r=-0.31$, $p=0.21$), body fat ($r=-0.28$, $p=0.26$) or change in steps of non-exercise physical activity ($r=0.35$, $p=0.16$). **Conclusion:** Neither aerobic exercise training or aerobic training and increasing non-exercise physical activity reduced inflammation levels in obese adults measured by GlycA. Changes in GlycA are not associated with body composition, non-exercise physical activity, or fitness changes associated with aerobic exercise training.

3101 Board #147 May 31 3:30 PM - 5:00 PM Power and Strength Training Produce Similar Improvements in Performance in Individuals with Parkinson's Disease

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(No relevant relationships reported)

PURPOSE: Loss of motor function is a cardinal symptom associated with Parkinson's disease (PD), with many studies indicating that muscular strength and power decrease as the illness progresses. Although literature supports the efficacy of resistance training to improve motor function in persons with PD, no study has compared the impact of strength and power training on measures of strength, power, balance and functional movement in PD patients. **METHODS:** Thirty-five participants diagnosed with mild to moderate PD were randomized into a 12-week strength or power training program (2 times per week). Measures of muscular strength (1RM), peak power (PP_{rel}), balance (Berg balance assessment, dynamic posturography, modified falls efficacy scale), and functional movement (timed up-and-go) were assessed before and after training. **RESULTS:** No significant group effect was found. Significant increases in leg press ($MD = 54.89 \text{ kg} \pm 7.41$; $\eta^2=.749$; $p < .0001$) and chest press ($MD = 7.33 \text{ kg} \pm 3.46$; $\eta^2=.518$; $p < .0001$) strength, as well as in leg press ($MD = 106.89 \text{ W} \pm 24.73$; $\eta^2=.358$; $p < .0001$) and chest press power output ($MD = 52.12 \text{ W} \pm 13.51$; $\eta^2=.299$; $p < .0001$) were seen for the entire sample. There was also a significant decrease in Berg scores for the sample ($MD = -1.68 \pm .551$; $\eta^2=.192$, $p = .009$). No other differences were detected across the training period. **CONCLUSION:** Strength and power training produced similar improvements in measures of strength and power in individuals diagnosed with PD. Although Berg scores decreased significantly following training, these declines were not considered clinically significant. We postulate that the lack of improvement in balance and functional movement scores for either intervention may be due to the failure to include movement-specific drills in the training protocol. Future research should continue to examine the differential effects produced by strength and power training in PD patients and should include a functional training phase designed to elicit improvements in balance and daily function.

3102 Board #148 May 31 3:30 PM - 5:00 PM The Impact Of A Workplace Wellness Program On Employees In A University Setting

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(No relevant relationships reported)

The Affordable Care Act of 2010 contained incentives for worksites to develop workplace wellness programs and employee wellness programs, which have shown positive outcomes to companies in various dimensions of wellness. Historically, studies have examined one dimension of wellness and typically within a corporate setting. **PURPOSE:** To evaluate the effectiveness of an educational wellness intervention on overall well-being based on the eight dimensions of wellness in university faculty and staff. **METHODS:** Employees ($N = 12$, 72.7% female; 81.8% white) underwent an 8-week intervention called the Employee Wellness Institute. Employees met once a week with each session highlighting one of the eight dimensions of wellness. Demographics, anthropometrics, physical activity, nutrition, and overall wellness were pre and post intervention. Statistical analysis utilized a paired-t test and Cohen's d for effect size. **RESULTS:** Within each dimension of wellness there was an average increase of 8% in Physical, 3% in Emotional, 3% in Social, 2% in Occupational, 4% in Spiritual, and both Environmental and Intellectual had the largest increase at 9% which was statistically significant ($p=0.011$). **CONCLUSION:** Data supports the hypothesis that employees would improve their proficiency within the 8-dimensions of wellness as well as physical activity, although not all improvements were statistically significant. Within a short 8-week intervention, employees had increased their overall wellness up to 9% in some dimensions. If the employees had access to a year-round program that continuously strived to improve their wellness, or if more employees had access to such a program, the overall wellness of an entire faculty/staff of a university may improve. Thus, future research and practice efforts should implement and evaluate year-long worksite wellness programs for university employees.

- 3103** Board #149 May 31 3:30 PM - 5:00 PM
Efficacy Of A Recess-based Intervention On Academic And Health Outcomes In Elementary School Children
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Both cardiorespiratory and muscular fitness are important for overall health and may benefit academic related outcomes in children. However, few intervention studies have examined the impact of an intervention that has emphasized both components on academic or cognitive outcomes. Furthermore, school recess may be an ideal time to promote physical activity and fitness and has been a relatively understudied setting in relation to these outcomes. **PURPOSE:** To evaluate the preliminary efficacy of a 3-month recess-based combined fitness intervention (INT; consisting of both aerobic and muscular fitness activities) on cognition (inhibition and working memory), classroom behaviors (engaged and off-task behaviors), fitness (cardiorespiratory and muscular), and moderate to vigorous physical activity (MVPA) in elementary school-age children. **METHODS:** Schools (n=2) were randomized to either the INT (n=27, sex: 66.7% male, age: 8.8±0.1 years) or control group (CON; n=27, sex: 42.3% male, age: 9.4±0.1 years). Baseline and post-intervention measures included a flanker test (inhibition), list sorting test (working memory), classroom behavior observation (on- and off-task behaviors), 20-meter shuttle run (cardiorespiratory fitness), muscular fitness battery (muscular fitness), and accelerometry (MVPA). Process evaluation measures were recorded daily, weekly, and post-intervention. ANCOVA models were adjusted for baseline score, age, and other covariates. An independent samples *t*-test was used to compare percent of time spent in MVPA during recess between schools. **RESULTS:** Percent of time spent in MVPA during recess was significantly higher in the INT compared to the CON group (INT=41.7±2.1%; CON=30.4±0.2, *p*<0.001). No other significant differences were observed. Although participant enjoyment and INT acceptability was high, the average participation in INT sessions was 19.4% (ranging from 0 to 95.6%). **CONCLUSION:** This pilot study demonstrated some preliminary support that offering a combined fitness program is feasible and can increase percent of time spent in MVPA during recess. Future research is warranted to determine if the INT can impact academic or cognitive outcomes. Supported by: University of Massachusetts Amherst Graduate School Dissertation Research Grant

F-57 Free Communication/Poster - Maternal and Child Health

Friday, May 31, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

- 3104** Board #150 May 31 2:00 PM - 3:30 PM
The Associations between Maternal Body Mass Measures and Macronutrient Intake on Insulin Sensitivity Measures during Late Pregnancy
 Brittany R. Allman, Aline R. Andres, Eva C. Diaz Fuentes, Elisabet Borsheim. *Arkansas Children's Nutrition Center, Little Rock, AR.*
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 (No relevant relationships reported)

PURPOSE: To determine associations between maternal body mass measures (body mass index [BMI], gestational weight gain [GWG]) and macronutrient intake (protein, carbohydrate [CHO], fat) on insulin sensitivity (IS) and fasting glucose (GLU) in late pregnancy in normal weight (NW, n = 87), overweight (OW, n = 67) and obese (OB, n = 31) women. **METHODS:** Participants were recruited early in pregnancy (<10 wk). A 100-gram oral glucose tolerance test (OGTT) was done following an overnight fast at 30 wks to calculate the metabolic clearance rate of glucose (MCR, mg·kg⁻¹·min⁻¹). Dietary intake of animal (AP) and plant (PP) protein (g·kg⁻¹·d⁻¹), fat (g) and CHO (g) were estimated using 3-d food records. Correlations between GLU and MCR with AP, PP, fiber, fat, CHO, GWG, and early pregnancy BMI were assessed using Pearson correlations. Multiple linear regression was used to model MCR and GLU with the independent variables. Data are mean ± SD. **RESULTS:** MCR (NW: 10.1 ± 0.8; OW: 8.3 ± 1.1; OB: 6.7 ± 1.0 mg·kg⁻¹·min⁻¹, *p* < 0.0001) and PP (NW: 0.39 ± 0.12; OW: 0.32 ± 0.09; OB: 0.27 ± 0.09 mg·kg⁻¹·min⁻¹, *p* < 0.0001) differed between groups. Fasting GLU was higher in OW compared to NW (NW: 79 ± 6; OW: 83 ± 7 mg/dL, *p* = 0.008), and AP was lower in OB compared to NW groups (NW: 0.67 ± 0.25; OB: 0.52 ± 0.18 g, *p* = 0.004). CHO intake was higher in NW vs. OB (*p* < 0.05). MCR correlated with AP (*r* = 0.21, *p* = 0.047) and BMI (*r* = -0.62, *p* < 0.0001) in NW, and with fat (*r* = -0.39, *p* = 0.001) and BMI (*r* = -0.58, *p*

< 0.0001) in OW. GLU correlated with BMI (*r* = 0.37, *p* = 0.001) in NW, with fat (*r* = 0.29, *p* = 0.025) and BMI (*r* = 0.31, *p* = 0.016) in OW, and with PP (*r* = -0.41, *p* = 0.035) in OB. Most parsimonious models: In OW, fat (*β* = -0.02, *p* < 0.001) and BMI (*β* = -0.41, *p* < 0.0001) were associated with MCR; and PP (*β* = -30, *p* = 0.008) and fat (*β* = 0.14, *p* = 0.002) associated with GLU. In OB, PP (*β* = 5.8, *p* = 0.011) and fat (*β* = -0.02, *p* = 0.005) were independently associated with MCR; and PP (*β* = -44.6, *p* = 0.003) and CHO (*β* = 0.03, *p* = 0.043) associated with GLU. **CONCLUSIONS:** Higher fat intake and BMI, and low PP intake in OW pregnant women is associated with lower IS. Higher fat and CHO intake, and low PP intake in OB pregnant women is associated with decreased IS. Thus, to improve insulin regulation and glucose metabolism, OW and OB pregnant women may benefit from increasing PP intake and ensure optimal macronutrient intake.

- 3105** Board #151 May 31 2:00 PM - 3:30 PM
Maternal Exercise and DHA Levels During Pregnancy Influences Infant Body Composition
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Nearly 14% of U.S. children aged 2-5 years are obese. Evidence indicates that obesity develops *in utero* and is affected by several maternal factors. Maternal exercise is shown to reduce the risk of delivering high-birthweight infants. However, previous studies restricted their exercise exposure to aerobic training; thus, the effects of other common exercise modes on infant body composition are unknown. Maternal diet, specifically DHA levels, is also suspected to affect infant size. Maternal DHA is shown to improve infant birth weight and decrease fat mass. However, it is unclear as to whether this association is affected among exercising mothers. **PURPOSE:** To determine the relationships between different maternal exercise modes and maternal plasma levels of DHA on infant body composition. **METHODS:** Thirty-six healthy, low-risk, women with a singleton pregnancy (<16 weeks) were randomized to one of four intervention groups: aerobic (n=13), resistance (n=4), circuit (n=6) (aerobic + resistance) or non-exercising control (n=13) group. Participants exercised 3x/week for 50 minutes at moderate intensity for ~20 weeks. Maternal plasma was collected at 16 and 36 weeks of gestation and analyzed for DHA levels using liquid chromatography/mass spectrometry. At one month of age, infant body composition was assessed via skinfold technique. ANCOVA models were performed to determine independent associations between maternal exercise mode, maternal DHA levels, and infant percent body fat (%BF). **RESULTS:** Infants born to aerobic- or circuit-trained mothers had significantly lower %BF compared to infants born to resistance-trained mothers (*p*=0.045, *p*=0.048), respectively. After controlling for infant sex, 16-week maternal DHA levels, and fasted state, maternal exercise exhibited no effect on infant %BF (*F*, 0.57; *p*=0.6865). Maternal DHA levels at 16 weeks (*F*, 1.30; *p*=0.2887), 36 weeks (*F*, 1.13; *p*=0.3742) or across pregnancy (~20 weeks) (*F*, 1.27; *p*=0.3026) did not associate with infant %BF, after controlling for maternal exercise mode, sex, and fasted state. **CONCLUSION:** The current data supports the relationship between maternal exercise modes with aerobic activity on infant body composition. The data suggests that exercise mode may be a more important modulator of infant body composition than maternal DHA levels.

- 3106** Board #152 May 31 2:00 PM - 3:30 PM
The Effects of Exercise Mode During Pregnancy on Maternal Metabolism
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Maternal metabolism is the strongest predictor of fetal growth and development; thus, it is imperative that women maintain a healthy pregnancy to ensure optimal health of their offspring. Evidence demonstrates that chronic exercise training exhibits potent metabolic effects (e.g., insulin sensitivity), indicating a healthier metabolic profile. In healthy pregnancies, however, the effects of prenatal exercise and various modes of exercise on maternal metabolism are unclear. **PURPOSE:** To determine the effects of exercise mode on maternal metabolism during pregnancy, in a sample of healthy women with singleton pregnancies. **METHODS:** At 16 weeks gestation, healthy pregnant women were randomized to one of four intervention groups: aerobic (AT), resistance (RT), circuit (CT) and non-exercising control (CON). Supervised exercise sessions consisted of 50 minutes of moderate-intensity (40-59% VO_{2peak}) exercise, three times per week. Fasting blood samples were collected via venipuncture and fingerstick at 16 and 36 weeks gestation to assess maternal glucose and lipid profiles. ANOVA models were performed to determine the effects of exercise mode on maternal glucose, total cholesterol (TC), triglycerides

(TG), high-density lipoprotein (HDL), low-density lipoprotein (LDL) and lactate (LT) at 36 weeks and the change from the 2nd to 3rd trimester. **RESULTS:** Seventeen pregnant women had complete metabolic data. Prenatal exercise exhibited no effect on glucose or lipid profiles at 36 weeks (glucose: $p=0.48$; TC: $p=0.29$; TG: $p=0.48$; HDL: $p=0.25$; LDL: $p=0.79$; LT: $p=0.96$) or their change between the 2nd and 3rd trimesters (glucose: $p=0.45$; TC: $p=0.87$; TG: $p=0.31$; HDL: $p=0.65$; LDL: $p=0.81$; LT: $p=0.37$). Similarly, no effects were found for exercise modes at 36 weeks (glucose: $p=0.76$; TC: $p=0.41$; TG: $p=0.24$; LDL: $p=0.49$; LT: $p=0.69$) or across pregnancy (glucose: $p=0.83$; TC: $p=0.40$; TG: $p=0.32$; LDL: $p=0.61$; LT: $p=0.70$), with the exception of HDL at 36 weeks. CT mothers exhibited lower HDL levels compared to controls ($p=0.04$). **CONCLUSIONS:** In healthy pregnancies, prenatal exercise and various modes of exercise do not appear to positively nor negatively affect maternal metabolism. Further research should include larger samples and more rigorous assessments of glucose and lipid metabolism (e.g., HbA_{1c}, HOMA-IR, CRP).

3107 Board #153 May 31 2:00 PM - 3:30 PM
Effects of Evidence-Based Materials and Local Resources on Knowledge/Beliefs and Physical Activity Levels During Pregnancy

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PURPOSE: Physical activity (PA) during pregnancy is safe and effective for improving maternal and infant health; however, only 23% of pregnant women exercise in accordance with guidelines, and this number is likely even lower in rural Kentucky. The purpose of this study is to determine the impact of evidence-based educational materials and access to local resources on PA levels and knowledge/beliefs about PA during pregnancy. **METHODS:** Women were recruited from a rural obstetric clinic (8-12 weeks gestation). PA levels were assessed using a fitness tracker and the Pregnancy Physical Activity Questionnaire. Knowledge/beliefs about PA during pregnancy were assessed via surveys. Stage of readiness to exercise was assessed using the transtheoretical model. Participants were randomly assigned to an intervention (IG) or control group (CG). The IG received evidence-based educational information regarding PA during pregnancy and free access to six local fitness facilities. All baseline assessments were repeated during late pregnancy (32-39 weeks). To assess obstetric outcomes, a survey was emailed to each participant after delivery. **RESULTS:** 63 women enrolled in the study (age=29.7±4.9 years, pre-pregnancy BMI= 26.2±6.3 kg/m², household income=\$78,589, average step count in 1st trimester=7,108 steps), and 45 have completed the study (follow-ups are ongoing). There were no differences in baseline variables between groups. In the IG, 13 women utilized PA services (prenatal yoga: 8, gym: 2, both: 3). There was no difference between groups in PA (assessed via change in step counts from early to late pregnancy) ($p=.81$). However, there was a trend for the IG to accumulate less sedentary time compared to the CG during late pregnancy ($p=0.12$). There were no differences in knowledge ($p=0.8$) or beliefs ($p=0.3$) regarding PA during pregnancy between groups. The IG was at a later stage of the transtheoretical model than women in the CG during late pregnancy ($p=0.04$). **CONCLUSION:** The intervention was unsuccessful at significantly increasing PA levels and knowledge/beliefs. Yoga was the most commonly utilized activity among IG women, and while beneficial, is unlikely to alter step counts. Future interventions need more than educational materials and access to resources in order to have a substantial impact on PA-related outcomes.

3108 Board #154 May 31 2:00 PM - 3:30 PM
Strategies And Challenges In Recruiting Overweight/ Obese Pregnant Women For A Behavioral Lifestyle Intervention Program

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 (No relevant relationships reported)

Pregnancy may serve as a unique window for lifestyle behavioral change because of increased concern for health and well-being in expectant mothers. **PURPOSE:** To report the recruitment efforts and results undertaken in a behavioral lifestyle intervention administered during and after pregnancy. **METHODS:** The Health in Pregnancy and Postpartum (HIPP) Study is an ongoing randomized controlled trial that targets excessive weight gain during pregnancy and promotes weight loss after delivery. The target population includes overweight or obese women who are pregnant ≤ 16 weeks, white or African American, aged 18-44 years, and do not have exercise contraindications. Women are recruited through OB/GYN clinics in metropolitan Columbia, SC. Interested women who meet the initial inclusion criteria (i.e., age, race,

gestational age, and pre-pregnancy BMI) are screened by phone for medical exclusions or other study exclusions. A script based on principles of motivational interviewing is used to ensure women consider pros and cons of each study condition, and if still interested in participating, they are scheduled for baseline visit. **RESULTS:** Of the 1,547 women initially eligible and interested, only 822 (53.1%) could be reached by phone for further screening and 161 (19.6%) were found ineligible. Of the 661 eligible women screened by phone, 387 (58.5%) scheduled baseline measurements. Top reasons women were ineligible include: incompetent cervix (3.3%), insulin-dependent diabetes (3.0%), and doctor contraindicated exercise during pregnancy (2.7%). After accounting for cancelled or no show ($n=126$) and in progress ($n=4$) appointments, 257 (66.2%) women have completed the in-person portion of baseline measurements, resulting in the overall recruitment yield of 16.6% (257/1547). Women who cancelled or did not show up at baseline visits were less likely to have their own cell phone ($p=0.02$) or a smart phone ($p<.004$), receive <20 texts/day ($p<.0001$), have access to a computer ($p=.007$), or have ever downloaded a podcast ($p=.0008$); women were more likely to miss or cancel appointments in April, July, and December ($p<.0001$). **CONCLUSION:** Recruitment of women in early pregnancy for a behavioral lifestyle intervention appears challenging, particularly among women with limited phone access.

3109 Board #155 May 31 2:00 PM - 3:30 PM
Evidence-based Educational Brochures Influenced Beliefs And Improved Knowledge Regarding The Benefits Of Exercise During Pregnancy

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Purpose: Women who are pregnant report receiving little or no advice about physical activity during pregnancy from their provider. The purpose of this study was to assess the effectiveness of an evidence-based educational brochure on both immediate and two-week retention of knowledge about exercise during pregnancy.

Methods: Thirty-two women of childbearing age (age: 25.0 ± 4.0 years, body mass index: 29.5 ± 6.5 kg/m²) completed a survey before exposure to an evidence-based educational brochure regarding exercise during pregnancy. Post surveys were taken immediately after viewing the educational brochure and again 2-weeks later.

Results: After exposure to educational brochures, survey scores on both surveys were significantly higher immediately-post and two-weeks post compared to baseline survey scores [Survey 1 (assessing beliefs) – pre: 79.2±8.9%, post: 92.6±7.4%, 2-weeks post: 92.0±6.5%, $p < 0.001$; Survey 2 (assessing knowledge) – pre: 65.3±16.4%, post: 81.3±14.9%, 2-weeks post: 78.8±12.4%, $p < 0.001$]. No significant differences detected between immediate post and 2-weeks post for either Survey 1 ($p = 0.72$) or Survey 2 ($p = 0.52$); suggesting the information was retained.

Conclusion: An evidence-based educational brochure is effective for improving and retaining information regarding exercise during pregnancy. Health care providers should consider providing patients with this information in order to improve knowledge and patient-provider communication on this topic.

3110 Board #156 May 31 2:00 PM - 3:30 PM
Maternal Water Exercise And Its Effects On Weight Gain And Fetal Outcomes: A Meta-analysis

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Physical activity during pregnancy is known to bring benefits not only for the mother but also for the fetus. Water-based exercises have been recommended as an adequate modality of exercise during pregnancy, however, no meta-analysis has analyzed the effects of water exercise programs on maternal weight gain and fetal outcomes including birthweight. **PURPOSE:** To conduct a systematic review and meta-analysis of randomized controlled trials to investigate the effects of prenatal water-based exercise on maternal weight gain and fetal outcomes. **METHODS:** Eligible trials were identified by a structured search of MEDLINE, EMBASE, ISI Web of Science, Scopus, and SportDiscus up to October 2018. Data were retrieved comparing standard care with standard care plus prenatal water exercise (at least once a week) for at least one of the following outcomes: maternal weight gain, gestational age at delivery, and/or fetal birthweight. Study selection and data extraction were performed by two independent reviewers. Random-effects meta-analysis was conducted for mean difference between exercise and control groups (PROSPERO registration: CRD42016039473). **RESULTS:** Our search yielded 1846 publications of which 1562 were assessed for eligibility. In total, 9 studies were eligible and included in the meta-analysis. Pregnant

women who engaged in a water exercise program showed a significant difference in total maternal weight gain (5 RCTs, $n=561$, OR -1.00 [95% CI -1.55, -0.45], $p<0.001$) compared to standard care only. No significant effects on gestational age at delivery (8 RCTs, $n=1442$, OR 0.04 [95% CI -1.02, 1.10], $p=0.94$) and birthweight (8 RCTs, $n=1427$, OR -24.32 [95% CI -86.44, 37.80]) were found. **CONCLUSION:** Water exercise during pregnancy controls maternal weight gain without influencing the duration of pregnancy or baby weight. Health care providers can consider suggesting water-based exercises during pregnancy to promote appropriate weight gain.

3111 Board #157 May 31 2:00 PM - 3:30 PM

Ripple Effect Of Lifestyle Interventions During Pregnancy On Untreated Partners' Weight

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Weight loss interventions have a positive "ripple effect" on untreated partners, but ripple effects in pregnancy are unknown. **PURPOSE:** To determine whether prenatal lifestyle interventions that reduced gestational weight gain in pregnant women had a positive "ripple" effect on untreated partner weight. **METHODS:** To determine whether prenatal lifestyle interventions that reduced gestational weight gain in pregnant women had a positive "ripple" effect on untreated partner weight. **RESULTS:** 122 partners (100% male, 23% Hispanic, 82% married, 48% obese) were randomized to intervention ($N=59$) or usual care ($N=63$). There was no intervention or intervention by time interaction effect on partner weight ($P=0.7953$). Partner weight trended higher, but weight changes were not statistically significant ($P=0.1204$) from study-entry to 35 weeks' gestation (Mean 0.19 kg; 95% CI -0.73 to 1.24) or to 12 months postpartum (Mean 0.82 kg; 95% CI: -0.84 to 1.12 kg). **CONCLUSIONS:** There was no evidence of a ripple effect on partner weight. Partner weight gain was 0.82 kg from pregnancy to 12-months postpartum. Partners of pregnant women appear not to experience sympathy weight gain. Supported by National Institutes of Health Award Number R01HL118208.

F-58 Free Communication/Poster - Systematic Reviews and Meta-Analyses

Friday, May 31, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

3112 Board #158 May 31 2:00 PM - 3:30 PM
The Effectiveness Of Tai Chi For Rehabilitation Of Post-stroke Patients: A Meta-analysis

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Stroke has been a growing public health concern that affects 33 million patients each year worldwide. Most seriously, stroke's prevalence rate increases each year worldwide. In recent years, tai chi is becoming an increasingly popular means of improving balance function and gait in patients with stroke. However, the clinical effects of tai chi beyond conventional physical therapy remain controversies.

Purpose: To systematically evaluate the effectiveness of tai chi for rehabilitation of post-stroke patients. **Methods:** Randomized controlled trials (RCTs) examining the effects of a tai chi training during 4 to 12 weeks for patients with stroke were included by searching 11 electronic databases until September 2018. Two reviewers independently extracted data and scored methodological quality by using the Physiotherapy Evidence Database scale. **Results:** 18 RCTs involving 1080 patients were identified for meta-analysis. Meta-analyses were performed using RevMan 5.3 and Stata 12.0. **Results:** Our work showed that tai chi was superior to usual rehabilitation for balance function (standard mean difference [SMD], 1.90; 95% confidence interval [CI], 1.14 to 2.66; $P<0.00001$), gait speed (mean difference [MD], 0.25 m/s; 95% CI, 0.05 to 0.45; $P=0.01$), Fugl-Meyer assessment (SMD, 1.22; 95% CI, 0.15 to 2.30; $P=0.03$) and ADL (SMD, 2.21; 95% CI, 0.57 to 3.85; $P=0.008$). **Conclusion:** Based on the current evidence and heterogeneity among studies, tai chi

with duration of 4 to 12 weeks can be cautiously recommended to effectively enhance the balance function, gait speed, motor ability of lower extremities, and activities of daily life of post-stroke patients.

3113 Board #159 May 31 2:00 PM - 3:30 PM
Exercise Effects On Cognitive Function And Adls In Alzheimer'S Disease: A Meta-analysis

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BACKGROUND: Alzheimer's Disease (AD) is the worldwide leading cause of senile dementia and affects approximately 5.3 million Americans. It is a healthcare issue which is accelerating at a rapid pace. While categorized as a disorder which cannot be cured or slowed, a convincing body of evidence has revealed protective effects of physical activity in mitigating symptoms and delaying progression of the disease.

PURPOSE: To investigate the effects of physical activity interventions on cognitive function and Activities of Daily Living (ADLs) in patients with AD. Based on these results, the design of exercise programs for individuals affected by AD are suggested.

METHODS: A Meta-Analysis was performed to analyze the effectiveness of different exercise modalities in ameliorating cognitive and functional symptoms of AD. Seven specific inclusion criteria were developed to include studies which contained exercise programs designed to improve or maintain aerobic fitness, strength, ADL performance or any combination of thereof.

RESULTS: Fourteen studies, which included 769 patients diagnosed with AD who were 65 years of age or older met the inclusion criteria for the analysis. Calculations for Effect Size (ES) and Confidence Interval (CI) showed that exercise interventions had a moderate positive effect on cognitive function ($ES=0.52$; $CI=0.15-0.89$; $p<0.001$), and a large positive effect on performance of ADLs ($ES=0.76$; $CI=0.19-1.33$; $p<0.001$). Furthermore, interventions that included an aerobic component (Aerobic Training and Multimodal Training) positively influenced cognitive function, while interventions that included resistance and functional training (Resistance Training and Multimodal Training) improved performance in ADLs.

CONCLUSION: While a large variability was found in study design, intervention, duration, and assessment measures, exercise was usually shown to have positive effects on measures of decline in AD. Exercise programs should be incorporated in the management of AD patients. The choice of exercise modality should include both aerobic and strength/functional components to achieve maximum benefit in cognitive function and ADLs performance. Multimodal Training, which includes activities across the metabolic spectrum, shows the greatest promise as an exercise intervention in AD.

3114 Board #160 May 31 2:00 PM - 3:30 PM
Insulin Resistance Adaptations To High-Intensity Interval Versus Moderate-Continuous Training In Health And Disease: A Meta-Analysis

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(No relevant relationships reported)

Besides the well-known physical fitness benefits of high-intensity interval training (HIIT) over moderate-intensity continuous training (MICT), the effect on other cardiometabolic risk factors, such as insulin resistance, is not yet well defined.

PURPOSE: to investigate the overall effects of HIIT and MICT on insulin resistance as well as subgroups analyses in i) population: healthy (H), overweight/obese (O), metabolic syndrome (MetS), type-2 diabetes (T2D); ii) age: <30 y, 30-50 y, >50 y; iii) training duration: <5 wk, 5-10 wk, >10 wk; iv) men ratio: <0.4 , 0.4-0.6, >0.6 ; and v) type of exercise: cycling vs running. **METHODS:** randomized controlled trials were identified through a systematic search in PubMed. After the selection, 17 studies were included. Small-study effects were analyzed through contour-enhanced funnel plots and the Egger's test. The standardized mean difference (Cohen's d) was the outcome used, it was calculated with the random-effects model, applying the DerSimonian-Laird estimator for the between-study variance (τ^2). Effect sizes (ES) were classified as trivial ($d<0.2$), small ($d=0.2-0.5$), medium ($d=0.5-0.8$), and large ($d>0.8$). A sensitivity analysis was performed using the leave-one-out cross-validation method. Positive and negative ES represent a favorable effect for HIIT and MICT, respectively. **RESULTS:** the overall effect presented a medium ES ($d=0.53$, $p=0.035$), with a $\tau^2=0.85$ and significant small-study effect ($p=0.01$). The population subgroup had a large ES for O ($d=1.77$, $p=0.02$), trivial ES for H ($p=0.8$), and MetS ($p=0.7$), and small ES for T2D ($p=0.6$). The age subgroup had a large ES for 30-50y ($d=0.87$, $p=0.09$), and trivial ES for <30 y ($p=0.5$) and >50 y ($p=0.5$). The training duration subgroup had a large ES for <5 wk ($d=0.97$, $p=0.055$), trivial ES for 5-10 wk ($p=0.6$), and small ES for >10 wk ($p=0.6$). The men ratio subgroup had a large ES for >0.6 ($d=1.43$, $p=0.03$), and trivial ES for <0.4 ($p=0.9$) and 0.4-0.6 ($p=0.8$). The type of exercise subgroup had a large ES for cycling ($d=0.83$, $p=0.02$) and trivial

ES for running ($p = 0.5$). **CONCLUSIONS:** despite a medium overall ES, the effects of HIIT and MICT on insulin resistance vary considerably. HIIT may be superior to MICT in improving cardiometabolic health in an overweight/obese population, men, and cycling exercise.

3115 Board #161 May 31 2:00 PM - 3:30 PM
An Alternative Model For A Meta-analysis On Exercise And Blood Pressure In Older Adults

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PURPOSE: Using a traditional random-effects model, a recent meta-analysis by Herrod et al. (2018) reported statistically significant reductions in both resting systolic blood pressure (SBP) and diastolic blood pressure (DBP) as a result of aerobic, resistance, and combined aerobic and resistance exercise in adults with a mean age of 65 years and older. However, a recently proposed and alternative method, the inverse heterogeneity model (IVhet), has been shown to provide more robust findings. The purpose of this study was to apply the IVhet model to these previous meta-analytic findings. **METHODS:** Data from 41 randomized controlled trials representing 96 groups (52 exercise, 44 control) were pooled using the IVhet model. In addition, absolute and relative differences between the IVhet and random-effects model were calculated. Data were reported using the mean difference (exercise minus control) with non-overlapping 95% confidence intervals considered statistically significant. **RESULTS:** Using the IVhet model, statistically significant reductions in resting blood pressure were found as a result of aerobic exercise (SBP, -4.7 mmHg, 95% CI, -7.7 to -1.8; DBP, -2.0 mmHg, 95% CI, -3.13 to -0.89), SBP but not DBP for resistance training (SBP, -7.0 mmHg, 95% CI, -10.5 to -3.4; DBP, -1.2 mmHg, 95% CI, -2.7 to 0.31), and both SBP and DBP for combined aerobic and resistance training (SBP, -5.5 mmHg, 95% CI, -8.3 to -2.7; DBP, -3.7 mmHg, 95% CI, -4.8 to -2.7). When compared to the random-effects model, findings from four of the six mean differences in blood pressure were smaller, ranging from -0.82 to -0.19 mmHg (6.1% to 41.0%) while all six 95% CI were wider, ranging from 0.24 to 1.56 mmHg (11.5% to 36.8%). **CONCLUSIONS:** These findings suggest that with the exception of changes in DBP as a result of resistance training, exercise (aerobic, resistance, combined aerobic and resistance) reduces resting SBP and DBP in older adults. Importantly, these findings are generally smaller than those previously reported, a factor that could have practical implications. Future studies should consider using the IVhet model when conducting an aggregate data meta-analysis.

3116 Board #162 May 31 2:00 PM - 3:30 PM
The Effect Of Qigong On Chronic Obstructive Pulmonary Disease: A Systematic Review And Meta-analysis

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PURPOSE: This review aims to investigate the effect Qigong on chronic obstructive pulmonary disease (COPD).

METHODS: All randomized controlled clinical trials published in English or Chinese and involving the use of Qigong by patients with COPD were searched in PubMed/MEDLINE, Cochrane Library, Embase, PsycINFO, Cambase databases, CNKI, and WanFang databases from their respective inception to June 2018. The meta-analysis was conducted using the Revman 5.3. The quality of the included trials was assessed using the Jadad rating scale. Two researchers independently completed the inclusion, data extraction, and quality assessment.

RESULTS: Fourteen RCTs with 1274 COPD patients met the inclusion criteria. The meta-analysis revealed that the FEV1, FEV1%, FEV1/FVC% and 6MWD was significantly enhanced in the experimental group (FEV1 mean difference [MD] = 0.29, 95%CI: 0.09 to 0.48; FEV1% MD=6.09, 95% CI: 3.15 to 9.04; FEV1/FVC% MD=4.20, 95% CI: 1.88 to 6.51; 6 months: MD=57.52, 95% CI: 17.48 to 97.57) than the control group. There was no significant difference in FVC between the experimental group and the control group ($P > 0.05$).

CONCLUSION: Qigong exercise can improve the lung function and exercise ability of COPD patients. However, future research with better quality RCTs needs to explain the mechanism of the positive effect of Qigong on COPD. (This study was supported by Fundamental Research Funds for the Central Universities at SWU Grant 1709240.)

3117 Board #163 May 31 2:00 PM - 3:30 PM
Evidence for Kinesio Taping in Management of Myofascial Pain Syndrome: A Systematic Review and Meta-analysis

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Myofascial pain syndrome (MPS) is one of the most common neuromuscular system diseases and is also easily misunderstood in pain clinic. And kinesio taping has been gradually used by physiotherapists or pain clinicians in the pain clinic as a clinical support treatment for MPS. However, no evidence-based medical data is available to support the advantageous effect of kinesio taping on MPS over other treatments at post-intervention and follow-up. **PURPOSE:** To evaluate the effectiveness of kinesio taping for managing MPS in terms of pain intensity, pressure pain threshold, range of motion (ROM), muscle strength and disability. **METHODS:** PubMed, EBSCO, ScienceDirect, Web of Science, Cochrane Library and Physiotherapy Evidence Databases were searched from database inception to January 2018. Randomised controlled trials (RCTs) that used kinesio taping as the main treatment protocol for participants diagnosed with MPS were included. Two reviewers independently screened articles, scored methodological quality by using Cochrane risk-of-bias tool and extracted data. The primary outcomes were pain intensity, pressure pain threshold and ROM at post-intervention and follow-up. The secondary outcomes were muscle strength and disability at post-intervention and follow-up. **RESULTS:** Meta-analyses of 15 RCTs involving 713 patients, showed that kinesio taping was more effective than other treatments in improving pain intensity (mean difference [MD] = 0.94 cm, 95% confidence interval [CI]: -1.55 cm to -0.32 cm, $p=0.003$) and ROM (standardised mean difference [SMD] = 0.32, 95% CI: 0.12 to 0.52, $p=0.002$) at post-intervention. Kinesio taping was also superior to other non-invasive techniques in relieving pain intensity at follow-up (MD = -0.68 cm, 95% CI: -1.22 cm to -0.13 cm, $p=0.02$). **CONCLUSION:** The latest evidence statistically supports the use of kinesio taping over other treatments for relieving the pain intensity and range of motion of patients with myofascial pain syndrome at post-intervention. Kinesio taping is also statistically superior to other non-invasive techniques in relieving pain intensity at follow-up. However, no significant superiority of kinesio taping was found in pressure pain threshold, muscle strength and disability.

3118 Board #164 May 31 2:00 PM - 3:30 PM
Sprint Interval Training or High-intensity Interval Training to Improve VO_{2max} In Sedentary Individuals? A Meta-analysis.

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PURPOSE: To evaluate improvements in VO_{2max} in sedentary adults aged 18-55 comparing sprint interval training (SIT) vs high intensity interval training (HIIT) vs continuous cardiovascular training (CCVT).

METHODS: A systematic literature search (key terms: HIIT, endurance, interval training, SIT, and VO_2) was conducted of electronic databases (PubMed, Scopus, Sport Discus, Science Direct, Web of Science, Google Scholar) to ascertain appropriate studies. The inclusion properties for the studies were: sedentary individuals between the ages of 18-55 free of comorbidities other than being overweight or obese; included a continuous training group; completed a pre and post VO_{2max} graded exercise test. These search criteria yielded 20 studies evaluating HIIT protocols totaling 527 subjects in the interval group and 214 subjects in the CCVT group. There were nine studies studying a SIT protocol with 111 total subjects in the interval group and 85 subjects in the CCVT group.

RESULTS: Statistics and effect sizes were calculated using G*Power software (Heinrich-Heine-Universität Düsseldorf) with a post-hoc two-tailed designed t-test with α error at .05. Training, regardless of type, increased VO_{2max} . HIIT increased VO_{2max} by 11.421%, whereas SIT increased it by 10.353%, followed by CCVT with an increase of 7.361%. Cohen's d provided effect sizes comparing HIIT, SIT, and CCVT training groups. Both HIIT and SIT had large Cohen's d effect sizes at 1.053 and 0.764, respectively, compared to a moderate effect size of 0.506 for the CCVT group. **CONCLUSIONS:** Both HIIT and SIT are valid options for increasing the VO_{2max} of sedentary individuals with a relatively small commitment time needed. This could have implications for participant adherence to the protocol. Both HIIT and SIT had a significantly positive effect on the participant's VO_{2max} when compared to the CCVT group. However, CCVT also improved their VO_{2max} . Therefore, any sustained physical activity is beneficial for sedentary adults to improve VO_{2max} .

3119 Board #165 May 31 2:00 PM - 3:30 PM
Aerobic Exercise And Balance In Adults Over 50 Years: Meta-analysis Of Randomized Controlled Trials

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(No relevant relationships reported)

Various interventions have combined aerobic exercise with strength, power or balance training and the direct effect on balance in older adults. The specific effect of aerobic exercise on balance is unclear. **PURPOSE:** The purpose of this study was to analyze the effect of aerobic exercise on balance in older adults. **METHODS:** The systematic search was made on academic scientific bases: Academic Complete Search, ProQuest, PubMed, Science Direct and Sport Discuss, using the Boolean phrase: (aerobic exercise OR aerobic training) AND (adult* OR aging* OR senior* OR older adult*) AND (balance*) NO (diet or nutrition) NO (Animal) And random*. The inclusion criteria were: publications in English or Spanish, full text, older adult (people and women), people over 50 years, experimental and quasi-experimental studies, treatment focused on aerobic exercise and dynamic or static balance indistinctly of the type of test. We analyzed 4496 studies and only 11 investigations met the inclusion criteria, obtaining 56 effect sizes (TE) in 590 subjects. The moderator variables were age, sex, level of physical activity, health condition, N per study, duration of the session and exercise modality. **RESULTS:** The overall effect size for the experimental conditions was $TE = 1.083$, ($p \leq 0.05$) (95% CI: 0.63 - 1.53, $Q = 679.07$, $p = 0.00$, $I^2 = 99.55$); the effect size of the control group was $TE = 0.056$, ($p = 0.685$) (95% CI: -0.14, .25, $Q = 11.48$, $p = 0.009$, $I^2 = 73.88$). There were no differences in differences between the control groups of TE ($n = 16$) and experimental group ($n = 40$) ($F = 2.73$, $p = .104$). The Cochran's Q test for the experimental group presents values that indicate that the calculated effect sizes have high heterogeneity according to Borenstein, et al. (2009). In addition, the Egger test was applied and this gave the following data $t = 4.55$, $gl = 54$, $p = 0.000$ *, accepting the alternative hypothesis indicating that there is asymmetry; procedure that detected a publication bias. **CONCLUSION:** Aerobic exercise (AE) exerts a positive effect on the balance of older adults; therefore, AE training is a valid strategy to counteract the loss of balance in older adults.

F-59 Free Communication/Poster - Athlete Nutrition

Friday, May 31, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

3120 Board #166 May 31 2:00 PM - 3:30 PM
NCAA Division III Football Players Dietary Intake: In Season vs. Off Season

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(No relevant relationships reported)

Excess caloric intake leads to weight gain which contributes to an increase in health risks such as those associated with metabolic syndrome. **PURPOSE:** The purpose of this study was to examine the diet of division III football players in and off season and to identify the differences between skilled and unskilled players. **METHODS:** Twenty-two players [18.9 ± 0.79 yr] completed in (F, Fall) and off season (S, Spring) testing. Data included height, weight, body composition and a 24 hour diet recall using the 5-pass method. Nutrition data were analyzed using Food Processor software. In and off season data were compared using a paired sample t-test. Repeated measures ANOVA was used to test for differences between skilled and unskilled players. This study was approved by the Linfield College Institutional Review Board. **RESULTS:** All players gained weight ($F: 86.1 \pm 13.1$ kg; $S: 92.0 \pm 12.8$ kg, $p = 0.033$) by spring. The weight gain was associated with an increase in percentage body fat ($F: 13.8 \pm 4.6$; $S: 16.3 \pm 4.4$, $p = 0.028$). All players decreased total caloric intake in the spring ($F: 5553 \pm 1922$ kcal; $S: 3972 \pm 1384$ kcal, $p = 0.0008$). There were no differences in the macronutrient distribution (%kcal) at either time point (Fat: $F: 37.3 \pm 5.9\%$; $S: 37.3 \pm 9.1\%$; Carbohydrate $F: 47.5 \pm 6.8\%$, $S: 46 \pm 11.0\%$ Protein $F: 15.2 \pm 3.8\%$; $S: 16.87 \pm 4.5\%$). The player's relative protein intake (g/kg) was lower in the off season ($F: 2.60 \pm 1.36$; $S: 1.87 \pm 0.97$; $p = 0.036$). Sodium and cholesterol consumption decreased from F to S but remained above the daily recommended intake for all players. There were no differences in total calories, macronutrient composition, relative protein intake, sodium or cholesterol between the skilled and unskilled players. A majority of the players meals were consumed at the college dining hall. **CONCLUSION:** Body weight and percent body fat increased from F to S with an associated increased caloric intake during the season. The players consumed large amounts of calories with a high percentage of fat during the season. All players decreased caloric intake in the off season. The change in body weight and body composition may increase health

risks in the long run. It is important for players to make dietary choices to maximize performance and reduce long term health risks within the constraints of eating at the college dining hall.

3121 Board #167 May 31 2:00 PM - 3:30 PM
Rapid Weight Loss Negatively Affects Body Composition and Serum Creatinine in Elite Judokas

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(No relevant relationships reported)

The most frequently used rapid weight loss (RWL) methods in weight-sensitive sports were dehydration and decreased energy intake, with RWL accompanied by many adverse health effects. **PURPOSE:** To evaluate the effects of 7-day RWL intervention on body composition and biomarkers of creatine metabolism in eight elite judokas during a pre-competition period. **METHODS:** The participants voluntarily participated in this study. Strategy of weight loss included restriction of fluid and food intake, and started 7 days before competition. During the first six days, dietary changes included restricted intake of fluids and macronutrients (35% reduction in total caloric intake), followed by a total food restriction on the last day (a weigh-in day). **RESULTS:** RWL induced a significant drop in weight (81.7 ± 10.7 kg at baseline vs. 76.8 ± 10.3 kg at follow-up; $P < 0.001$), fat mass (12.6 ± 5.6 kg vs. 9.2 ± 4.0 kg; $P = 0.003$) and fat-free mass (69.1 ± 7.3 kg vs. 67.6 ± 7.7 kg; $P = 0.05$), accompanied by an increase in serum creatinine levels at follow up (104.0 ± 10.5 $\mu\text{mol/L}$ vs. 114.9 ± 10.2 $\mu\text{mol/L}$; $P = 0.009$). **CONCLUSIONS:** An acute restriction of food and fluid intake appears to negatively affects fat-free mass and indices of kidney function in judokas. Decreased tubular secretion of creatinine due to poor fluid intake (and excretion) might be a possible cause of elevated serum creatinine and a potential kidney stress after RWL, which requires further investigation. This project was partly supported by the Serbian Ministry of Education, Science and Technological Development (175037 and 179011), the Provincial Secretariat for Higher Education and Scientific Research (142-451-2473 and 114-451-710) and the Faculty of Sport and Physical Education, University of Novi Sad (2018 Annual Award).

3122 Board #168 May 31 2:00 PM - 3:30 PM
Intentions Matter When It Comes to Body Composition Changes in DIII Athletes Over Summer Break

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(No relevant relationships reported)

In Division III, coaches cannot require athletes to report summer workouts, but can suggest what should be done to be ready the upcoming season. Coaches also cannot cut an athlete based on knowledge of a lack of summer workouts. **PURPOSE:** To determine whether athlete intentions lead to efficacious outcomes in DIII athletes over summer break. It was hypothesized that due to lack of accountability, body composition intentions over summer break would not be achieved. **METHODS:** Fifty-one student athletes (32 women, 19 men; 20 ± 1.77 ; 1 years old) had their body composition assessed in May in addition to their intention(s) regarding body composition changes over summer break (increase muscle mass and/or decrease fat mass or no change). Body composition was again assessed in August of the following school year. **RESULTS:** Only an intention to increase muscle mass or decrease body fat mass led to no significant change in either variable. When athletes had the combined intention of increasing muscle mass and decreasing fat mass, a significant decrease in body fat percentage was observed (-1.8 ± 1.77 ; 2.3%; $p = 0.017$). Independently, the increase in muscle mass ($+1.33 \pm 1.77$; 2.3kg; $p = 0.063$) and decrease in fat mass (-1.1 ± 1.77 ; 2.2kg; $p = 0.094$) were not significant. **CONCLUSIONS:** Thus, these data suggest in order to achieve a decrease in fat mass, that has a significant impact on percent body fat, this intention should be combined with the intention to increase muscle mass. Additionally, singular intentions did not evoke intended body composition changes.

3123 Board #169 May 31 2:00 PM - 3:30 PM
The Effect of Feedback on Pre-Game Hydration Status of Division II Collegiate Basketball Players.

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Proper hydration is vital to peak athletic health and performance. Although hydration status is relatively simple to monitor, regular hydration testing is rarely implemented in sport regardless of competition level. Consequently, many athletes enter competition unaware of their hydration status, preventing opportunities to begin in an optimal state of readiness. **PURPOSE:** To evaluate the effect of hydration testing and simple feedback on pre-game hydration status of collegiate basketball players. **METHODS:** Twenty men's collegiate basketball players from a single NCAA Division II university participated in this study during the 2016-17 (N = 14) and 2017-18 (N = 12) seasons. In Season 1, players' urine specific gravity (USG) and body weight (BW) were assessed 1-2 hours prior to the start (PRE) of eight pairs of regular season conference games (16 games total) played on consecutive days (Fri & Sat). In Season 2 (10 games), players' USG was assessed 4-5 hours before game time, at which time they were provided feedback about their hydration status. USG was reassessed 1-2 hours prior to game time, along with BW. USG was measured using a hand-held clinical refractometer. Hydration status was defined as: hyperhydrated (HYP; USG < 1.005), euhydrated (EUH; $1.005 \leq \text{USG} < 1.020$), moderately hypohydrated (MOD; $1.020 \leq \text{USG} < 1.025$), and severely hypohydrated (SEV; USG ≥ 1.025). BW was measured using a digital scale, with players wearing similar clothing each time. **RESULTS:** PRE hydration status, based on proportional distribution, was significantly different between Season 1 and Season 2 (P < 0.001). In Season 1, 41.4% of players were EUH and 24.9% were MOD at PRE compared to 82.3% and 4.6% in Season 2, respectively. While 27.1% of players were SEV at PRE in Season 1, no players were SEV at PRE in Season 2. There was no change in PRE USG from Fri (1.018 ± 0.008) to Sat (1.019 ± 0.008) in Season 1 (P = 0.077), but PRE USG on Sat (1.010 ± 0.005) was significantly lower than on Fri (1.011 ± 0.006) in Season 2 (P = 0.015). **CONCLUSION:** The implementation of hydration testing and simple feedback significantly improved pre-game hydration status of collegiate basketball players compared to hydration testing alone. Athlete monitoring, when combined with proper feedback and education, can be used effectively to optimize athletic readiness.

3124 Board #170 May 31 2:00 PM - 3:30 PM
Perceptions of Food Group Recommendations in Division II Athletes

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 (No relevant relationships reported)

PURPOSE: The purpose of the project was to conduct a needs assessment in order to make targeted nutrition education available to athletes at an NCAA Division II university. **METHODS:** 82 athletes (10 males, 72 females) completed a survey designed to explore eating patterns, to assess basic nutrition knowledge, and to determine nutrition topics about which participants wanted to receive nutrition information. Survey items included nutrition education preferences, gender, height, weight, activity level, nutrition knowledge questions, as well as how many servings of fruits, vegetables, grains, dairy and protein they typically consumed and how many servings they thought they needed. Guidelines for quantities and examples were provided. **RESULTS:** Hydration and protein were the topics most frequently requested (74% and 72% of those making requests). Daily caloric and food group needs were estimated using information from the 2015-2020 Dietary Guidelines based on age, gender, and activity level. Consumption patterns (C) and perceived needs (PN) were compared to recommendations (R). C < R for vegetables (81.7%), fruits (41.5%), protein (61%), grains (86.6%), and dairy (81.7%). PN < R for vegetables (29.3%), fruits (9.8%), protein (53.7%), grains (85.4%), and dairy (48.8%). PN < C for vegetables (6.1%), fruits (15.9%), protein (67.1%), grains (43.9%), and dairy (13.4%). **CONCLUSION:** Since athletes were aware that their consumption of vegetables was lower than recommended, they may be receptive to strategies for incorporating vegetables into their diets. Awareness of the need for information about protein was reflected by their requesting information on the topic and by the consistency of the percentage of athletes with protein C < R and PN < R. Apparently low consumption of and awareness of the need for carbohydrates such as grains may be affecting performance among these athletes. Dairy consumption was lower than the perceived need for dairy, suggesting the need for information in this area. Basic nutrition education relating to food groups is relevant for this group of NCAA Division II athletes.

3125 Board #171 May 31 2:00 PM - 3:30 PM
Food Servings Ingested Before And After An Intervention Program In A University Setting

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 (No relevant relationships reported)

PURPOSE: To compare the food servings ingested by food groups after a 12-week intervention program to promote physical activity in a university setting. **METHODS:** 66 (32 men, 34 women) subjects belonging to the university community (teachers, students, administrative staff) of three different University Centers of the University of Guadalajara were evaluated on their food habits. They were asked about their daily food intake employing a food frequency questionnaire by standardized staff during the interview process. Each subject described how many days per week he/she usually ate each food and the usual amount they consumed on those days. A daily average of food group servings was calculated. Servings' size were determined according to Mexican System for Equivalent Foods. The sample was divided into three groups: Device group (D, participants wore an accelerometer), Device plus counseling group (DC, participants wore an accelerometer and received a series of tips by a website to promote the physical activity and to change health-related behaviors), and Control group (CO, participants received no intervention). Comparisons were considered significant at a p-value < 0.05. **RESULTS:** Subjects' age, body weight, and stature were: 24 ± 7 y 21 ± 7 years, 69.9 ± 12.9 y 57.9 ± 13.0 kg; y 172.1 ± 8.4 y 160.1 ± 8.4 cm, for men and women, respectively. Cereals was the food group most consumed and Legumes the less one for all groups. Considering the average, the intake of Fats increased for all groups. However, Seeds group decreased significantly in the D and CO groups only. No other significant difference was observed. **CONCLUSIONS:** The addition of non-contact counseling was associated with no change in Seeds group in comparison with the other groups. Maybe this kind of intervention might not be effective to modify food intake in this population.

Table. Food servings ingested by Food Group in the studied Groups (n=66)

	Device (n = 25)		Device plus counseling (n = 25)		Control (n = 16)	
	Pre	Post	Pre	Post	Pre	Post
ASF	6.0 $\pm 3.1^*$	5.4 ± 2.7	6.0 ± 3.0	5.0 (2.0 - 14.0)	7.7 ± 3.9	7.1 ± 3.0
Dairy	2.0 (0.0 - 7.0)**	3.0 (0.0 - 11.0)	2.6 ± 1.6	2.0 (0.0 - 4.0)	3.6 ± 1.5	3.4 ± 1.9
Legumes	1.0 (0.0 - 6.0)	1.0 (0.0 - 6.0)	0.0 (0.0 - 1.0)	0.0 (0.0 - 3.0)	1.0 (0.0 - 2.0)	1.0 (0.0 - 2.0)
Cereals	6.0 (3.0 - 18.0)	8.2 ± 4.0	7.8 ± 3.8	7.0 (3.0 - 24.0)	10.3 ± 5.9	8.0 (1.0 - 28.0)
Vegetables	2.0 (0.0 - 5.0)	2.0 (0.0 - 8.0)	2.0 (1.0 - 6.0)	2.0 (0.0 - 7.0)	1.5 (0.0 - 12.0)	2.0 (1.0 - 6.0)
Seeds	2.0 (0.0 - 11.0)	1.0 (0.0 - 7.0) ^a	0.0 (0.0 - 11.0)	0.0 (0.0 - 3.0)	1.0 (0.0 - 9.0)	0.5 (0.0 - 3.0) ^a
Fats	3.0 (0.0 - 16.0)	4.0 (2.0 - 16.0) ^a	4.0 (0.0 - 17.0)	5.0 (1.0 - 15.0) ^a	3.5 (0.0 - 15.0)	5.0 (2.0 - 22.0) ^a
Fruits	3.6 ± 2.0	3.0 (1.0 - 10.0)	3.0 (1.0 - 11.0)	3.0 (1.0 - 11.0)	2.5 (0.0 - 13.0)	4.2 ± 2.6
Sugars	2.7 (0.0 - 12.0)	2.0 (0.0 - 8.0)	2.0 (0.0 - 10.0)	1.0 (0.0 - 5.0)	2.0 (0.0 - 8.0)	2.0 (0.0 - 7.0)

ASF: Animal source foods. * Mean \pm standard deviation. ** Median (min - max). ^a p < 0.05 pre vs post.

3126 Board #172 May 31 2:00 PM - 3:30 PM
Collegiate Athletes That Consumed Adequate Energy Post-concussion Reported Fewer Days Of Concussion-related Symptoms

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(No relevant relationships reported)

PURPOSE: To determine whether meeting overall calorie intake impacts the number of days an athlete has concussion-related symptoms following diagnosis.

METHODS: Fourteen Division I collegiate athletes with a mean age of 20.14 ($SD=1.027$) who were diagnosed with a concussion were randomly placed in a control group ($n=7$) or intervention group ($n=7$). In both groups, daily caloric intake was compared to total daily caloric needs and the individual was coded as met or did not meet energy needs. Concussion related symptoms were assessed using the Sports Concussion Assessment Tool (SCAT5) Symptom Evaluation Form. For the intervention group, four single serving packets of a carbohydrate supplement were provided following immediate impact at the suspicion of a concussion or within 30 to 60 minutes of diagnosis (two servings immediately at suspicion or following diagnosis of concussion, and one serving every other hour within the first 4 hours following the initial servings), and two single serving packets during daily concussion protocol evaluation until the athlete reported no symptoms. A 2x2 Factorial ANOVA was conducted on the total number of days of concussion symptoms with respect to daily average calories being met (AvgCalories) and comparing the control and intervention groups (ControlIntervention).

RESULTS: Statistically significant differences were found in a number of days of concussion symptoms between those who met average daily caloric needs and those who did not, $F(1, 14) = 7.826$, $p < .05$. No statistically significant difference was seen in the number of days of concussion symptoms between athletes who were in the control group and the intervention group, $F(1, 14) = 0.936$, $p = .356$. Although a statistical significance was not observed in the number of days of athlete symptoms, an average decrease in the number of days was observed in the intervention ($M = 4.43$, $SD = 2.37$) when compared to the control ($M = 8.57$, $SD = 5.09$), $t(7) = 2.357$, $p = .151$.

CONCLUSION: In this population, athletes that meet their daily caloric needs had fewer days that they experienced concussion related symptoms compared to the subjects that did not meet their caloric needs. This preliminary research suggests that it is beneficial to assure that individuals are aware of their caloric needs and strive to meet them following the diagnosis of a concussion.

3127 Board #173 May 31 2:00 PM - 3:30 PM
Body Composition And Food Consumption Of A Group Of Trekkers Of sãO Paulo - Sp, Brazil

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(No relevant relationships reported)

The demand for physical activities in the nature has increased a lot and one of the most practiced modalities in Brazil is the trail. The trail is characterized by open paths amidst nature and it is considered the main form of access to preservation areas and lush landscapes. Due to the lack of national literature regarding trekkers, it is justified the importance of studying these sportsmen. **PURPOSE:** Evaluate the body constitution and the food consumption of a group of trekkers of São Paulo, Brazil.

METHODS: Cross-sectional study, approved by the Research Ethics Committee of the Mackenzie Presbyterian University, performed with trekkers of both sexes, who consented to participate in the research. To assess body composition showed the weight, height, skinfolds and body circumferences. The percentage of body fat was calculated by the Body Density (D) calculation proposed by Durnin and Womersley (1974) and subsequent conversion of D by the Siri's equation (1961). The body fat percentage classification was made according to Lohman et al. (1992). The food consumption was evaluated by a 24-hour Recall. The macronutrients, fatty acids, vitamins A, C, E, calcium, magnesium and iron were calculated using Avanutri® Software version 4.0. We used the recommendations of the Institute of Medicine (2001) and the Brazilian Society of Cardiology (2013). The analysis of the average difference between nutrients and anthropometric variables was made by Student's t test and Analysis of Variance (ANOVA). **RESULTS:** 14 trekkers were evaluated with an average age of 29 years, 50% female and 50% male. It was observed that 35.71% of the participants were overweight and 50.0% showed a high fat percentage. Men had higher stature and weight, while women presented higher fat percentage and biceps skinfold ($p < 0.001$). It was found adequate intake of macronutrients, but the consumption of saturated fats and cholesterol was high. There was also a high prevalence of inadequacy about calcium consumption and greater intake of lipids by men ($p < 0.05$). **CONCLUSIONS:** It is recommended that the trekkers search for guidance on food and nutrition, seeking a good performance and greater utilization of this experience with nature.

3128 Board #174 May 31 2:00 PM - 3:30 PM
Association Of The Adequate Intake Of Macronutrients Between Strength Levels From 1RM In University Athletes

Sayra Nataly Muñoz-Rodriguez, Alejandro Gaytan-Gonzalez, Sergio Alejandro Copado-Aguila, Roberto Gabriel Gonzalez-Mendoza, Joaquin Ojeda-Robles, Juan R. Lopez-Taylor, Marisol Villegas-Balcazar. *Universidad de Guadalajara, Guadalajara, Mexico.*

(No relevant relationships reported)

PURPOSE: To analyze the association between the proportions of athletes with adequate macronutrient intake with one repetition maximum (1RM) on bench press in college athletes.

METHODS: 164 (103 men, 61 women) college athletes from different sports were evaluated. 24-h dietary recalls were administered to estimate the macronutrient intake. Carbohydrate (CHO), protein (PRO) and fat (FAT) intake were calculated and adjusted for body weight (g/kg/day). Consumption was classified as "adequate" if the athlete consumed the recommended minimum amounts for each macronutrient: 5 g/kg/day of CHO, 1.2 g/kg/day of PRO, and 0.5 g/kg/day of FAT. Bench press 1RM test was performed to determine the maximal strength. Then, 1RM was classified into sex-specific quartiles (Men: Q1 <57.8 kg, Q2 57.8 - 66.8 kg, Q3 66.9 - 80.3 kg, and Q4 >80.3 kg; Women Q1 <35.1 kg, Q2 35.2 - 39.6 kg, Q3 39.7 - 48.8 kg, and Q4 >48.8 kg) of displaced weight (kg). The proportion of athletes with an adequate intake of each macronutrient was compared between 1RM quartiles and analyzed by sex. Similarly, the proportion of subjects with adequate intake were compared between macronutrients within quartiles. Chi-square and multiple Z tests (with Bonferroni adjustment) were used to determine significant differences between groups. Significant differences were deemed at a p -value ≤ 0.05 .

RESULTS: There were no significant differences in the proportions of adequate intake between 1RM quartiles for all three macronutrients, for both men and women ($p > 0.05$). However, while analyzing the proportion of subjects with adequate macronutrient intake within quartiles, CHO was the one with the lowest proportion on men for all quartiles. The same pattern was observed in women except for Q1 (Table).

CONCLUSIONS: No association between adequate macronutrients intake and 1RM bench press strength levels were observed. However, CHO was the macronutrient with the lowest proportion of athletes achieving the minimum recommended intake.

Table. Proportion of participants with adequate macronutrient intake by 1RM strength quartile.						
		Q1	Q2	Q3	Q4	p-value
Men	PRO	13 (93%) ab	28 (90.3%) a	27 (84.4%) a	24 (92.3%) a	0.734
	FAT	14 (100%) b	29 (93.5%) a	30 (93.8%) a	24 (92.3%) a	0.786
	CHO	8 (57%) a	20 (64.5%) b	18 (56.2%) b	11 (42.3%) b	0.412
	p-value	0.005	0.004	0.001	<0.001	
Women	PRO	7 (70%)	20 (83.3%) a	13 (86.7%) a	10 (83.3%) a	0.744
	FAT	9 (90%)	21 (87.5%) a	15 (100%) a	10 (83.3%) a	0.483
	CHO	6 (60%)	6 (37.5%) b	4 (26.7%) b	2 (16.7%) b	0.166
	p-value	0.303	0.001	<0.001	0.001	
Data expressed as frequencies (%). Different letters denote significant differences between nutrients within quartiles ($p < 0.05$).						

3129 Board #175 May 31 2:00 PM - 3:30 PM
A Comparison Study of Energy Expenditure and Nutrition Intake in Amateur Athletes in Long Distance Running

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(No relevant relationships reported)

PURPOSE: By analyzing the energy expenditure figures of each group (training group, marathon group and cross-country running group) and their nutrition intake figures, some reasonable suggestions were given to solve the problem of nutrition intakes in daily training or competition.

METHODS: The energy expenditure data were collected by wearing 3-axis accelerometer (ActiGraph GT3X, USA) when 10 amateurs did 10km training, 6 amateurs did marathon competition, and 6 amateurs did 50-100 km cross-country running. They were asked to recall and record all the foods and beverages during competition or training. After measuring energy expenditure during their exercises, and recording the process of nutrition supplement, we compared the differences in energy expenditures of different groups, and analysis the relativity between energy expenditures and nutrition intakes.

RESULTS: (1) The energy expenditure figure of training group was 0.66 ± 0.10 kcal/kg/km, which was observably less than those of marathon group (1.22 ± 0.32 kcal/kg/km) and cross-country group (1.20 ± 0.18 kcal/kg/km) ($P < 0.01$); however, there was no any obvious difference between the marathon group and cross-country group ($p > 0.05$); (2) The calorie of supplement intakes was 756.17 ± 387.80 kcal/kg/km, which was significant lower than the calories of energy expenditure (2331.61 ± 939.30 kcal/kg/km) in 22 amateurs. However, there was a positive correlation between energy expenditure and supplement intake among the 22 amateur athletes ($r = 0.950$, $P < 0.01$). **CONCLUSIONS:** (1) The energy expenditure level during daily training was obviously lower than which during competition in amateur runners; (2) The nutrition intake didn't meet the demand of energy cost during long distance running although the runners had followed the principle of "the more energy cost, the more supplement will need".

3130 Board #176 May 31 2:00 PM - 3:30 PM

The Exercise Microbiome Project: An 8 week Cardiovascular Intervention on the Human Gut Microbiome

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(No relevant relationships reported)

INTRODUCTION: The effects of diet and exercise are well studied in connection with human health. However, the relationship between the human gut microbiome (HGM) and exercise is not well understood. **PURPOSE:** The purpose of this study was to examine possible changes to the HGM diversity and composition resulting from an 8-week intervention of cardiovascular exercise (CVE). **METHODS:** Twenty-seven participants (20 F and 7 M) aged 18-25 years were recruited. Inclusion/exclusion criteria were determined using the AHA/ACSM pre-screening questionnaire along with screening for historical factors that might impact the microbiome. Fecal samples for HGM profiling were collected weekly, during three phases of the project: baseline (4 wks; no CVE), intervention (8 wks; CVE 3x wk), and washout (4 wks; no CVE). Pre/post VO_2 max and body composition analyses were conducted. Heart rate ranges for the CVE intervention were pre-determined by the subject's VO_2 max test. Gut microbiota were profiled using 16S rRNA gene sequencing. Microbiome sequence data were analyzed with the QIIME 2 bioinformatics platform. **RESULTS:** To track changes in each subject's HGM, community richness and composition were compared to the week 1 (baseline) values for each subject. One week after the CVE began there was a significant change ($p = 0.0001$) in the HGM composition. This change persisted through week 11, when the CVE program stopped and microbial compositions abruptly returned to baseline values. Interestingly, in week 8, some individuals seem to have returned to a composition similar to baseline. Reasons for this anomaly are unclear. Additionally, each individual's community richness and compositions were compared to the prior week to understand week-to-week changes, demonstrating a significant shift ($p = 0.0002$) in composition at week 8, indicating settlement into a novel HGM composition. The week to prior week community richness showed significant decreases in weeks 7-9 ($p = 0.02$). This was followed by a significant increase in week 12 ($p = 0.017$). **CONCLUSION:** The CVE intervention showed significant changes in HGM richness and composition that correlated with the beginning and the end of the CVE intervention. These changes indicate that exercise has a clear impact on the HGM and further studies are needed to uncover the underlying mechanism.

F-60 Free Communication/Poster - Micronutrients

Friday, May 31, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

3131 Board #177 May 31 2:00 PM - 3:30 PM Oral Calcium Loading Before Exercise Influences PTH and CTX Responses

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(No relevant relationships reported)

Timing of calcium (Ca) ingestion relative to exercise may attenuate observed increases in parathyroid hormone (PTH) and c-terminal telopeptide of type I collagen (CTX, a marker of bone resorption). Controlled Ca supplementation studies have typically used doses of ≥ 1000 mg, but it is not known how much Ca is absorbed. **PURPOSE:**

to quantify Ca absorption during exercise when preceded by a high (H: 1015 mg) or low (L: 215 mg) Ca-containing meal and determine effects on serum PTH, CTX, ionized Ca (iCa), and total Ca (tCa). **METHODS:** Healthy, cycling-trained men ($n=10$, aged 20-45 y) underwent two identical 1-hour cycling bouts at $\sim 75\%$ HRmax. In a randomized, cross-over design utilizing dual calcium tracers, participants were provided with a H or L Ca meal 2 hours before exercise. Each meal included 15 mg of $^{44}\text{CaCO}_3$. A bolus dose of 2.5 mg of $^{42}\text{CaCl}_2$ was administered 4 hours before exercise followed by a constant infusion of $^{42}\text{CaCl}_2$ at 0.0125 mg/hr that continued through exercise and a 1-hour recovery. Gut absorption was determined from the appearance of the oral tracer in plasma relative to the rate of disappearance of the IV tracer using compartmental modeling. Blood was sampled every 15 minutes during exercise and recovery. Urine was collected prior to the meal, immediately before exercise, and at the end of recovery. **RESULTS:** Ca absorbed was 2.5 times higher with H versus L (H: 295 ± 158 mg; L: 116 ± 50 mg; $p=0.007$); there was no difference in urinary Ca excretion (H: 22 ± 15 mg; L: 21 ± 18 mg). Changes in iCa during exercise were not different (H: -0.03 ± 0.11 mg/dL; L: -0.08 ± 0.24 mg/dL; $p=0.46$). H prevented the increase in CTX during exercise (H: -0.03 ± 0.04 ng/mL; L: 0.02 ± 0.05 ng/mL; $p=0.03$), but the increase in PTH during exercise (H: 12.7 ± 16.7 pg/mL; L: 11.3 ± 16.5 pg/mL; $p=0.80$) did not differ for H and L. During recovery, CTX was lower for H (H: 0.03 ± 0.05 ng/mL; L: 0.10 ± 0.06 ng/mL; $p=0.003$); PTH did not differ (H: -10.3 ± 14.9 pg/mL; L: -9.5 ± 14.5 pg/mL; $p=0.88$). There were no differences between H and L for iCa during recovery or tCa during exercise or recovery. **CONCLUSION:** Ca absorption was higher in H versus L, but there was no difference in urinary excretion, suggesting that absorbed Ca was retained. The H Ca load was effective in attenuating the increase in CTX despite no attenuation of the PTH response. Supported by DoD Grant W81XWH-12-1-0364.

3132 Board #178 May 31 2:00 PM - 3:30 PM

Short-Term Low Choline Intake May Not Negatively Affect Strength Gains in Older Adults

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(No relevant relationships reported)

PURPOSE: The micronutrient choline is a precursor to acetylcholine (ACh), which mediates skeletal muscle contraction and force production. We previously reported that 12 weeks of low choline consumption ($\sim 50\%$ of Adequate Intake [AI]) impaired strength gains in older adults in response to resistance exercise training. The purpose of this study was to investigate whether low choline consumption for a shorter period of time has negative effects on muscle responses to resistance exercise (RE) in older adults. **METHODS:** Thirty-one, 50-to-65-year-old, generally healthy men and women were randomly assigned to one of three choline intake groups (Low, 3.6 ± 0.6 mg/kg/d, $n=10$; Med, 6.0 ± 0.6 mg/kg/d, $n=11$; High, 8.8 ± 0.8 mg/kg/d, $n=10$) and underwent 3 weeks of diet and RE intervention (leg press and extension, 2x/week, 3 sets, 8-12 reps, 75% of maximum strength [1RM]; 4 bouts of maximal isometric force production on leg extension). 1RM and EMG tests were performed before and after intervention. **RESULTS:** While all three groups experienced significant increases in strength, there was no difference between choline groups in changes in 1RMs (Leg press, Low: $12.4 \pm 12.0\%$, Med: $17.5 \pm 10.7\%$, High: $15.8 \pm 10.7\%$, $p=0.588$; Leg extension, Low: $17.9 \pm 13.0\%$, Med: $15.3 \pm 18.8\%$, High: $5.9 \pm 12.2\%$, $p=0.209$). Similarly, no differences were observed in EMG amplitudes or average/peak isometric force outputs between groups. **CONCLUSION:** These data suggest that less than a month of low or high choline intake may not affect strength gains in older adults. It appears that only a prolonged period of low choline intake may have negative effects on muscle responses to RE.

3133 Board #179 May 31 2:00 PM - 3:30 PM Vitamin D Status and Biobehavioral Health in U.S. Navy Explosive Ordnance Disposal Operators

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(No relevant relationships reported)

Vitamin D (VITD) is essential for musculoskeletal health and, thus, plays a critical role in human performance, especially in specialized military groups such as U.S. Navy Explosive Ordnance Disposal (EOD). As the premier combat force for countering explosive hazards, EOD must perform optimally in the most austere environments. Accumulating evidence also indicates that VITD may help to prevent certain diseases and reduce all-cause mortality risk. To safeguard health and EOD mission success, it is critical to evaluate factors that influence biobehavioral health in this elite group. **PURPOSE:** The primary purpose of this study was to assess VITD status

in EOD operators. A secondary purpose was to evaluate the associations between VITD and biobehavioral correlates (i.e., body composition, mood). **METHODS:** In 72 EOD operators (86% Caucasian), VITD was measured using a blood test (25-hydroxyvitamin D3). Body fat percentage (BF%), bone mineral content (BMC), maximal volume of oxygen uptake (VO_{2max}), muscular strength (one-repetition max; back squat, bench press), blood lipids, blood pressure, posttraumatic stress disorder symptoms, and depression symptoms were also assessed. Pearson product-moment correlation analyses were used to evaluate associations between VITD and biobehavioral characteristics. **RESULTS:** Mean \pm SE were as follows: age = 34.2 ± 0.8 y; BF% = 17.6 ± 0.4 ; VITD = 39.0 ± 1.0 ng/mL; and VO_{2max} = 47.9 ± 0.7 mL/kg/min. Associations with VITD were: BF% ($r = -.33$) and android fat ($r = -.36$), both $p < .01$; VO_{2max} ($r = .24$), blood triglycerides (TGs; $r = -.30$), and diastolic blood pressure (DBP; $r = -.25$), all $p < .05$. No correlations were observed with strength, BMC, other blood lipids, or behavioral health. **CONCLUSION:** EOD operators in this study were generally healthy with respect to VITD levels and all other measures. The negative association between VITD and BF% is consistent with accruing data in both military and athletic populations. It also reflects the prevailing hypothesis that in overweight individuals, VITD can become sequestered within fat tissue. Inverse relationships with android fat, TGs, and DBP are in line with reports that VITD deficiency is linked to cardiovascular disease risk factors. Future studies will evaluate VITD status with neurocognitive function and genetic variants of stress physiology.

- 3134** Board #180 May 31 2:00 PM - 3:30 PM
Influence Of Vitamin D Status On The Post-exercise Hepcidin And Interleukin-6 Response In Trained Athletes
 Alexandra L. Shill¹, Molly Collinson¹, Mark Palmer¹, William D. Fraser², Jonathan Tang², Richard J. Burden³, Nicolette C. Bishop¹. ¹Loughborough University, Loughborough, United Kingdom. ²University of East Anglia, Norwich, United Kingdom. ³English Institute of Sport, Loughborough, United Kingdom.
 (No relevant relationships reported)

PURPOSE: Iron deficiency and reduced iron status have potential negative performance implications for athletes, particularly endurance runners. Hepcidin has a key role in iron homeostasis and is known to be influenced by interleukin (IL)-6. Emerging research from clinical populations indicates that vitamin D supplementation can reduce both circulating hepcidin and IL-6 levels hence could improve iron availability and increase performance. Exercise is known to increase both IL-6 and hepcidin levels, but the influence of vitamin D status on this response is unknown. **METHODS:** Twenty trained participants (24 ± 4 years; 184.3 ± 6.5 cm; 79.8 ± 7.5 kg; 55.7 ± 6.5 mL/min/kg) divided into 3 activity groups (endurance runners $n=6$; resistance trained $n=6$; team sports $n=8$) gave informed consent to take part in this study. Following an overnight fast, participants completed a sub-maximal and graded treadmill test to volitional exhaustion. Venous blood samples were collected pre, post, 1 h and 3 h post-exercise. Blood was analysed for serum total 25-hydroxy vitamin D at pre-exercise only; plasma hepcidin-25, plasma IL-6 and serum iron concentrations were assessed at all time points. **RESULTS:** Pre-exercise vitamin D values were similar between groups (90.2 ± 32.5 nM, $p=0.563$). Hepcidin increased significantly after exercise ($F_{(1,1,18,4)}=36.81$ $p<0.001$) with values peaking at 3 h post-exercise (pre 17.13 ± 12.15 ng/mL; 3 h post-exercise 38.44 ± 23.92 ng/mL). Both iron and IL-6 concentration increased significantly in response to exercise ($F_{(1,9,32,2)}=44.1$ $p<0.001$ and $F_{(2,1,36,4)}=18.92$ $p<0.001$, respectively). No significant interactions or group differences were found for hepcidin ($p=0.121$ and $p=0.409$), iron ($p=0.529$ and $p=0.297$) or IL-6 ($p=0.709$ and $p=0.175$). There was a significant negative correlation between peak hepcidin and relative VO_{2peak} ($\rho=-0.468$ $p=0.038$). There was a trend for a negative relationship between vitamin D values and % change in hepcidin from pre-exercise to 3 h post-exercise ($r=-0.431$ $p=0.058$) and a trend for a positive relationship between vitamin D and peak IL-6 values ($r=0.410$ $p=0.072$). **CONCLUSIONS:** Higher serum Vitamin D levels have the potential to reduce the post-exercise hepcidin response and therefore could have positive implications on athletes' post-exercise iron status.

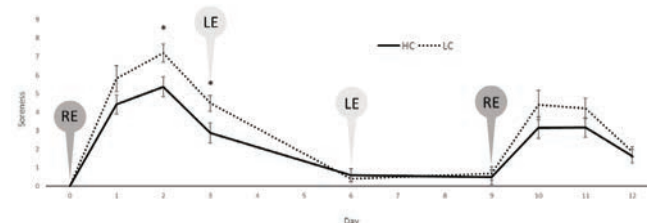
- 3135** Board #181 May 31 2:00 PM - 3:30 PM
Evaluation Of Vitamin K Intake and Its Relation to Bone Mineral Density
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 (No relevant relationships reported)

Vitamin K is a required nutrient important in bone health. Some researchers have reported that vitamin K can help to prevent bone fractures. **PURPOSE:** To explore whether a relationship exists between vitamin K intake and bone mineral density (BMD) among athletes, 18 to < 35 years of age and ≥ 35 years of age. **METHODS:**

This was a cross-sectional study, where 198 athletes were measured for total body BMD (TBBMD), lumbar spine BMD (LBMD), and dual femoral neck BMD (FNBMD) with dual-energy X-ray absorptiometry (DXA). Athletes also completed a food frequency questionnaire (FFQ) to determine their average daily intake of Vitamin K intake, as phyloquinone (also known as vitamin K₁). Athletes were separated into two age groups: 18 to < 35 years of age (57 women; 42 men) (28.10 ± 3.86 years of age) and ≥ 35 years of age (60 women; 39 men) (46.21 ± 8.80 years of age). Pearson correlation models were used to correlate all three BMD sites with vitamin K intake. Alpha levels were set *a priori* at $p < 0.05$. **RESULTS:** In the 18 to < 35 years of age group, mean vitamin K intake was 370.75 ± 265.82 mcg/day. Significant correlations were reported between all three BMD sites and vitamin K intake in this age group ($n=99$): TBBMD $r = -0.254$, $p < 0.05$; LBMD $r = -0.248$, $p < 0.05$; FNBMD $r = -0.278$, $p < 0.05$. In the ≥ 35 years of age group, mean vitamin K intake was 406.27 ± 267.99 mcg/day. There was no significant correlation between vitamin K intake and any of the three BMD sites in the ≥ 35 years of age group ($n=99$). **CONCLUSION:** Our results demonstrate that the average vitamin K intake in these athletes was over 300% of the Dietary Reference Intakes (DRI), where 97.1% of female athletes and 79.2% of male athletes met and exceeded their respective DRI (90 mcg/day for women, 120 mcg/day for men). It is unclear, however, why a negative relationship existed between vitamin K intake and BMD in athletes 18 to < 35 years of age, and no relationship existed in athletes ≥ 35 years of age. A prospective study should be conducted to better elucidate these relationships. This study was not funded.

- 3136** Board #182 May 31 2:00 PM - 3:30 PM
Short Term High Intensity Resistance Exercise-induced Muscle Soreness Is Attenuated with Dietary Cholesterol
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 (No relevant relationships reported)

Inflammation plays an important role in muscle soreness after the high-intensity resistance exercise. Cholesterol is essential for mediating inflammation through regulating membrane homeostasis and facilitating cell signaling. **PURPOSE:** The purpose of this study was to investigate the effects of dietary cholesterol on the exercise-induced soreness levels. **METHODS:** 16 untrained, healthy young men ($n=12$) and women ($n=4$) performed a short-term high-intensity resistance exercise consisting of unilateral leg press and extension with 5 sets and repetitions until failure at 85% 1RM in the Resistance Exercise (RE) sessions and 3 sets/10 repetitions at 50% 1RM in the Light Exercise (LE) sessions. The RE was performed on the starting day (day 0) and day 9 while the LE was performed on day 3 and 6. Participants were randomly assigned to either a Low Cholesterol Intake (LC, $n=7$) or a High Cholesterol Intake (HC, $n=9$) group. Soreness levels were recorded with a Soreness Visual Analogue Scale. Overall soreness was defined as the average soreness from Day 1 to 12. **RESULTS:** The overall soreness levels in LC were $91.6 \pm 3.6\%$ higher than HC ($P=0.044$). Two days after the first RE, soreness levels reached to the highest point in both groups and were higher in LC than HC ($P=0.028$). The soreness in LC on Day 10 was lower than Day 2 ($P=0.021$). There was no significant difference between groups after the second RE. **CONCLUSIONS:** The soreness levels peaked at two days after the first resistance exercise in both groups, which is consistent with the Delayed Onset Muscle Soreness. The lower overall soreness in HC than LC might suggest that the higher level of dietary cholesterol promoted a more efficient recovery via the regulation of inflammation and thus lowered the soreness levels. However, the levels of the biomarkers such as creatine kinase and C-reactive protein were unknown and should be analyzed in future studies to investigate the effects of cholesterol on the exercise-induced inflammation.



* $P < 0.05$, significant difference between HC and LC groups on the day. Data are Mean \pm SEM.

F-61 Free Communication/Poster - Nutrition and Children

Friday, May 31, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

3137 Board #183 May 31 2:00 PM - 3:30 PM
Effects of Fruit and Vegetable Consumption on Physical Activity Levels in Elementary School-Aged Children

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(No relevant relationships reported)

PURPOSE: This study will examine the association of fruit and vegetable consumption at school on physical activity and academic achievement among children from disadvantaged backgrounds. Concern for this topic arose from the awareness that childhood obesity and the diseases that accompany it such as diabetes and hypertension are continuing to rise, all while participation in physical activity is declining. Meals served in school could potentially intervene and help to reverse these statistics, especially for underprivileged children where many rely on this food to satisfy their daily nutritional needs. This project seeks to discover relationships between these factors in order to optimize the success of young students from different backgrounds. **METHODS:** This is a cross-sectional, mixed-methods study designed to compare the association of fruit and vegetable consumption on physical activity and academic performance in a sample of underserved grade-school children. The student sample will come from the UCP Beta Downtown campus. There will be 50 student subjects from each grade 3 to 5 that will be selected from each class roster, using systemic random sampling. Teachers and parents of participants will also be asked to participate in focus groups and fill out short multiple-choice questionnaires. **RESULTS:** Results showed that children in the 3rd - 5th grades spend over 70% of their day being sedentary, roughly 20% of time throughout the day was spent participating in light physical activity, and less than 10% of daily living was spent participating in moderate-to-vigorous physical activity (MVPA). These same children also did not meet the recommended dietary intake for fruit and vegetable consumption, as on average they consumed less than one fruit or vegetable serving per day. **CONCLUSIONS:** It is necessary to educate the nation's children on healthy eating options, as well allow more opportunity for higher intensity physical activity. School-based interventions are critical to reach children of diverse backgrounds. These interventions could help begin the reversal of current trends in the fight against obesity.

3138 Board #184 May 31 2:00 PM - 3:30 PM
Preschool Children in Childcare Settings Do Not Consume Healthy Snacks Despite Menus That Meet Recommended Dietary Standards

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(No relevant relationships reported)

Preschool snack menus must meet the Dietary Guidelines for Americans, however, what is actually served and consumed by children is not restricted, potentially affecting consumption of a healthy diet.

PURPOSE: Compare preschool snack menus that meet recommended dietary guidelines to what is served and consumed by children.

METHODS: Fifty-two preschool children (mean±SD, age 3y 9m ± 4m) from a university early childhood center participated in a 10-week study. Dietary intake was measured by trained investigators using direct observation for pre and post snack analysis. Energy and nutrient content was completed using Food Processor Nutrition Analysis by ESHA. Food color was determined by observation during analysis to determine if the color of food affected consumption of certain snacks. A food preference survey was administered orally by investigators to children immediately after each snack.

RESULTS: There was a significant ($p<0.05$) difference for total kilocalories (kcal) between menu (168 ± 48), served (269 ± 129) and consumed (179 ± 137). There was a significant ($p<0.05$) difference for grams of carbohydrate between menu (23.9 ± 8.5g), served (39.9 ± 18.7g) and consumed (27.1 ± 19.6g). There was a significant ($p<0.05$) difference for grams of fat for menu (5.7 ± 3.2g) and consumed (5.4 ± 5.8g), compared to served (8.5 ± 5.7 g). There was a significant ($p<0.05$) difference for grams of protein for menu (5.7 ± 2.0g) and consumed (5.8 ± 4.2 g) compared to served (8.7 ± 4.2g). The majority of food served was white (47.4%), brown (14.0%), or orange (19.0%) in appearance indicating a larger amount of processed/prepackaged foods consumed. Minimal food was served with the colors of yellow (4.7%), red (9.0%) or green (2.2%); colors normally associated with fruits, vegetables, and lean meats. Children consumed about 23.1% of meats and 50% of vegetables that were served to them,

which was significantly ($p<0.05$) lower than dairy (75.2%), fruits (72.6%), and grains (77.0%). Children consumed a high amount (84.2%) of the fats/sweets served to them. Children described the snack food as yummy (85.3%), okay (6.4%), or yucky (8.3%).

CONCLUSIONS: The results indicate that snack menus meeting recommended dietary standards may not match what children are served or consuming for snack, potentially contributing to long-term health consequences.

3139 Board #185 May 31 2:00 PM - 3:30 PM
Construction And Validation Of a Digital Instrument For The Evaluation Of Children Nutritional Status

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BACKGROUND: Self-assessment of body image refers to the internal representations of their body structure and physical appearance in relation to themselves and others. Silhouette scales can be an alternative to assess the nutritional status in children.

PURPOSE: Develop and indicate metrical qualities of a digital instrument for evaluation of nutritional status in children.

METHOD: 414 children, aged between seven and 10 years old were assessed for the following measures, Circumferences (neck, shoulder, chest, relaxed arm, wrist, waist, abdomen, hip, proximal thigh, medial thigh, distal thigh, leg, ankle); diameters (biliocrystal and biacromial); stature; body weight. Descriptive statistics were performed using simple frequency, position and dispersion measurements. The normality of the data was tested by Kolmogorov Smirnov test was used. The inferential tests were performed, validity coefficient of content, Spearman's correlation, using SPSS version 20.0® and considering $p<0.05$.

RESULTS: The instrument is composed of nine three-dimensional body figures developed from average values of body measurements of 200 children aged 7 to 10 years. These figures represent a continuum of excessive thinness (BMI 12.0 kg/m²) to severe obesity (BMI 29.0 Kg/m²). The application of this instrument consists of the presentation of the figures, with the following instructions, 1) (real) and 2) (ideal). The dissatisfaction with the body image is obtained by subtracting the real from the ideal. The validity coefficient of content presented values higher than 0.90 for the image clarity, practical relevance and representativeness of the item, obtained through the evaluation of 10 judges. For the validation of the criterion, the children with excess weight indicated the greatest real figures, as well as the highest values of discrepancy, regardless of gender, boys ($r=0.36$, $p<0.01$) and girls ($r=0.52$, $p<0.01$). **CONCLUSION:** It is concluded that the developed instrument demonstrated good psychometric qualities, becoming a viable option for evaluating children's body image.

3140 Board #186 May 31 2:00 PM - 3:30 PM
Low Cruciferous Vegetable Intake is Associated with Elevated Inflammation in Preadolescent Girls

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(No relevant relationships reported)

Subclinical chronic inflammation, measured by C-reactive protein (CRP), is strongly linked to cardiovascular disease (CVD) in adults. CRP has been shown to be elevated in some children and is considered a potential risk factor for early onset CVD.

Strategies to reduce chronic inflammation among children is paramount. In adults, higher cruciferous vegetable intake has been associated with lower inflammation.

PURPOSE: To examine the relation between cruciferous vegetable intake and CRP among preadolescent girls.

METHODS: Among girls aged 9-12 yrs (N=296), cruciferous vegetable intake was measured by the Youth/Adolescent Questionnaire and categorized as >0-0.25, 0.26-0.50, >0.50 servings per day. Fasting serum CRP (mg/L) was measured by the Beckman Coulter AU5812 Clinical Chemistry Analyzer. Girls with CRP values >10mg/L were excluded. CRP levels were categorized by normal, moderately increased risk, and high risk for CVD according adult cut-offs (CRP <1, ≥1-3, >3 mg/L). Multinomial logistic regression with covariates of BMI percentile, maturation, and physical activity was used to evaluate CRP category relation with cruciferous vegetable intake.

RESULTS: Mean age, BMI, and CRP levels were 10.8±1.1 yrs, 20.7±5.1 kg/m², and 1.3±1.8 mg/dl, respectively. The proportion of girls in the normal, moderate, and high risk CRP categories were (N(%): 218 (69.2%), 50 (15.9%), 47 (14.9%). Average cruciferous vegetable intake was 0.27±0.3 servings/day. Low cruciferous vegetable intake (>0.25 servings/day) was significantly associated with a CRP level of 1-3mg/L (RRR=3.5, 95% CI 1.1-11.3; $P=0.04$).

CONCLUSIONS: Cruciferous vegetable intake among girls aged 9-12 years was low overall. The lowest intake was associated with the CRP risk category considered to confer a moderately elevated risk of CVD among adults. Enrichment of the diet with cruciferous vegetables is an intervention strategy that should be tested in girls to reduce inflammation and CVD risk early, regardless of BMI status. Supported by National Institute of Child Health and Human Development (HD074565) and the National Cancer Institute (P30CA023074)

F-62 Free Communication/Poster - Education and Funk

Friday, May 31, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

3141 Board #187 May 31 2:00 PM - 3:30 PM Pathology Classification And Exercise Adherence: A JTA Educational Approach To Providing Community-Based Exercise Programs

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(No relevant relationships reported)

Pathology Classification and Exercise Adherence: a JTA Educational Approach to Providing Community-Based Exercise Programs

PURPOSE: The purpose of this study was to determine if pathology classification is a significant predictor of adherence to a community-based exercise program. **METHODS:** A cohort study design was implemented, evaluating the Lyndon Health/Fitness Intervention Program (HFIP). Subjects ($N = 44$) had a mean age of 65.82 ($SD = 10.00$) years, participated in a 6-week exercise program consisting of 60 min per session, two days per week. Each subject's Primary Healthcare Provider identified the pathology classification and exercise adherence was defined as the number of sessions attended out of 12 possible sessions. Data were analyzed via an independent groups 2-way analysis of variance (2-way ANOVA), simple linear regression, and multiple linear regression. **RESULTS:** No significant interaction was found for Pathology x Gender in regards to exercise adherence ($F(1,2) = 0.363$, $p = .698$). There was no significant difference between exercise adherence for gender ($F(1,1) = 0.299$, $p = .588$), or for pathology ($F(1,4) = 1.823$, $p = .146$). Pathology classification was found to be significant predictor of exercise adherence ($F(1,31) = 4.560$, $p = .041$). **CONCLUSION:** While pathology classification was a statistically significant predictor of exercise adherence, only 10.0% of the variance in adherence could be predicted from this model (adjusted $R^2 = .100$). Necessary future research in this area should consider larger and more diverse samples, longer duration exercise programs, and following-up with subjects after program conclusion. Furthermore, the Lyndon HFIP was facilitated in conjunction with a senior-level, undergraduate exercise science course, and served as an applied means to elucidate imbedded ACSM Job Task Analyses (JTA) required of Commission on Accreditation of Allied Health Education Programs (CAAHEP) accredited exercise science programs. The Lyndon HFIP appeared to be a feasible means to promote student learning while expanding community-based exercise opportunities.

3142 Board #188 May 31 2:00 PM - 3:30 PM Program Directors' Perspectives On Coaes-mediated Caahep Accreditation For The Exercise Sciences

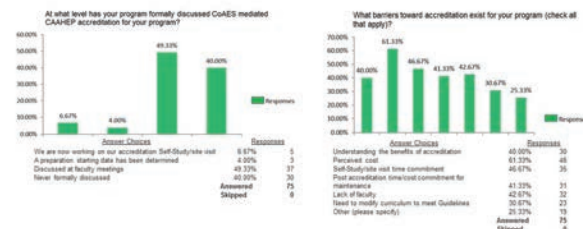
Carlton R. Insley, III¹, Susan M. Muller¹, Sidney R. Schneider¹, William Coale². ¹Salisbury University, Salisbury, MD.
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Reported Relationships: C.R. Insley: Other (please describe); Not sure if this constitutes a required disclosure. The authors Insley and Muller volunteer services at the CoAES (ACSM). The author Coale is a part-time employee at the CoAES (ACSM).

For viability, college medical faculty must provide quality programs in an enrollment-competitive market. Accreditation, credentialing, and licensure contribute to health practice prosperity. Kinesiology-related domain programs (exercise science, exercise physiology etc.) have incomplete achievement in program accreditation, credentialing, and licensure.

PURPOSE: To assess Program Directors' perspectives on CoAES-mediated CAAHEP accreditation for the Exercise Sciences. **METHODS:** A 19-question survey was developed and validated by an expert committee. Upon IRB approval, an exploratory study was conducted. Results were anticipated to offer data clarifying the Program Directors' perspectives, and enabling CoAES insight to forward a more positive accreditation path. Electronically solicited, 75 individuals from approximately 500

commercially identified Kinesiology-related programs (undergraduate and graduate) with published e-mail addresses, offered responses. Utilizing descriptive statistics, response analyses were performed in context of survey items. **RESULTS:** The following data graphs represent salient features of survey results:



CONCLUSION: Respondents indicated several major barriers; one of which being 40% of faculty had never discussed pursuing accreditation. The CoAES is challenged to disseminate accreditation information to promote accreditation discussions, and mitigate barriers perceptions. Data support CoAES' Accreditation Ambassador/Mentor Program, which addresses noted needs.

3143 Board #189 May 31 2:00 PM - 3:30 PM Retrieval Practice Improves the Recall and Transfer of Learning of Physiology Information.

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PURPOSE: It is well-documented that retrieval practice can enhance the recall of both complex and simple information when compared to more typical methods of learning such as repeated studying (i.e., reading). Evidence is also accumulating that retrieval practice can enhance higher orders of thinking, such as the ability to critically evaluate research articles (Dobson, Linderholm and Perez, 2018) and transfer of learning (Butler, 2010). One purpose of this investigation was to explore the effects of retrieval practice on transfer of learning with physiology information. A second purpose was to compare recall and transfer of physiology information following retrieval practice versus a judgment of learning task (JOL) that may be easier for students to implement on their own. **METHODS:** Participants were randomly assigned to learn three short (~500 words) physiology texts using each of the following strategies: 1. studying a text four consecutive times (SSSS), 2. studying and then retrieving a text two consecutive times (SRSR), and 3. studying a text four consecutive times while completing multiple JOL during the second and fourth repetitions (SJSJ). Recall and transfer of learning were both assessed one week after the participants learned the texts, and the results were analyzed using repeated measures ANOVAs. **RESULTS:** The SRSR strategy facilitated significantly greater recall than the SSSS strategy (21.35 ± 1.08 vs. 17.35 ± 0.86 , $p < 0.05$), and both the SRSR and SJSJ strategies lead to significantly greater transfer than the SSSS strategy (44.60 ± 2.55 and 41.79 ± 2.63 , respectively, vs. 36.07 ± 2.40 , $p < 0.05$). **CONCLUSION:** These results demonstrate that retrieval practice enhances both recall and higher order thinking about physiology information and that covert retrieval, as experienced in a JOL task, may provide similar benefits.

3144 Board #190 May 31 2:00 PM - 3:30 PM Effects Of A Situated Environment On Classroom Community, Connectedness, And Learning In Exercise Science Students

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Clinical exercise science programs require rigorous academic preparation often taught in traditional classroom and lab settings. However, employers also require students to develop strong interpersonal professional skills necessary to be successful in the field. Incorporating situated learning in the exercise science classroom provides opportunities for students to develop social interaction, theory application, critical thinking, and problem solving skills. A greater sense of classroom community is understood to significantly enhance students' internalization of learning and the development of these desired professional skills. **PURPOSE:** The purpose of this research is to explore students' perceptions of overall classroom community, connectedness, and learning in both a situated and traditional classroom environment. **METHODS:** 53 undergraduate exercise science students (age [yrs] = 22.21 ± 2.96 , males = 35.8%; females = 62.3%) who had participated in either a situated learning course or a traditional learning course completed Rovai's (2002) Classroom Community Survey at the end of the semester. A one-way ANOVA was performed to

determine if there were any significant differences between the two groups ($\alpha = .05$). **RESULTS:** The results demonstrated significant differences between the groups across all three variables of overall classroom community ($p < .00$), connectedness ($p = .02$), and learning ($p < .00$). The situated learning group demonstrated significantly higher mean scores. **CONCLUSIONS:** Students' perceive higher levels of overall classroom community, connectedness, and learning when participating in a situated learning experience. Incorporation of these types of learning environments in exercise science degree programs may enhance professional skill development and successful employment within the field.

3145 Board #191 May 31 2:00 PM - 3:30 PM

Contemporary Conflict Management in the Sports Medicine Setting

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Purpose. Conflict management is an important aspect in the administration and organization of sports medicine teams. Health care professionals attempt to exert personalities, influences, biases that may create points of misunderstanding within everyday team operations. **Methods.** This review gathers contemporary information and theories towards conflict and conflict management, including definitions of current terminology and current concepts. This study also identifies opportunities that team members may utilize when dealing with conflict. Four main types of conflict are discussed and are juxtaposed with sports medicine scenarios. These types include: goal related conflict, affective conflict, procedural conflict, and cognitive conflict. A review of recent literature also provides strategies for dealing with conflict and creating commitment within team members. **Results.** Potential effects and benefits of various conflict management approaches are discussed. Evidence is then presented to further understand and appreciate the elements involved with conflict when intertwining healthcare professionals in a sports medicine setting. **Conclusion.** In conflict management, recognizing that all team members have differing viewpoints can serve as a resolution point which encourages team members to embrace their differences. Finally, a case study summarizes the theories for conflict management.

3146 Board #192 May 31 2:00 PM - 3:30 PM
The Promotion Of Physical Activity By Craft Breweries In Knoxville, Tennessee

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(No relevant relationships reported)

A growing body of research supports a positive relationship between physical activity (PA) and alcohol consumption within various sample populations. Anecdotally, producers of craft beer appear to specifically market to active consumers via sponsorship competitions, charity biking, and hosting of regular PA events (e.g., group runs). Currently, no empirical data exists regarding the promotion of PA promotion by craft breweries. **PURPOSE:** Determine the prevalence and type of PA promoted by craft breweries located in a single community. **METHODS:** Operators of 13 craft breweries located in Knoxville, TN were solicited to complete an electronic survey capturing type and frequency of common PA-related events (e.g., running, biking, fitness classes) hosted over an average month, as well as associated promotions (e.g., discounted beers). Census tract data was tabulated for each brewery location. Descriptive statistics and frequency scores were computed to quantify the promotion of PA across surveyed craft breweries. **RESULTS:** A response rate of 77% was achieved. Participating breweries ($N=10$) were located in areas that are populated by predominately white (80.9±14.0%), young-to-middle aged adults (35±5y), and that generally consist of a higher proportion of renter-occupied housing units (63.1±18.8%). All respondents indicated that the respective establishment hosted at least one type of PA event. Over an average month, 25 group runs (mean=4±1), 18 group fitness classes (6±3), and 16 group biking events (3±1) were held across seven, three, and five breweries, respectively. In nine of the ten breweries, patrons attending active events are eligible for one or more of the following promotions: \$1USD off all beers (50%), discounted first beer (30%), discounted two beers (10%), and one free beer (20%). **CONCLUSIONS:** A majority of craft breweries in Knoxville, TN host one or more types of group activities multiple times per month, with specific beer promotions for participating patrons. These data provide preliminary evidence for the promotion of PA by craft breweries within a community setting. Further research is necessary to determine the impact and reach of such events, as well as operators' motivations to pair the promotion of PA with the consumption of craft beer.

3147 Board #193 May 31 2:00 PM - 3:30 PM

Effects of Exercise Habits on Working Memory of College Students

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PURPOSE: Working memory is the process of storing information by human body and processing by way of thinking. Relevant studies have shown that exercise have positive impacts on working memory of human body, but previous studies mostly focused on the forms of exercise, and the subjects were mostly children or elderly people. So, this study aimed to explore whether exercise can affects the working memory of college students by comparing who have the exercise habit with who have been sedentary.

Methods: 12 students from the Capital University of Physical Education and Sports were taken as subjects. According to the exercise habits, 6 subjects with exercise habits were divided into exercise group and 6 subjects with sedentary were divided into control group. The E-prime software was used to program the 2-Back task to measure the working memory of subjects. The experimental procedure was divided into four blocks. The first and third blocks were simple tasks, the second and fourth blocks were complex tasks. The SPSS23.0 was used to analyze the experimental data.

RESULTS: The behavior data were analyzed with 2 (exercise habit group)*2 (task type) repeated measurement ANOVA to investigate the responsiveness of different exercise habits to 2-Back task. The results showed that for accuracy, the main effect of task type was not significant $F(1,10)=2.923, p=.118$, and the interaction effect between task type and group was significant $F(1,10)=6.245, p=.032$, indicating that the subjects with exercise habits had higher accuracy than those who with sedentary, but there was no difference in accuracy when performing simple and complex tasks. For the response time, the main effect of task type was not significant $F(1,10)=.125, p=.731$; the interaction effect of task type and group was not significant $F(1,10)=.048, p=.831$, indicating that there was no difference in response time between subjects in the process of two tasks, and there was no significant difference in the reaction time between subjects with exercise habits and sedentary.

Conclusion: Exercise habits may have positive effects on working memory of college students, especially on accuracy of completing working memory process, and the related brain mechanisms need to be further studied.

F-63 Free Communication/Poster - Musculoskeletal and Ultrasound

Friday, May 31, 2019, 1:00 PM - 6:00 PM

Room: CC-Hall WA2

3148 Board #194 May 31 3:30 PM - 5:00 PM

Reduced Cardiorespiratory Fitness and Greater Body Fatness Will Develop As A Consequence of Chronic Ankle Instability

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(No relevant relationships reported)

Our laboratory has recently reported significant declines in daily physical activity (PA) performed in humans and mice as a result of Chronic Ankle Instability (CAI), which will likely accelerate the development of unhealthy characteristics. **PURPOSE:** To assess the impact of CAI on cardiorespiratory fitness and body composition. **METHODS:** Thirty-four subjects participated in the study. Seventeen subjects with CAI were matched for sex (10 females, 7 males/group), age (22.1±2.6yr and 22.2±3.0yr; Mean±SD), height (167±8cm and 168±8cm), and weight (70.5±7.3kg and 66.7±7.5kg), to subjects with no history of ankle injury, respectively. Subjects reported to the Health Risk Assessment Lab for one session. Subjects completed the foot and ankle ability measure (FAAM and FAAMSport) and the NASA physical activity questionnaire. Subject's body composition was assessed by DEXA. Afterward, subjects performed a treadmill maximal exercise test. Every minute of the treadmill test the subjects rated their exertion using the Borg RPE scale (6-20 scale). For the treadmill test we used a two-minute progressive test until volitional fatigue was attained. **RESULTS:** No differences were observed between groups for age ($p=0.86$), height ($p=0.79$), and weight ($p=0.15$). Body composition was different ($p=0.0002$) between the CAI and Control group (33.9±6.0% and 24.6±6.8%, respectively). VO2max (ml/kg/min) was significantly different ($p<0.0001$) between CAI and Control groups (30.2±4.8 and 49.2±7.5, respectively). Time to maximal exercise test completion ($p=0.02$) and VEmax ($p=0.008$) were different between groups. Maximal

HR was not different ($p=0.96$) between groups however resting HR was different ($p=0.0001$) between the CAI and Control groups (77.3 ± 7.5 bpm and 64.9 ± 8.1 bpm, respectively). FAAM ($p<0.0001$), FAAMSport ($p<0.0001$) and NASA ($p<0.0001$) were all observed to indicate differing activity levels between the groups. **CONCLUSIONS:** CAI in college-aged adults results in significantly reduced PA and cardiorespiratory fitness levels accompanied by significantly greater body fatness. Our findings suggest these serious negative health outcomes will rapidly develop as a consequence of the reoccurrence of this musculoskeletal injury as a young adult.

3149 Board #195 May 31 3:30 PM - 5:00 PM
Early Brace Progression Following Anterior Cruciate Ligament Reconstruction Leads to Improved Knee Range of Motion

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Loss of passive knee extension (KE) following anterior cruciate ligament (ACL) reconstruction is a common deficit after surgery, and has been associated with prolonged pain, quadriceps weakness, and gait impairments. Recent literature indicates that it is also predictive of an increased risk of osteoarthritis due to altered knee kinematics. Post-operative bracing may limit the ability to achieve full terminal KE; however, the effects of various brace progressions have received little attention. **PURPOSE:** To quantify the time to achieve baseline KE and knee flexion (KF) after ACL reconstruction following an early versus delayed brace progression. **METHODS:** 18 ACL-reconstructed subjects were allocated into an early brace progression ($n=9$; 4F, 5M; 21.2 ± 4.9 y; 27.6 ± 5.1 kg/m²) or delayed brace progression ($n=9$; 3M, 6F; 22.8 ± 5.6 y; 24.4 ± 3.0 kg/m²) group. The delayed group was weight bearing as tolerated (WBAT) with a post-operative brace locked in full extension for ambulation for 4 weeks. After 4 weeks, the brace was unlocked with a transition to a hinged knee sleeve at 2 months. The early group was WBAT with the post-operative brace locked in full extension for 1-2 weeks. Subjects were gradually weaned from crutches at 1-3 weeks with complete discontinuation of the brace at 3-6 weeks. KE and KF were measured with a goniometer. Independent t-tests were used to compare differences between groups ($\alpha<0.05$). **RESULTS:** There were no significant differences between groups for baseline KE (early: $-5.7 \pm 2.2^\circ$; delayed: $-4.6 \pm 3.5^\circ$; $p=0.43$) and KF (early: $142.6 \pm 5.2^\circ$; delayed: $142.4 \pm 8.6^\circ$; $p=0.97$). There were significant differences between groups post-surgery in time to achieve baseline KE (early: 12.8 ± 9.3 days; delayed: 40.4 ± 16.6 days; 68.4% difference; $p<0.001$) and KF (early: 31.6 ± 8.8 days; delayed: 55.6 ± 13.8 days; 43.2% difference; $p<0.001$). No subjects were noted to have increased knee laxity. **CONCLUSIONS:** Early brace progression was more effective than delayed brace progression in reducing the time to restore baseline KE and KF. Early restoration of knee motion following ACL reconstruction may limit post-operative complications, such as knee stiffness, anterior knee pain, delay in strength recovery, and gait impairments. Adjustment of post-operative brace protocols can have a profound impact on clinical outcomes.

3150 Board #196 May 31 3:30 PM - 5:00 PM
The Detection of Knee Joint Sounds under Different Loading Conditions using Vibroarthrography

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 (No relevant relationships reported)

Crepitus of the knee may mirror structural changes of the joint during motion. Although the magnitude of these sounds increases with greater cartilage damage, it is unclear whether knee joint sounds also reflect joint loading. **PURPOSE:** To reveal whether the magnitude of knee joint sounds differs across defined dynamic loading conditions using vibroarthrography. **METHODS:** Twelve healthy volunteers (26 ± 3.59 years, 7 females) participated in the randomized-balanced crossover study. Knee joint sounds were recorded (linear sampling, 5512 Hz) by means of two acoustic sensors (microphones), one placed on the medial tibial plateau and one on the patella. Two activities of daily life (standing up from and sitting down on a bench; descending stairs) and three open kinetic chain (OKC) knee extension-flexion cycles (passive movement, 10 % and 40 % loading of the individual one repetition maximum) were performed. Each participant carried out three sets of five repetitions and three sets of 15 steps downwards (stairs), respectively. For data analysis, the mean noise volume for each loading condition was determined. The resulting values were expressed as relative difference to the individual OKC passive movement value. Friedman test and Bonferroni-Holm adjusted post-hoc test were performed to detect differences between conditions. **RESULTS:** The OKC passive movement sound ranged from .0001 to .003 a.u. ($\pm 43.6 - 69.3$ dB) at the medial tibia and from .001 to .03 a.u. ($\pm 60.6 -$

87.7 dB) at the patella. Significant differences between joint sound amplitudes for all movements, both measured at the medial tibial plateau ($\chi^2=20.7$, $p<0.001$) and at the patella ($\chi^2=27.6$, $p<0.001$) were obtained. The corresponding median differences for the tibia sensor were: stand/sit: 236 %, stairs: 675 %, OKC₁₀: 291 %, OKC₄₀: 384 %; and for the patella sensor: stand/sit: 158 %, stairs: 260 %, OKC₁₀: 75 %, OKC₄₀: 78 %. **CONCLUSION:** Overall, the larger the supposed knee joint loading was, the louder was the recorded knee crepitus. Consequently, vibroarthrographically assessed knee joint sounds can differ across knee joint loading conditions. Future studies should further support these findings using inverse dynamics as a measurement of knee joint loading.

3151 Board #197 May 31 3:30 PM - 5:00 PM
Glenohumeral And Hip Range Of Motion Are Associated In Softball: Implications For Performance And Injury

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 (No relevant relationships reported)

Effective ball release during throwing requires coordination between the upper extremity (UE) and lower extremities. Deficits in UE and lower extremity (LE) range of motion (ROM) have been associated with decreased throwing performance and musculoskeletal injury. **PURPOSE:** To determine the association between glenohumeral and hip ROM in softball athletes. **METHODS:** 28 NCAA Division I female softball athletes participated (Age: 18.8 ± 1.5 years, Height: 168.1 ± 6.8 cm, Weight: 70.6 ± 9.3 kg). ROM tests included: glenohumeral internal rotation (GIR) and external rotation (GER), hip internal rotation (HIR) and external rotation (HER). All ROM tests were completed bilaterally and an average of three trials was utilized for data analysis. ROM measurements were analyzed individually, as well as a total ROM for the UE (TGROM) and LE (THROM). Data was stratified by pitcher vs. position players, dominant (DOM) vs. non-dominant (NDOM) UE and LE. Normality was assessed using a Shapiro-Wilk test. Correlations between UE and LE ROM were analyzed utilizing Pearson correlations or Spearman-Rho correlations, as appropriate. Significance was set *a priori* at $p < 0.050$. **RESULTS:** Pitchers demonstrated significant correlations between DOM GIR and DOM HIR (Correlation: 0.845, $P=0.017$), as well as between DOM GIR and NDOM HER (Correlation: 0.79, $P=0.034$). Pitchers also demonstrated correlations between DOM GIR and DOM THROM (Correlation: 0.770, $P=0.043$), as well as DOM GIR and NDOM THROM (Correlation: 0.785, $P=0.036$). Position players did not demonstrate any significant correlations between glenohumeral and hip ROM. **CONCLUSION:** Pitchers demonstrated significant correlations between glenohumeral and hip ROM, while position players did not. The positive correlation in pitchers may indicate that effective pitch performance is dependent on efficient coordination between the glenohumeral joint and hip. Proper hip ROM is necessary for an athlete to effectively transfer energy to the glenohumeral joint. Changes in hip ROM may lead to adaptations in glenohumeral ROM, both positive and negative; future research should focus on understanding these possible adaptations.

3152 Board #198 May 31 3:30 PM - 5:00 PM
Return To Play Testing In Individuals With ACL-Reconstructed Knees: Does Timing Of The Assessment Matter?

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Context: Traditional return to play assessments following anterior cruciate ligament reconstruction (ACLR) identify large muscular deficits at 6 months post-surgery. This is concerning with majority of patients being cleared for sports on time alone. It is unknown if individuals post-ACLR show improved outcomes if assessed later than 6 months post ACLR. The purpose of this study was to examine patient function in individuals stratified by months post-ACLR.

Methods: A total of 293 individuals with ACLR (23.2 ± 10.1 years, 142 Female, 6.4 ± 9 mo post-ACLR) participated in the study. Participants were stratified based on the timing of their evaluation in months since ACLR: 5-6 mo: $n=122$, 6-7 mo: $n=102$, 7-8 mo: $n=43$, 8-9 mo: $n=26$. Subjective knee function was assessed through the International Knee Documentation Committee (IKDC) Subjective Form. Mass-normalized maximal voluntary isometric contraction (MVIC) and limb symmetry indexes (LSI) were collected on knee extensor and flexor muscle groups. Non-parametric statistics were run due to violation of the assumption of normality. Measures of subjective and muscular function were compared through Kruskal-Wallis with *post-hoc* partial eta squared values for effect sizes.

Results: There were significant difference between the 5-6 mo. vs 6-7 mo groups ($\eta^2=.04$) and the 5-6 mo vs 8-9 mo groups ($\eta^2=.04$) for subjective function ($P=.04$). There were significant differences between the 5-6 mo vs 8-9 mo groups ($\eta^2=.07$) and the 6-7 mo vs 8-9 mo groups ($\eta^2=.04$) for MVIC Extension ($P=.14$). No differences were seen between groups for MVIC for knee extension ($P=.14$) or flexion ($P=.97$) or knee flexor LSI ($P=.60$) (Table 1).

Conclusions: There are significant differences which demonstrate progressively increasing subjective function and knee extension symmetry when tested at later timepoints from surgery. However, the observed values are low suggesting even at 9-months post ACLR patients are demonstrating deficits that may be improving.

Table 1: Between Group Differences: Median (IQR)						
Mo. Post-ACLR	5-6	6-7	7-8	8-9	P-Value	Effect Size (η^2)
IKDC	79.7 ^{ab} (70.1, 88.5)	83.9 ^a (74.5, 92.0)	79.3 (73.6, 88.8)	89.1 ^b (75.8, 92.3)	.019 ^a .026 ^b	.04 ^a .04 ^b
MVIC Extension (Nm/kg)	1.46 (1.16, 1.87)	1.60 (1.26, 2.03)	1.59 (1.23, 2.07)	1.65 (1.39, 2.05)	-	-
MVIC Flexion (Nm/kg)	.737 (.51, 1.01)	.76 (.59, .98)	.77 (.57, .89)	.66 (.511, 1.11)	-	-
MVIC Extension LSI (%)	60.0 ^b (49.8, 76.2)	67.9 ^c (52.2, 79.1)	67.7 (59.2, 80.0)	76.7 ^{bc} (64.0, 90.5)	.002 ^b .021 ^c	.07 ^b .04 ^c
MVIC Flexion LSI (%)	89.5 (71.0, 105.0)	84.2 (68.8, 98.1)	88.5 (66.7, 99.2)	84.3 (69.4, 95.8)	-	-

^a Significant difference between 5- and 6-month groups. ^b Significant difference between 5- and 8-month groups. ^c Significant difference between 6- and 8-month groups.

3153 Board #199 May 31 3:30 PM - 5:00 PM

The Effect of Icing with Varying Degrees of Compression on Quadriceps Intramuscular Temperature

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Clinically, compression is often applied in combination with ice. Amongst practitioners, elastic wrap is the most common type of external compression, while plastic wrap has become increasingly popular because it can be discarded without returning it to the treatment facility. However, few studies have investigated the magnitude of tissue cooling among different types of external compression applied to an ice bag.

PURPOSE: To evaluate and compare the cooling effectiveness of wetted ice bag applied with elastic wrap compression or held in place with plastic wrap but with no added compression on intramuscular and skin surface temperatures.

METHODS: Ten male participants (36±9 yo) received ice packs made with wetted ice applied simultaneously to a standardized area on the anterior aspect of the quadriceps for 30 minutes. The ice pack was secured with low compression (plastic wrap) to the right anterior thigh and high compression (elastic wrap) to the left anterior thigh. Skin and intramuscular (1 and 2 cm plus one-half skinfold measurement) temperatures of the vastus lateralis were measured continuously during a 10-minute baseline period, 30-minute treatment period, and a 60-minute recovery period.

RESULTS: Intramuscular temperatures decreased from baselines of 35.1 ± 1.1°C at 3 cm and 34.4 ± 1.3°C at 1 cm, to 23.1 ± 4.9°C at 3 cm and 17.8 ± 5.2°C at 1 cm by the end of the elastic compression treatment. Intramuscular temperatures decreased from baselines of 35.4 ± 0.9°C at 3 cm and 34.4 ± 0.9°C at 1 cm, to 24.5 ± 6.7°C at 3 cm and 17.9 ± 4.4°C at 1 cm by the end of the plastic wrap control treatment (Fig. 1). Although the mean difference between compression treatments was 45.1 ± 8.3 mm Hg ($P = 0.0001$), no difference was observed between treatments in terms of the magnitude of reduction in skin and intramuscular temperature at both 1 cm ($P = 0.475$) and 3 cm ($P = 0.421$) regardless of compression pressure.

CONCLUSIONS: The magnitude of temperature reduction was comparable using either elastic wrap with high compression or plastic wrap with minimal compression. Plastic wraps are a practical alternative for clinicians as they may be disposed of by the patient or athlete without having to stay at the treatment facility.

3154 Board #200 May 31 3:30 PM - 5:00 PM

Impact of Musculoskeletal Injury and Pain in Lacrosse Officials: Implications for Clinical Care and Preparedness

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PURPOSE: Lacrosse officials come from different backgrounds, ages and training levels, but all function as athletes while refereeing. Anecdotal evidence shows that mild-to-severe musculoskeletal pain is common in this population. We need to understand the scope of the problem to help keep these adults active over the long-term and engaged in the sport. The purposes of this study were to: 1) determine the prevalence, location and impact of musculoskeletal pain, and 2) identify physical or training-related correlates of pain. **METHODS:** A specific anonymous survey was developed and distributed to members of the national US Lacrosse Officials Development Program and 1,441 were returned complete. Respondents were 52.0 ± 12.9 yrs, 79.5% male and 63.5% represented east coast regions. 51.1% never played lacrosse, and 37.8% of former players participated through post-collegiate years. Pain sites and severity (0-10 numerical pain rating), previous injuries and current impact of pain on officiating duties were captured. **RESULTS:** Pain was present in 18.1% - 40.1% of officials primarily at the foot, shoulder, back and knee. Pain severity during rest and exercise averaged 4.3 - 4.6/ 10 pts, respectively. A total of 437 officials reported diagnoses of osteoarthritis ([OA]; knee 48.7%, hip 10.5%, spine 10.1%, shoulder 8.0%) and 247 reported OA in more than one joint. Correlates of these pain symptoms included former lacrosse injury (22.6% have long-term pain today) and weight gain in last five years (r range = -.053-.186; all $p < .05$). Current participation in running as a sport was inversely related to pain symptoms. Officials with any diagnosis of OA more often reported frequent or continual difficulties with a) running the entire field distance, b) starting and stopping on the field, c) keeping pace, d) focusing on multiple actions of players at once, and e) enjoying the officiating duties than officials with no OA (Mann Whitney U tests all $p < 0.0001$). **CONCLUSION:** Officials are unrecognized athletes, and many may benefit from clinical care support at the field before, during and after games to help manage musculoskeletal pain, especially during regulation games or tournaments. Pain relief may translate to better engagement in lacrosse officiating duties, improvement in player safety and enjoyment of the officiating role.

3155 Board #201 May 31 3:30 PM - 5:00 PM

Age Related Error of the Measurement of the Tibialis Posterior Muscle via Ultrasound Imaging

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(No relevant relationships reported)

PURPOSE: The tibialis posterior (TP) is a key muscle in controlling foot function and is associated with several lower extremity pathologies. Being able to assess the strength, activity and size of the TP across ages plays an important role in treating and understanding pathologies associated with the TP. It may be more difficult to image the TP of older individuals due to fatty infiltration and fibrosis. The purpose of this study evaluated the reliability of ultrasonic measurements of the TP in young and older adults. **METHODS:** Legs of 23 individuals (older (O) $n=7$; younger (Y) $n=16$) were imaged via ultrasound (6-15ML probe, GE Logiq S8) and the cross-sectional area (CSA) and thickness of the TP was recorded. To measure the TP, the probe was held at a point 30% and 50% between the knee joint line and the inferior tip of the lateral malleolus. Subjects inverted their foot and videos of the contraction cycle were recorded. Two separate still-shots of the muscle at rest were saved from the recorded videos at each location to make size measurements. This process was performed on both anterior and posterior sides of the leg. To assess reliability, intraclass correlation coefficients (ICC) and the standard error of the measurement (SEM) were calculated. An independent t-test was used to determine differences in the measurement error between age groups. **RESULTS:** The average TP CSA at the 30% point for the anterior view was 3.96 ± 1.05 cm², and the posterior was 4.00 ± 1.06; at the 50%, the anterior was 3.43 ± 1.09 cm², and the posterior was 3.55 ± 1.09. Excellent reliability was seen when comparing repeated measurements for anterior and posterior area and thickness measurements for both younger and older individuals (ICC=.937-.999), however, there was a significant difference in the SEM for TP thickness (O = 0.06 ± 0.02cm; Y = 0.035 ± 0.01cm, $p=.008$) and CSA (O = 0.11 ± 0.07cm; Y = 0.046 ± 0.01cm, $p=.02$). **CONCLUSIONS:** Repeated measurements showed excellent reliability in both groups. There was a greater error in the measurement in the older adults. Despite

showing excellent reliability, these results show that age does affect the accuracy of the measurement of the TP muscle size assessed by ultrasound imaging; however, it would also be beneficial to be able to assess quality of muscle tissue.

- 3156** Board #202 May 31 3:30 PM - 5:00 PM
No Differences in Sub-Cortical Motor Region Activity for Knee Motor Control Following Anterior Cruciate Ligament Reconstruction
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 (No relevant relationships reported)

PURPOSE: Emerging research has indicated that anterior cruciate ligament reconstruction (ACL-R) is associated with neuroplasticity. It has been speculated that these findings may have future implications on rehabilitation and ACL-R outcomes. However, most of this research has focused on cortical plasticity rather than sub-cortical plasticity. The purpose of this project was to determine the effects of ACL-R on sub-cortical portions of the cortical-subcortical motor loop. **METHODS:** A healthy group of active participants (n=16, age=23.2±3.5 years, height=1.7±0.1 m, weight=69.7±14.3 kg) and a left ACL-R group (n=15, age=21.7±2.7 years, height=1.7±0.1 m, weight=70.4±15.8 kg, 38.1±27.2 months' post-surgery) were locally recruited. Functional magnetic resonance imaging (fMRI) and T1 structural imaging were performed to analyze brain activation during a unilateral left (involved) 45° knee extension/flexion at a rate of 1.2 Hz for 4 blocks of 30 seconds interspersed with 30 seconds of rest. The right putamen and right sub-thalamic nuclei (STN) served as seed regions, and the two groups were contrasted using a mixed-effects general linear model with *a priori* cluster threshold of $p < .05$. **RESULTS:** Compared to the control group, the ACL-R group displayed no differences in right putamen and right STN activation during the unilateral motor task. **CONCLUSION:** These results indicate that ACL-R may not influence the motor control loop at the sub-cortical level. Therefore, motor control and motor learning, as it relates to the subcortical structures, may not be affected by ACL-R. As a result, neurorehabilitation after ACL-R should use priming techniques to target specific cortical regions that previous studies have indicated as being affected by ACL-R.

- 3157** Board #203 May 31 3:30 PM - 5:00 PM
Performance and Return to Sport Following Latissimus Dorsi and Teres Major Tears in Professional Baseball Pitchers
 Kevin Ma¹, Brandon Erickson², Peter Chalmers³, John D'Angelo¹, Anthony Romeo². ¹MLB, New York, NY. ²Rothman Orthopaedic Institute, Tarrytown, NY. ³University of Utah, Salt Lake City, UT.
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 (No relevant relationships reported)

Purpose: Determine the performance and return to sport (RTS) rate in professional baseball pitchers following LD/TM tears treated operatively and non-operatively, and to compare RTS rate and performance between pitchers who sustained a LD/TM tear and matched controls. The authors hypothesize there is a high RTS rate in professional baseball pitchers following LD/TM tears with no significant difference in RTS rate or performance, specifically related to primary outcome performance variables: WHIP ((walks + hits)/innings pitched), fielding independent pitching (FIP), and wins above replacement (WAR)) between cases and controls for both operative and non-operative treatment. **Methods:** All professional baseball pitchers who sustained a LD/TM tear between 2011-2016 were included. Demographic and performance data (pre and post injury) for each player was recorded. Performance metrics were then compared between cases and matched controls within both operatively non-operative treatment. **Results:** Overall, 120 pitchers had a documented LD/TM tear; (42 (35%) were major league players). Most players (107 (89.2%)) were treated non-operatively. Average time to return to the same level of competition for pitchers treated non-operatively was 170.7 +/- 169.7 days while for those treated operatively was 406 +/- 146.83 days. The RTS rate among players treated non-operatively and operatively was identical at 75%. Players treated non-operatively had no change in FIP or WAR following injury but had a higher (i.e. worse) WHIP after injury ($p=0.039$), and performed significantly worse in several secondary performance metrics, including number of games played per year ($p<0.001$). Players treated operatively had no change in any measured performance metrics following surgery. No difference existed between cases and controls in the primary performance variables. **Conclusion:** LD/TM tears occur more frequently in professional pitchers than previously recognized and reported. The majority of LD/TM tears are treated non-operatively. RTS rate for professional baseball pitchers following LD/TM tears treated operatively or non-operatively is 75%. Players treated non-operatively saw a decline in several performance metrics while players treated operatively had no significant difference in performance after surgery.

- 3158** Board #204 May 31 3:30 PM - 5:00 PM
Characterizing the Prevalence of Cam-Type Hip Impingement in Women's Professional Ice Hockey Players
 Cordelia W. Carter, Darryl Whitney, Matthew Kingery, Samuel Baron, Guillem Gonzalez-Lomas. NYU-Langone Medical Center, New York, NY.
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 (No relevant relationships reported)

Purpose Recent studies have demonstrated an increased prevalence of femoroacetabular impingement (FAI) in elite men's ice hockey players, yet little is known about the hips of players in the National Women's Hockey League (NWHL). The primary purpose of this study was to determine the prevalence of radiographic cam-type FAI in women's professional ice hockey players. The secondary purpose was to analyze the relationship between the presence of cam deformity and hip ROM; clinical impingement signs; and age of menarche. **Methods** Clinical, radiographic and demographic data were collected for NWHL players during pre-participation physicals. Alpha angles were measured on 45° Dunn radiographs, with alpha angles $>55^\circ$ defined as cam-positive. Spearman correlations were performed to analyze the relationship between alpha angle and both ROM measurements and menarchal age. Players were grouped into those with and without cam lesions and group differences were assessed using the student's t-test. **Results** Twenty-seven athletes were included. Nineteen (70%) had alpha angles $>55^\circ$; 14 (52%) had bilateral cam deformity. Average menarchal age was 13.9 ± 1.5 years. There was a significant association between age of menarche and alpha angle (right hips, $p=0.01$; left hips, $p=0.04$). There was no significant association between alpha angle and either hip ROM or clinical impingement signs. **Conclusion** This study suggests that elite female ice hockey players have a higher prevalence of cam-type morphology than the general population. The positive association between alpha angle and age of menarche lends additional support to the etiological hypothesis of the cam lesion resulting from activity-related stress at the proximal femoral physis; players with earlier menarche (and therefore earlier physal closure) seem to be less vulnerable to the development of cam deformity of the proximal femur. Thus, professional women's ice hockey players have a high risk of developing cam-type morphology of the proximal femur, although each player's age of menarche may mediate her individual risk for cam lesion development.

- 3159** Board #205 May 31 3:30 PM - 5:00 PM
Clinical Outcomes of Ultrasound-Guided Percutaneous Patellar Tendon Scraping
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 (No relevant relationships reported)

Purpose: To report the clinical outcomes of patients with patellar tendinopathy treated with ultrasound-guided percutaneous patellar tendon scraping. **Methods:** Design: Retrospective case series
 Setting: Academic sports medicine clinic
 Patients: Nine patients with patellar tendinosis (total of 10 tendons). Six patients had primary patellar tendinosis and three had persistent pain despite surgery. Mean age was 21.2 years old. Four were competitive athletes, 4 were recreational athletes and 1 has ceased sport participation. Interventions: All patients underwent ultrasound-guided patellar tendon scraping using a 14-gauge needle, followed by a brief rehabilitation period before returning to sport. Main Outcome Measures: Patient reported outcome measures (PROM), including the Victoria Institute of Sport Assessment Questionnaire-Patellar Tendon and Lower Extremity Functional Scale; time to return to sport and; adverse events. **Results:** All patients with primary patellar tendinosis met the minimal clinically important difference (MCID) for their PROM with 1 patient experiencing a symptom relapse. The average time to return to competitive sport was 2.67 weeks. In the post-surgical group, one of the three patients experienced a significant clinical improvement durable for 16 months. No adverse events were reported for any patient. **Conclusions:** Ultrasound-guided percutaneous patellar tendon scraping may result in improved patient-reported outcome scores and facilitate a safe, rapid return to sports in cases of primary patellar tendinopathy. Results were less reliable for persistent pain after surgery.

3160 Board #206 May 31 3:30 PM - 5:00 PM

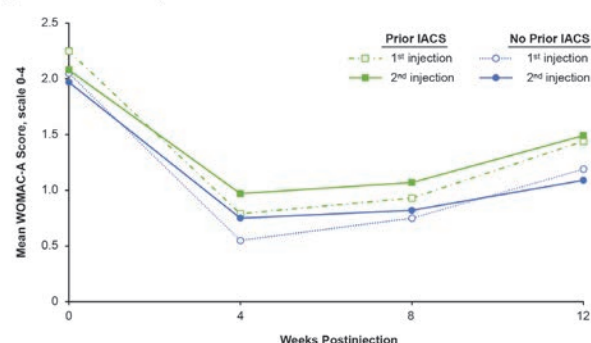
Initial/Repeat Triamcinolone Acetonide Extended-Release (TA-ER) Reduces Osteoarthritis Knee Pain Regardless of Prior Intra-Articular Corticosteroids (IACS)

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(No relevant relationships reported)

PURPOSE: Repeat IACS are common in the management of knee osteoarthritis (OA), but efficacy may diminish over time, and recurrent use has been associated with articular damage. This post hoc analysis of a Phase 3b, single-arm, open-label study was designed to evaluate repeat injection of TA-ER in patients with knee OA who had received prior IACS. **METHODS:** Patients ≥ 40 y with symptomatic knee OA for ≥ 6 mo received the 1st TA-ER injection on Day 1 and the 2nd injection at the first visit (Wk 12, 16, 20, or 24) at which repeat dose criteria were met (benefit from and tolerated the 1st injection without safety concerns and clinical indication to receive the 2nd injection). Patients who received 2 injections were evaluated every 4 wks up to 52 wks after the 1st injection. Treatment-emergent adverse events (TEAEs) and index knee radiography were evaluated. Exploratory efficacy endpoints included Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) A (pain). **RESULTS:** Of 208 enrolled patients, 179 received 2 injections. Of these, 95 (53.1%) had prior index knee IACS. Median time to 2nd injection was 16.4 wks (prior IACS) and 16.9 wks (no prior IACS); in both subgroups $\sim 20\%$ did not need the 2nd injection until Wk 24. Mean WOMAC-A scores were comparable in both groups and decreased $\sim 50\%$ following each injection (Figure). Incidences of serious and Grade 3/4 TEAEs were low and similar in both groups. There were no indications of chondrolysis, osteonecrosis, subchondral insufficiency fractures, or clinically significant subchondral bone changes in either group. **CONCLUSION:** TA-ER provided substantial analgesia for 12-24 wks postinjection that did not diminish with repeat administration and/or prior IACS use. Safety profiles were consistent with the overall population and previous reports. TA-ER may be a potential long-term nonoperative management strategy for knee OA pain.

Figure. Comparison of mean WOMAC-A (pain) scores following the 1st and 2nd TA-ER injections for patients with and without prior index knee IACS.



IACS, intra-articular corticosteroid; TA-ER, triamcinolone acetonide extended-release; WOMAC, Western Ontario McMaster Universities Osteoarthritis Index.

3161 Board #207 May 31 3:30 PM - 5:00 PM

Acute and Longitudinal Effects of Pitching on Passive Range of Motion in Division I Athletes

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(No relevant relationships reported)

PURPOSE: To assess passive range of motion (ROM) measurements acutely over time and how this acute change alters over the course of a baseball season. **METHODS:** Seven healthy male NCAA Division I baseball pitchers were measured prior to the start of the season. Each pitcher was assessed for passive shoulder and elbow ROM, with measurements taken after each pitching bout during the season.

Pitching bouts were allotted to early season, mid-season, or late season. In addition to ROM measurements, pitch volume, pitch type, and ball velocity were also collected for analysis.

RESULTS: Following a pitching bout, passive shoulder external rotation decreased by 7% ($p = 0.000$) during the early season. However, passive shoulder internal rotation was significantly reduced during the early season (-37% ; $p = 0.001$), mid-season (-30% ; $p = 0.000$), and late season (-42% ; $p = 0.000$). Further, total motion also decreased during the early season (-12% ; $p = 0.000$), mid-season (-6% ; $p = 0.000$), and late season (-9% ; $p = 0.000$). In terms of pitch type, increasing the volume of fastballs thrown had a moderate correlation with loss of passive shoulder external rotation during the late season ($r = -0.705$). Increasing the volume of curveballs thrown had a moderate correlation with total motion lost during the late season ($r = -0.665$) as well as with passive elbow extension lost during mid-season ($r = -0.760$).

CONCLUSIONS: Passive ROM is significantly impacted immediately after throwing. This decrease continues to be present throughout all parts of the baseball season. Moreover, a moderate correlation of fastballs and curveballs to losses in passive ROM indicates that attention to pitch type may be warranted, particularly during the middle and latter parts of the baseball season.

3162 Board #208 May 31 3:30 PM - 5:00 PM

Long-Term Characteristics of Injured Shoulders in Overhead Sports: A Gender Comparison

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(No relevant relationships reported)

Overhead sports require high levels of mobility and force produced by the shoulder joint. Additionally, gender differences in glenohumeral joint mobility and upper extremity strength are apparent in various athletic populations. Previous studies have found relationships in shoulder range of motion (ROM) and strength in several shoulder injuries. However, data are lacking regarding the long-term effects of shoulder injuries and considerations with respect to gender. **PURPOSE:** To determine the long-term effects of shoulder injuries on shoulder ROM and strength and examine gender differences in collegiate overhead athletes. **METHODS:** 35 male (age: 20.3 ± 1.2 yr, mass: 84.1 ± 9.7 kg) and 25 female (age: 19.6 ± 0.8 yr, mass: 70.8 ± 10.9 kg) overhead athletes fully participating in NCAA division I baseball, softball, volleyball, or tennis were recruited and divided into injury history group and healthy group depending on the existence of a history of shoulder injury. Active ROM of shoulder internal rotation (IR), external rotation (ER) and horizontal adduction (HAD) were measured using a digital inclinometer. Isometric shoulder IR and ER strength were assessed using a hand-held dynamometer and normalized by body mass. A two (group) by two (gender) factorial ANOVA was used to evaluate the dominant shoulder ROM and strength. Cohen's d effect sizes were calculated to assess the magnitude of differences. **RESULTS:** Females showed significantly lower IR ROM ($p = .03$, $d = 0.88$), IR strength ($p = .04$, $d = 0.83$), and ER strength ($p = .04$, $d = 0.86$) in the injury history group versus the healthy group, whereas there were no group differences in males ($p > .05$). Additionally, male overhead athletes had lower IR ($p = .01$, $d = 0.67$) and HAD ROM ($p = .01$, $d = 0.85$) and greater IR strength ($p = .02$, $d = 0.64$) compared to female overhead athletes. **CONCLUSION:** The results of this study indicate that shoulder injuries may have longer-lasting effects in female overhead athletes compared to male athletes. Furthermore, male overhead athletes demonstrated larger differences in posterior shoulder tightness and rotator cuff strength imbalances compared to female overhead athletes. This study may have significant implications for protocols aimed at preventing shoulder reinjury for specific genders in overhead sports.

3163 Board #209 May 31 3:30 PM - 5:00 PM

Skin Compatibility with 3d Printed Splints And Casts

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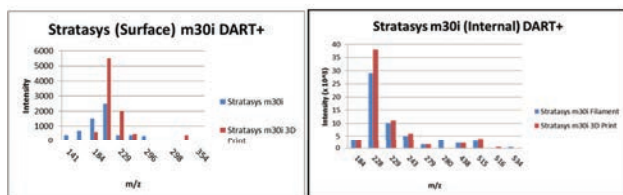
(No relevant relationships reported)

PURPOSE: 3D printed limb orthotics offer hygienic advantages over traditional technology because no padding is needed. We investigated biocompatibility and chemical profile of 3D printed material in contact with skin. **METHODS:** Patient-specific 3D printed ABS polymer casts from multiple sources of feedstock were evaluated according to ISO 10993 standards used by FDA for review of biocompatibility. The effect of post-processing with acetone vapor was evaluated as an independent variable. Cytotoxicity testing using L929 fibroblast reactivity, sensitization by Kligman Maximization methods in Guinea Pigs and irritation evaluation by intracutaneous injection in New Zealand White Rabbits of 3D print extractions were conducted under GLP conditions. In addition, mass spectrometry of filament feedstock and 3D printed casts was performed on solvent extractions using DART methods. **RESULTS:** Finished casts met criteria for permanent contact with skin

and limited contact with mucosal membranes. Mass spectrometry findings indicated that changes in ABS polymer occurred with 3D printing and post-processing in both surface and internal chemistry.

However, these chemical changes did not compromise biocompatibility assessed under ISO 10993. **CONCLUSIONS:** Patient-specific 3D printed, ABS orthotics met industry standards for biocompatibility for extended patient skin contact despite changes in material chemistry from feedstock. Therefore, testing and adherence to specific manufacturing controls is necessary to assure patient safety. Mass spectrometry assessment of composition of ABS polymers may serve to continually monitor product quality of 3D printed medical devices in accordance with 21 CFR 820.30.

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3164 Board #210 May 31 3:30 PM - 5:00 PM

Pubertal Timing is Not Related to Anterior Cruciate Ligament Laxity in Young Adults.

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(No relevant relationships reported)

Females sustain ACL injuries more often than males, especially among physically active adolescents and young adults. Studies suggest that increased estrogen during the ovulatory phase of the menstrual cycle is related to ephemerally increases in ACL laxity, and thus elevated injury risk. These hormonal factors may partially explain the sex-bias in injury risk, since males do not experience the same estrogen spikes and thus avoid these bouts of elevated risk. Little is known, however, about how variability in estrogen exposure within females affects inter-individual differences in injury risk. One factor that may play a role in cumulative estrogen exposure is age at menarche, since it relates to total number of cycles experienced. Our prior work shows links between age at menarche, pubertal growth patterns, and biomechanical risk for ACL injury. It is possible that age at menarche also has an impact on ACL injury risk through effects on laxity.

Purpose: To determine if age at menarche is related to female ACL laxity.

Methods: Subjects were recreationally active undergraduate and medical school females (N=15) and males (N=20). Males served as a control group, in which pubertal development timing was assessed as age at achieving adult height (recall). Age at menarche and current menstrual status in females were assessed by recall questionnaire. Telos™ stress radiography was used to assess ACL laxity. Statistical analysis consisted of an independent samples t-test to compare laxity in males and females. Linear regression analysis was used to determine whether laxity was related to pubertal timing within each sex.

Results: The t-test found no significant sex difference in ACL laxity (female mean \pm SD = 3.0 ± 1.8 mm; male mean \pm SD = 3.7 ± 1.7 mm; $P = 0.26$). In males, regression analysis demonstrated no relationship between age at achieving adult height and knee laxity: slope = -0.03 (95% CI: $-0.38 - 0.31$); intercept = 4.34 (95% CI: $-1.60 - 10.39$); $r^2 = 0.003$; $P = 0.83$. Similarly, females exhibited no relationship between knee laxity and age at menarche: slope = -0.17 (95% CI: $-0.95 - 0.61$); intercept = 5.15 (95% CI: $-4.87 - 15.16$); $r^2 = 0.02$; $P = 0.65$. The absence of regression relationship persisted after controlling for current menstrual cycle status.

Conclusion: ACL laxity in females appears to be unrelated to age at menarche.

Sponsor: DAGMEC

3165 Board #211 May 31 3:30 PM - 5:00 PM

Accuracy of Ultrasound Imaging of the Lisfranc Joint Complex

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(No relevant relationships reported)

Lisfranc injuries account for 1 in 55,000 injuries yearly and are associated with poor outcomes and high complication rates. Superficially connecting the medial

cuneiform and second metatarsal, the dorsal Lisfranc ligament is easily visualized with ultrasound. Ultrasound can provide quick, cost effective diagnosis but is not currently standard in clinical practice.

PURPOSE: This study sought to compare measurement accuracy of the dorsal Lisfranc ligament using ultrasound, external software, and gross anatomic dissection, with an additional anatomic study of the joint complex. **METHODS:** Ultrasound images of 22 embalmed cadaveric feet (13 male, 9 female, 79.5 ± 13.3 years) were obtained using a 6-13MHz linear array. Dorsal Lisfranc ligament length and joint space were measured and compared between methodologies.

Images were also re-measured using ImageJ software. Specimens were dissected to evaluate dorsal, interosseous, and plantar Lisfranc ligaments. Joint complex morphology was documented. **RESULTS:** Ultrasound (8.39 ± 1.26 mm) and ImageJ measurements (8.26 ± 1.76 mm) of the dorsal Lisfranc ligament did not differ significantly, but both were significantly different ($p < 0.05$) than gross dissection (10.8 ± 1.84 mm). There were no significant differences in dorsal joint space measures between ultrasound (2.19 ± 0.49 mm) and ImageJ (2.05 ± 0.52 mm), but both were significantly different ($p < 0.05$) than dissection measurements (1.04 ± 0.24 mm).

The dissected dorsal and interosseous ligaments had consistent morphology, whereas the plantar ligament demonstrated a Y- and a fan-shaped variant. A connection between the interosseous and plantar ligaments was present in 64% of dissections.

CONCLUSION: The dorsal Lisfranc ligament is easily visualized on ultrasound with 23% of the ligament not clearly visible at the peripheral bony attachments. While visually underrepresented on ultrasound, measurements were consistent. Radiographic joint space measurement remains the diagnostic gold standard. Further research should focus on using ultrasound to measure both bony and ligament integrity.

Ligament echogenicity provides additional diagnostic information to assess more subtle joint injuries. Additionally, the plantar Lisfranc ligament variability may impact the stability of the joint in some patients.

F-64 Free Communication/Poster - Breast Cancer

Friday, May 31, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

3166 Board #212 May 31 3:30 PM - 5:00 PM

Impact of Aerobic and Resistance Exercise on Global Shoulder Function in Breast Cancer Survivors

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(No relevant relationships reported)

Purpose: Treatment strategies for breast cancer including surgery, radiation, endocrine therapy and chemotherapy have contributed to improving survival rates. However, the implementation of surgical and radiation therapies precipitates adverse musculoskeletal effects in the upper extremity (UE), including decreased shoulder range of motion (ROM), weakness, and chronic pain, with 67% of breast cancer survivors (BCS) reporting upper extremity problems. The purpose of this exploratory analysis of a randomized, controlled trial was to investigate the effects of a 16-week aerobic and resistance exercise intervention on the functional mobility of the UE in BCS.

Methods: BCS were randomized to the Exercise (EX; N=50) or Control (CON; N=50) groups. The EX group underwent moderate-to-vigorous aerobic and resistance exercise sessions 3 times/week for 16 weeks. Functional mobility was assessed pre- and post-intervention by active ROM, maximal isometric voluntary strength, the Disabilities of Arm, Shoulder and Hand (DASH) questionnaire, and the Penn Shoulder Scale (PSS). Repeated-measures analyses of variance were used to compare pre- and post-intervention data in the two groups and assess between group differences.

Results: Included BCS were 53.5 ± 10.4 years old, Hispanic white (55%) with body mass index 33.5 ± 5.5 kg/m². Participants were treated with surgery (79% mastectomy) and both chemotherapy and radiation therapy (76%), including breast alone (55%) or breast + nodal radiation (45%). At baseline, EX and CON did not differ on functional mobility measures ($p > 0.05$). Post-intervention, the EX group experienced statistically significant improvements in active ROM (shoulder flexion, external rotation at 0°/90°), isometric strength (shoulder flexion, external rotation, internal rotation and horizontal adduction) and DASH/PSS scores when compared to their baseline measures ($p < 0.001$) and to the CON group ($p < 0.001$). The CON group did not experience any changes ($p > 0.05$).

Conclusions: A 16-week aerobic and resistance exercise program is associated with improved functional mobility of the UE. Clinical exercise programs should be incorporated into current rehabilitation oncology practice as a means of improving global shoulder function following breast cancer treatment.

3167 Board #213 May 31 3:30 PM - 5:00 PM
Body Composition, Strength And Physical Function In Short- And Long-term Breast Cancer Survivors

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 (No relevant relationships reported)

Previous data have found that breast cancer survivors (BCS) have poorer body composition, strength, and physical function compared to age and weight matched controls. Whether these changes improve over time after treatment remains uncertain.

PURPOSE: To compare body composition, strength, and physical function between short-term (ST; <4 years; n=17; age=57±9 yrs) and long-term (LT; >4 years; n=24; age=62±7 yrs) BCS. **METHODS:** Body composition [lean mass (LM), fat mass (FM)] was assessed using dual-energy X-ray absorptiometry. Lower body strength was assessed using the Biodex leg extension/flexion system at 60 ° isometric knee extension. Upper body strength was assessed using one repetition maximum chest press. Physical function was measured using the continuous-scale physical function performance test. Independent t-tests were used to compare ST and LT-BCS. Significance was accepted at $p \leq 0.05$. **RESULTS:** Time since treatment completion was 1.8±1.0 yrs for ST and 11.8±6.9 yrs for LT. There were no differences in body weight, LM, FM, and upper and lower body strength between groups. Total physical function (ST:64±14; LT:73±11 U) and the functional domains for endurance (ST:66±15; LT:75±12 U) and balance (ST:65±15; LT:75±12 U) were significantly lower in ST-BCS. **CONCLUSION:** Our findings indicate that without exercise, body composition and strength do not improve whereas physical function improves over time following treatment. Funding: ACSM Doctoral Student Grant; NSCA Doctoral Graduate Student Research Grant.

3168 Board #214 May 31 3:30 PM - 5:00 PM
Effects of High-Intensity Interval Training on Body Composition in Breast Cancer Patients Undergoing Anthracycline Chemotherapy

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 (No relevant relationships reported)

Purpose: While widely used in breast cancer patients, anthracyclines induce multiple adverse side effects, including weight gain and muscle atrophy. High intensity interval training (HIIT) is a novel exercise method that improves glucose metabolism, cardiorespiratory fitness and body composition in less exercise time than traditional continuous aerobic exercise in the general population. However, the effects of HIIT on body composition when performed during chemotherapy are unknown. The purpose of this study was to examine the effects of HIIT on body composition in breast cancer patients undergoing anthracycline chemotherapy.

Methods: Thirty sedentary breast cancer patients diagnosed with stage I-III breast cancer were randomized to exercise (HIIT=15) or control (CON=15) groups. HIIT performed 3 exercise sessions per week on stationary bike for 8 weeks during anthracycline chemotherapy. Exercise intensity was individually prescribed based on peak power output (PPO) and each HIIT session included 7 alternating bouts of 90% of peak power output followed by 10% peak power output. CON was asked to maintain current levels of activity. Lean mass and fat mass were obtained at baseline (wk0) and post-treatment (wk9) from the InBody 770 bioelectrical impedance scale (Biospace, Cerritos, California). Paired t-test and repeated ANOVA were used to determine effects of HIIT on body composition within and between the two groups.

Results: At baseline, HIIT and CON groups did not differ by age (46.9±9.8yr) or BMI (31.0±7.5 kg/m²). Following 8 weeks, body composition did not significantly change in either group ($p>0.05$). Fat mass slightly decreased in the HIIT (wk0: 37.8±13.8kg to wk9: 35.4±13.4kg, $p>0.05$) and CON (wk0: 30.2 ± 12.6kg to wk9: 29.4±13.7kg, $p>0.05$) groups. Lean mass slightly increased in the HIIT group (HIIT: wk0: 44.0±6.4kg to wk9: 44.7±6.4kg, $p>0.05$) and did not change in the CON group (wk0: 44.3±8.8kg to wk9: 44.2±8.5kg, $p>0.05$).

Conclusions: An 8-week HIIT intervention did not improve body composition in obese breast cancer patients undergoing anthracycline therapy. Longer duration interventions with a larger sample must be explored to elucidate the benefits of HIIT on body composition in this population.

3169 Board #215 May 31 3:30 PM - 5:00 PM
Relationship Between Accelerometer Output And Oxygen Consumption In Patients With Breast Cancer After Chemotherapy Treatment

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 (No relevant relationships reported)

PURPOSE: Currently used accelerometer cut-points to identify different intensities of physical activity are validated in the healthy population. These cut-points may not be applicable to patients with cancer due to lower fitness levels or different energy expenditure in rest. We aimed to examine the relationship between oxygen consumption and accelerometer output during different controlled activities in women with breast cancer shortly after completion of chemotherapy treatment.

METHODS: Forty women aged 50.4 (SD 9.5) years who completed chemotherapy treatment for breast cancer two to four months ago participated in this laboratory study. A cardiopulmonary exercise test was conducted to assess peak oxygen consumption (peakVO₂). Oxygen consumption in rest was assessed while lying supine for 6 minutes. Subsequently, nine activities with different intensities were performed while wearing an accelerometer on the right hip, and during which oxygen consumption was assessed. The relationship between oxygen consumption (expressed as percentage of peakVO₂ and Metabolic Equivalent of Task (MET) value) and accelerometer output (in counts per minute (cpm)) was studied with linear regression analyses.

RESULTS: PeakVO₂ was 21.5 (SD 6.1) mL/kg/min. Oxygen consumption in rest was 3.1 (SD 0.6) mL/kg/min. The accelerometer output corresponding to the cut-points for low versus moderate (40% peakVO₂) and moderate versus vigorous (60% peakVO₂) intensity physical activity were 1100 and 1868 cpm, respectively. The analyses based on MET values resulted in a cut-point of 1172 cpm to distinguish between low and moderate intensity physical activity (3 MET) and a cut-point of 2689 cpm to distinguish between moderate and vigorous intensity physical activity (6 MET).

CONCLUSIONS: The accelerometer cut-points to distinguish different physical activity intensities were lower than cut-points validated in the general population (i.e. 1952 cpm for moderate and 5724 cpm for vigorous intensity). This finding was irrespective of the method used to express oxygen consumption (%peakVO₂ versus MET). This study demonstrates that the use of accelerometer cut-points validated in the general (healthy) population underestimates the physical activity intensities in patients with breast cancer after chemotherapy treatment.

3170 Board #216 May 31 3:30 PM - 5:00 PM
Community-Based Exercise Improves Cancer-Related Fatigue and Physical Fitness In Breast Cancer Survivors: A Preliminary Analysis

Chad W. Wagoner, Jordan T. Lee, Stephanie A. Sullivan, Erik D. Hanson, Brian C. Jensen, Lee Stoner, FACSM, Aaron Piepmeier, Kirsten A. Nyrop, Hyman B. Muss, Claudio L. Battaglini, FACSM. University of North Carolina at Chapel Hill, Chapel Hill, NC. (Sponsor: Claudio Battaglini, FACSM)
 (No relevant relationships reported)

PURPOSE: A preliminary analysis was conducted to examine the potential impact of a community-based exercise program to improve cancer-related fatigue (CRF) and markers of physical fitness in breast cancer survivors (BCS) who were within a year of post primary treatment. **METHODS:** Ten early stage (I-III) BCS were included in the analysis (58 ± 11 years; 168.8 ± 7.5 cm; 74.7 ± 20.5 kg). Pre and post intervention assessments were completed for CRF via the PROMIS Fatigue 7a questionnaire, VO_{2peak}, lower and upper body strength, and subendocardial viability (SEVR). A 6-Minute Walk Test (6MWT) and Timed Up and Go (TUG) were completed to assess physical function. Participants aerobically trained on their choice of elliptical, treadmill, or stationary bike, progressively increasing intensity over the 16-weeks. Resistance training consisted of full-body circuits targeting major muscle groups. Training took place 3 days/week for 1 hour each day. **RESULTS:** CRF (-6.0 ± 3.5; $p < 0.001$), 6MWT (50.3 ± 46.5 m; $p < 0.01$), and SEVR (6.25 ± 8.3; $p < 0.05$) all significantly improved in response to the exercise intervention. VO_{2peak}, lower and upper body strength, and TUG showed small but nonsignificant improvements. Further analyses elicited inverse associations between changes in CRF and 6MWT ($r = -0.60$; $p = 0.05$) as well as CRF and SEVR ($r = -0.40$; $p = 0.25$). **CONCLUSIONS:** Preliminary analyses revealed that a community-based exercise program is effective in improving CRF while either maintaining or improving other markers of physical fitness. Community-based exercise programs have the potential to be viable alternatives for treating BCS who are presently experiencing CRF. Future studies are needed to explore relationships among CRF and markers of physical fitness as they could provide insight into potential underlying mechanisms driving CRF. Supported by funding from the Breast Cancer Research Foundation of New York.

3171 Board #217 May 31 3:30 PM - 5:00 PM

The 24-month Follow-up Of The Optitrain Exercise Rct For Women With Breast Cancer Undergoing ChemotherapyKate A. Bolam, Sara Mijwel, Natalie Holowko, Jonas Bergh, Helene Rundqvist, Yvonne Wengström. *Karolinska Institutet, Stockholm, Sweden.*

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(No relevant relationships reported)

In the earlier OptiTrain randomized controlled exercise trial, we found beneficial effects of two different exercise programs on health and treatment related outcomes. **PURPOSE:** The aim of this study was to report on cancer-related fatigue (CRF), quality of life (QoL), symptoms, muscle strength, cardiovascular fitness, body mass and physical activity levels of women with stage I-IIIa breast cancer who had been involved in the OptiTrain exercise RCT, 24 months from baseline. **METHODS:** The original 16-week, supervised exercise program was a three-armed, randomized controlled trial comparing the effects of a combined program of resistance training and high intensity interval aerobic training (RT-HIIT) or a combined program of moderate intensity and HIIT aerobic exercise (AT-HIIT) to usual care among 240 women with breast cancer undergoing chemotherapy. At 24 months, 117 and 155 participants participated in the in-clinic tests and completed the self-report questionnaires, respectively. We assessed CRF, QoL, symptoms, muscle strength, estimated cardiorespiratory fitness, body mass and objectively measured sedentary behaviour and physical activity. Analyses included mixed linear effects model analyses. **RESULTS:** RT-HIIT reported lower levels of total CRF (-1.37, 95% confidence interval (CI) -2.70, -0.04, effect size (ES) = -0.38), cognitive CRF (-1.47, 95% CI -2.75, -0.18, ES = -0.44), physical symptoms (-0.23, 95% CI -2.70, -0.00, ES = -0.29) but higher muscle strength (12.09, 95% CI 3.77, 20.40, ES = -0.51) than UC at 24 months. Whereas AT-HIIT reported lower total symptoms (-0.23, 95% CI -0.42, -0.03, ES = -0.29), symptom burden (-0.30, 95% CI -0.60, -0.01, ES = -0.08 (no effect)) and body mass (-2.15, 95% CI -3.71, -0.60, ES = -0.28) than UC at 24 months. **CONCLUSIONS:** The RT-HIIT group from the OptiTrain exercise RCT reported lower levels of total and cognitive CRF, and physical symptoms but higher muscle strength at 24 months, whereas, the AT-HIIT group reported lower total symptoms, and body mass at 24 months. The clinically relevant ES in muscle strength in the RT-HIIT is particularly encouraging given the importance of muscle strength as a predictor of many relevant health outcomes. While these results are promising, effect sizes range from small to medium and the results must therefore be interpreted with caution.

3172 Board #218 May 31 3:30 PM - 5:00 PM
Effects Of Exercise Training During Breast Cancer Chemotherapy On Fitness Outcomes At 1-year Follow-upAndria R. Morielli¹, Ki Yong An¹, Dong-Woo Kang¹, Christine M. Friedenreich², Donald C. McKenzie³, Karen Gelmon⁴, John R. Mackey⁵, Robert D. Reid⁶, Kerry S. Courneya¹. ¹University of Alberta, Edmonton, AB, Canada. ²Alberta Health Services, Calgary, AB, Canada. ³University of British Columbia, Vancouver, BC, Canada. ⁴University of British Columbia & British Columbia Cancer Agency, Vancouver, BC, Canada. ⁵Cross Cancer Institute, Edmonton, AB, Canada. ⁶University of Ottawa Heart Institute, Ottawa, ON, Canada.

(No relevant relationships reported)

PURPOSE: To determine the effects of different doses and types of exercise during breast cancer chemotherapy on fitness outcomes at 1-year follow-up and to investigate the associations of physical activity during the follow-up period with fitness outcomes. **METHODS:** The Combined Aerobic and Resistance Exercise (CARE) Trial was a multicenter trial in Canada that randomized 301 breast cancer patients initiating chemotherapy to 3 days/week of supervised exercise consisting of either: (1) a standard dose of 25-30 minutes of aerobic exercise (STAN, n=96), (2) a higher dose of 50-60 minutes of aerobic exercise (HIGH, n=101), or (3) a combined dose of 50-60 minutes of aerobic and resistance exercise (COMB, n=104). At 1-year post-intervention, patients completed objective measures of aerobic fitness, muscular strength, and muscular endurance. Physical activity was collected via questionnaire at 1-year follow-up and patients were categorized as meeting (1) aerobic only, (2) strength only, (3) combined, and (4) neither exercise guideline. **RESULTS:** We obtained fitness data on 263 (87.4%) patients and self-report data on 284 (94.4%) patients at 1-year follow-up. Analyses of covariance showed that COMB was superior to HIGH for upper body muscular endurance (8.8 reps; $p = 0.020$); borderline superior to HIGH for lower body muscular strength (5.1 kg; $p = 0.05$); and borderline superior to STAN for upper body muscular endurance (6.4 reps; $p = 0.09$). Moreover, meeting the combined exercise guideline at follow-up was associated with: (1) better VO_2 peak (2.1 ml/kg/min; $p = 0.002$); upper body strength (2.8 kg; $p = 0.017$); and upper body endurance (13.4 reps; $p = 0.004$) compared to meeting neither guideline, (2) better upper body endurance (8.6 reps; $p = 0.026$); and lower

body endurance (15.2 reps; $p = 0.020$) compared to meeting the aerobic only guideline and (3) better VO_2 peak (1.7 ml/kg/min; $p = 0.041$); and lower body endurance (20.1 reps; $p = 0.036$) compared to meeting the strength only guideline. **CONCLUSIONS:** Performing combined aerobic and strength exercise during breast cancer chemotherapy resulted in longer-term improvements in muscular endurance and strength compared to aerobic exercise alone. Moreover, performing combined aerobic and strength exercise during follow-up was strongly associated with better fitness outcomes.

3173 Board #219 May 31 3:30 PM - 5:00 PM
Effects Of Exercise During Chemotherapy On Hospitalization And Chemotherapy Completion: The OptiTrain Breast Cancer TrialSara Mijwel, Kate A. Bolam, Yvonne Wengström, Helene Rundqvist. *Karolinska Institutet, Stockholm, Sweden.*

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(No relevant relationships reported)

PURPOSE: Prevention of chemotherapy adverse effects may aid in reducing the number of women being admitted to the hospital. Moreover, the importance of sustaining full dose chemotherapy-intensity has been demonstrated. We previously showed that a 16-week exercise program in patients with breast cancer undergoing chemotherapy was beneficial to prevent physiological and self-reported health-related deteriorations. Here, the aim was to examine the effects of exercise on hospitalization and chemotherapy completion rates.

METHODS: 240 women scheduled for chemotherapy were randomized to 16-weeks of resistance and high-intensity interval training (RT-HIIT), moderate-intensity aerobic and high-intensity interval training (AT-HIIT) or to usual care (UC). Chemotherapy completion rate is reported as the mean relative dose intensity (RDI; $\text{mg}\cdot\text{m}^{-2}\cdot\text{wk}^{-1}$), which represents the actual received dose intensity as a fraction of the dose intensity of the originally planned chemotherapy regimen. Lymphocyte and thrombocyte concentrations were measured prior to each chemotherapy session. All data were extracted from medical records.

RESULTS: A significantly lower proportion of participants in the RT-HIIT group (3%) were hospitalized compared to participants in the UC group (15%) over the course of chemotherapy ($p=0.049$). In total, 22% of the participants in RT-HIIT, 28% in AT-HIIT, and 20% in UC required a dose adjustment with no significant between group differences ($p=0.49$). Among those that required dose adjustment, median relative dose intensity was 80% (IQR=75-87) in the RT-HIIT group, 75% (IQR=75-80) in the AT-HIIT group, and 77% (IQR=73-82) in the UC group ($p=0.25$). No significant differences were found between groups for lymphocyte or thrombocyte concentrations. **CONCLUSIONS:** A 16-week exercise intervention consisting of resistance and high intensity interval training during chemotherapy may have significant implications for the cost of cancer care due to reduced hospitalization rates, but had no effect on chemotherapy completion rates.

F-65 Free Communication/Poster - Clinical Exercise Physiology - OtherFriday, May 31, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA23174 Board #220 May 31 3:30 PM - 5:00 PM
Inflammatory and Affective Responses to Acute Resistance Exercise of Varying Loads in Postmenopausal Women.Ciaran M. Fairman¹, Maryam B. Lustberg², Marcy L. Haynam², Anna Kimborowicz², Josh Bartels², Michael Lantz², Sarah Johnson², Carl Maresh², William J. Kraemer, FACSM², Brian C. Focht, FACSM². ¹Edith Cowan University, West Perth, Australia. ²Ohio State University, Columbus, OH. (Sponsor: Brian C Focht, FACSM)

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Resistance exercise (RE) is increasingly recognized as a powerful behavioral intervention that can improve key metabolic and cardiovascular risk factors among aging women. The manipulation of RE variables, such as repetitions and load, may illicit differing physiological and psychological responses to acute bouts of RE. Although differential responses to acute RE may influence training adaptations and subsequent motivation for regular RE participation, the effects of acute RE upon these outcomes in postmenopausal (PMW) have yet to be evaluated. **PURPOSE:** To determine the effects of RE intensity on physiological, affective, and motivational outcomes in PMW.

METHODS: Thirteen PMW (Age: 59.23±11.3; BMI 29.99±4.55) participated in the study. Each participant completed 3 experimental conditions in a randomly assigned order. The low-load condition involved 3 sets of 12-15 reps at 55%-64% 1 repetition maximum (RM), with 60 seconds of rest between sets. The moderate load involved 3 sets of 8-12 reps at 65%-75% 1RM, with 90 seconds of rest between sets. The heavy load involved 3 sets of 3-6 reps at 80-90% 1RM, with 120 seconds of rest between sets. Assessment of inflammatory markers (IL-6, TNF- α) were obtained prior to, immediately after, 15 minutes and 30 minutes after each condition. Affective and motivational outcomes were assessed prior to, during, and at multiple timepoints following each condition.

RESULTS: Results revealed no significant ($p > 0.05$) differences in inflammatory markers or affective responses as a function of RE load. Furthermore, there was no significant differences ($p > 0.05$) in intention or self-efficacy between experimental conditions.

CONCLUSIONS: CONCLUSION: Acute bouts of RE at 55-64% 1RM, 65-75% 1RM and 80-90% 1RM yielded comparable inflammatory and affective responses in PMW. The similar responses to the varying loads of acute RE observed in this investigation may have valuable practical implications for RE prescription among PMW.

3175 Board #221 May 31 3:30 PM - 5:00 PM Blood Pressure Abnormalities Among NCAA Athletes

Hannah M. Wright¹, Michael C. Meyers, FACSM¹, Mark L. Niebyski², James C. Sterling³, Shad K. Robinson¹. ¹Idaho State University, Pocatello, ID. ²World Hypertension League, Corvallis, MT. ³Baylor, Scott & White, Dallas, TX.
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(No relevant relationships reported)

Although an athlete is routinely exposed to rigorous physical training programs leading to improved cardiorespiratory function, more recently, there has been concern with athletes presenting with hemodynamic abnormalities commonly associated with morbidity and mortality within the general population. **PURPOSE:** To quantify blood pressure (BP) abnormalities among NCAA Division I and II collegiate athletes. **METHODS:** Following written informed consent, 217 (131 male, 86 female) athletes (mean \pm SEM; age = 20.0 \pm 0.1 yr; ht = 178.7 \pm 1.1 cm; wt = 86.9 \pm 1.8 kg) underwent supine, hyperventilation, and standing BPs using a manual, hand-held sphygmomanometer as part of a preexercise evaluation prior to CPET. Supine BPs were subsequently evaluated using ACC/AHA criteria, with data analyzed by gender and race (50 African American, 167 White). **RESULTS:** MANOVAs (Wilks' λ) indicated a significant main effect across gender ($F_{2,214} = 14.987$; $P < 0.0001$), but not race ($F_{2,214} = 2.239$; $P = 0.101$). Post hoc analyses revealed that, overall, males exhibited a higher incidence of elevated BP ($BP_{sys} 121.2 \pm 0.9$ vs. 113.8 ± 1.1 ; $BP_{dias} 70.1 \pm 0.9$ vs. 74.4 ± 0.7 , $p < 0.0001$) than females, respectively. Among the 45.6% of total athletes diagnosed with elevated BP, 74.7% were males ($BP_{sys} 124.9 \pm 0.7$ / $BP_{dias} 77.8 \pm 0.7$) as compared to 25.3% of cases documented among females ($BP_{sys} 122.9 \pm 1.2$ / $BP_{dias} 76.9 \pm 1.2$). Of equal concern, was the hypertension indicated in 7.6% of male athletes ($BP_{sys} 142.8 \pm 1.9$ / $BP_{dias} 84.0 \pm 1.9$), with none reported among females. **CONCLUSION:** Findings indicated that 50.2% of NCAA Division I and II athletes in this study were diagnosed, based on ACC/AHA guidelines, with either elevated BP (BP_{sys} between 120-129 mm Hg and BP_{dias} less than 80 mm Hg) or Stage I or II hypertension (BP_{sys} greater than 129 mm Hg, and $BP_{dias} \geq 80$ mm Hg). These findings support the need for early detection, follow-up screening, and non-drug treatment of athletes to include identifying risk factors (i.e., stress) and knowledge assessment. Ongoing studies are underway to assess the breadth and long-term implications of elevated BP on the athletes' health, particularly with respect to potential cardiovascular risk.

3176 Board #222 May 31 3:30 PM - 5:00 PM Cardiac Etiology of Exercise Induced Hypoxemia within Elite Athletes

Jiri Dostal¹, Josef Stasek¹, Radka Kockova², Viktor Kocka³. ¹Faculty of Medicine, Charles University, Hradec Kralove, Czech Republic. ²University Hospital Hradec Kralove, Hradec Kralove, Czech Republic. ³University Hospital Kralovske Vinohrady, Prague, Czech Republic.
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(No relevant relationships reported)

PURPOSE: Exercise induced hypoxemia (EIH) is common finding within a group of elite athletes. It is generally thought, that the causality lies in the pulmonary. We report a group of 8 elite athletes with severe EIH (SpO₂ below 92%) examined for the origin of the EIH. The task was to perform differential diagnoses to locate the shunt into the pulmonary circulation or cardiac shunts.

METHODS: Eight consecutive national level endurance athletes (cycling, running and rowing) with severe EIH (SpO₂ reproducibly below 92) has been examined with stress transthoracic echocardiography with injection of agitated saline. The saline was administered via cubital vein during the last two steps of the stress echo and the

presence of the hypoxemia. Differential diagnoses was based on previously published reports for evaluation of cardiac shunts - number of microbubbles and latency (number of cardiac cycles) between the injection and the appearance of the microbubbles in the left heart. Trans-esophageal echo has been performed in the follow up procedure to evaluate the anatomical etiology of the shunt.

RESULTS: Four athletes presented pulmonary etiology of the hypoxemia.

Four athletes have presented cardiac origin with right to left shunt causing EIH. Concurrent transeophageal echocardiography discovered one atrial septal defect and three patent foramen ovale (PFO). One athlete with present PFO underwent successful catheterization closure of the PFO. Follow up exercise testing and stress echo confirmed no signs of shunt and no signs of presence of EIH in that patient. Also, performance measures of that athlete improved significantly. One athlete with present PFO/ASD underwent unsuccessful catheterization closure due to anatomical challenges.

CONCLUSIONS: Exercise induced hypoxemia is generally thought to be caused by anatomical or functional shunts within the pulmonary circulation. Our findings suggest possibly higher prevalence than originally thought of cardiac etiology. Successful treatment by catheter-based closure device improves performance and eliminate other clinical signs of the right to left cardiac shunt. Further evaluation of larger group of elite athletes with EIH is warranted to understand better the real prevalence and possible treatment of the cardiac origin of the EIH.

3177 Board #223 May 31 3:30 PM - 5:00 PM Metabolic And Cardiovascular Effects Of Body Weight Support Treadmill Walking In Healthy Older Adults.

Robert S. Van Zant, Wick Colchagoff, Anya Cox, Benjamin Eggleston, Andrea Griffith, Linda Harrison, Amie Newberry, Blake Price. The University of Findlay, Findlay, OH.
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(No relevant relationships reported)

Purpose: Body weight supported treadmill training (BWSTT) has been proven to be effective for gait re-education for patients experiencing neurologic and musculoskeletal impairments. Recently our lab showed no significant difference in cardiovascular and metabolic effects of BWSTT in healthy young adults at clinically appropriate levels of body weight support (BWS). The purpose of this study was to determine the effects of BWSTT on cardiovascular and metabolic function in older (50-80 years) healthy adults. **Methods:** A total of 20 subjects (50% female, 58.3±7.3 yr; 172.6±9.0 cm; 84.2±22.4 kg; 28.1±5.4 kg/m²) provided their informed consent for study participation. Each subject completed 3, 5-minute treadmill walking trials at a self-selected pace, with 0%, 15%, and 30% BWS, performed in a single-blind randomized fashion. Subjects rested for a minimum of 5 minutes between each trial, and did not begin a subsequent trial until HR was verified to be < 5 bpm of HR rest. Heart rate using a Polar Beat HR monitor, blood pressure (BP) via auscultation, rate of perceived exertion (RPE) using the Borg ratio scale, and oxygen uptake (VO₂) using continuous indirect calorimetry, were measured at rest, and during the 3 walking trials. Mean data from minutes 3, 4, and 5 were then analyzed for difference by repeated measures ANOVA using SPSS statistical analysis (Version 24). **Results:** At rest, HR was 70.8±8.2 bpm and BP was 126.8±12.2 / 84.3±8.6 mmHg. Mean walking speed was 67.1 m/min. All tested parameters for all exercise trials were significantly ($p < 0.05$) different from rest. Among exercise trials, VO₂ and tidal volume at 30% BWS was significantly less than 0% BWS. **Conclusion:** In contrast to previous findings in younger adults, 30% BWSTT elicits a significant reduction in VO₂ and tidal volume in older adults at self-selected walking speeds.

3178 Board #224 May 31 3:30 PM - 5:00 PM The Combined Effects of Whey Protein and Aerobic Exercise on Glycemic Responses

Todd Castleberry¹, Ryan Gordon², Matthew Sokoloski², Emily Zumbro², Christopher Irvine², Aubrien Henderson², Matthew Brisebois², Vic Ben-Ezra². ¹Texas Christian University, Fort Worth, TX. ²Texas Woman's University, Denton, TX.
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(No relevant relationships reported)

BACKGROUND: An acute bout of aerobic exercise has been shown to improve glycemic responses in both healthy people and those with type 2 diabetes. More recent literature has also suggested that consuming whey protein prior to a meal or glucose challenge may decrease postprandial glucose response. To the authors' knowledge, no studies have examined the combined effects of acute aerobic exercise and whey protein on glycemic responses.

PURPOSE: The purpose of this study was to evaluate the combined effect of acute aerobic exercise and whey protein on plasma glucose, insulin, gastric inhibitory polypeptide (GIP), glucagon like peptide-1 (GLP-1), and glucagon following glucose ingestion in healthy, sedentary men.

METHODS: Eleven males (mean \pm SD, age: 24.3 \pm 5.4 years; BMI: 26.0 \pm 5.3 kg/m²; HbA1c: 5.2 \pm 0.2 %; VO_{2 max}: 38.3 \pm 6.1 ml/kg/min) completed four randomized trials:

no exercise and no whey protein (R); acute treadmill exercise (EX; 70% $\dot{V}O_2$ max for 60 min) performed ~12-14 hrs prior to a 75 g oral glucose tolerance test (OGTT); 50 g of whey protein (W) administered as a 30 min preload prior to an OGTT; and EX combined with W (EXW). Plasma samples from the OGTTs were analyzed for insulin, glucagon, GIP and GLP-1 using multiplex kits. Glucose was measured using enzyme-electrode technology. All variables are represented as incremental area under the curve (iAUC).

RESULTS: Glucose and insulin responses are represented in Table 1. GIP, GLP-1, and glucagon increased for both W and EXW compared to R ($p < .01$) and EX ($p < .03$).

Table 1. Participant glucose and insulin iAUC between trials				
	R	EX	W	EXW
Glucose (mmol x 120 min)	116.8 ± 105.3	155.7 ± 92.9	-21.1* ± 103.6	16.2* ± 118.1
Insulin (pmol x 120 min)	40922 ± 32078	34176 ± 22624	78956* ± 36162	63182 ± 51780

* $p < .01$ vs R; * $p < .01$ vs EX

CONCLUSION: Postprandial glucose responses are reduced following the consumption of 50 g of whey protein prior to a 75 g glucose challenge. Additionally, 50 g of whey protein increased plasma GIP and GLP-1, which has been shown to stimulate insulin secretion. Based on these findings, the combination of acute aerobic exercise and whey protein provides the most benefit compared to exercise or whey alone.

3179 Board #225 May 31 3:30 PM - 5:00 PM
Associations Among Objectively and Subjectively Measured Physical Activity in Older Adults
 Gabrielle Volk. *Miami University, Oxford, OH.*
(No relevant relationships reported)

Less than thirty-percent of older adults (>55y) meet the physical activity requirements outlined by Centers for Disease Control and Prevention. Physical activity has been reported to reduce the risk of diseases/conditions such as hypertension, type II diabetes, coronary heart disease, depression, and cancer—highlighting its importance as a modifiable, health-related factor. Consequently, it may be clinically useful for physicians to be able to assess physical activity in their patients. Thus, the **PURPOSE** of this study was to evaluate the validity of the Community Healthy Activities Model Program for Seniors (CHAMPS) questionnaire compared to a more objective measure of physical activity using accelerometry. **METHODS:** In 58 adults ($\geq 58y$) we assessed physical activity via questionnaire (CHAMPS) and 7-day accelerometry (Actical); and body composition (bioelectrical impedance). For accelerometry, subjects were advised to continue their habitual activity level. Pre-established cut-points for accelerometry interpretation were: sedentary (<100 counts/min); light physical activity (100-431 counts/min); moderate-to-vigorous physical activity (MVPA) (>431 counts/min). MVPA for CHAMPS included activities with MET values ≥ 3.0 METs. Associations were examined utilizing partial correlations (controlling for age and sex). **RESULTS:** Mean values for these subjects included: age = 69.0 ± 6.3y; BMI = 27.4 ± 7.3 kg/m²; body fat percentage (32.8 ± 11.6%); CHAMPS MVPA = 1843.5 ± 1477.2 kcal/wk. Mean values for accelerometry were: wear time: 890.8 ± 112.3 min/day; 14.8 ± 1.9 h/day; counts/min: 110.5 ± 59.3; accelerometer MVPA = 56.7 ± 29.1 min/day. CHAMPS MVPA was significantly correlated with accelerometer counts/min ($r = 0.40$, $p = 0.003$) and accelerometer MVPA ($r = 0.29$, $p = 0.035$). CHAMPS MVPA was inversely correlated with body fat percentage ($r = -0.33$, $p = 0.015$). **CONCLUSION:** These preliminary data suggest that the CHAMPS questionnaire may provide clinicians with a suitable estimation of their patients' habitual physical activity level.

F-66 Free Communication/Poster - Musculoskeletal/Neuromuscular

Friday, May 31, 2019, 1:00 PM - 6:00 PM
 Room: CC-Hall WA2

3180 Board #226 May 31 3:30 PM - 5:00 PM
Assessment of Bilateral Asymmetry in Cycling Peak Torque in Multiple Sclerosis Patients vs. Controls
 Brian A. Pribble¹, John W. Farrell, III², Daniel J. Larson¹, Christopher D. Black, FACSM¹, Debra A. Bembien, FACSM¹, Rebecca D. Larson¹. ¹University of Oklahoma, Norman, OK. ²University of Ottawa, Ottawa, ON, Canada.
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Bilateral asymmetry (BA) is defined as any significant differences in functional or anthropometric measures between contralateral limbs. BA in muscle function has previously been observed in persons with multiple sclerosis (PwMS), with higher levels of asymmetry in lower limb strength having a negative impact on walking capacity and quality of life. Previous methods used with PwMS have not allowed for the assessment of BA during bipedal movements. **Purpose:** The aim of the current study was to assess the levels of BA in power output in PwMS during submaximal cycling compared to healthy controls. **Methods:** Eight PwMS and 6 controls completed a cycle ergometer graded exercise test (GXT) at a self-selected cadence. Peak torque (PT) produced by each leg was assessed at 50%, 60%, and 70% of peak power output (PPO) to determine level of BA. Subjects additionally completed a 25-ft walk test (25FWT), six-min walk test (6MWT), and maximal voluntary contractions (MVCs) of the knee extensors. Group comparisons were assessed at each %PPO using a mixed factorial ANOVA. Correlations between GXT outcomes and 25FWT, 6MWT, MVC, and Expanded Disability Status Scale (EDSS) scores were assessed using Pearson's r and Spearman's rho correlations. **Results:** Non-significant effects were found for the Group x %PPO interaction ($p = 0.28$) and %PPO ($p = 0.49$) variables. Compared to controls, PwMS did not show any significant differences in BA at any %PPO. When collapsed across groups, the % difference in peak torque was found to have a weak to strong correlation with the 25FWT ($r = 0.72$, 0.80, and 0.79, all $p \leq .01$), 6MWT ($r = -0.41$ $p = 0.14$, -0.63 $p = 0.02$ and -0.73 $p = .00$), MVC ($r = 0.27$ $p = 0.35$, 0.47 $p = 0.09$, and 0.80 $p = 0.00$) and EDSS ($\rho = 0.38$ $p = 0.18$, 0.27 $p = 0.35$, 0.02 $p = 0.94$) at 50, 60, and 70% of PPO respectively. **Conclusion:** No significant differences were found for cycling peak torque asymmetry between PwMS and controls. Despite non-significance, PwMS displayed a between limbs difference of $\geq 10\%$ for peak torque at all levels of %PPO whereas controls all had differences $< 10\%$. Furthermore peak torque asymmetry was found to correlate moderately well with MS outcome measurements when collapsed across groups. Future research is needed to determine the viability of assessing BA with cycling PT measures.

3181 Board #227 May 31 3:30 PM - 5:00 PM
The Effects of Fatigue on Peak Torque During Dorsiflexion Between Limbs in Multiple Sclerosis Patients
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Multiple Sclerosis (MS) is a progressive immune-mediated disease that causes demyelination of the central nervous system. One of the most common symptoms in MS patients is fatigue. While strength asymmetries (SA) have been previously identified in MS patients, less is known of the impact fatigue has on SA. Fatigue of ankle dorsiflexion (AD) has the potential to limit walking function and activities of daily living (ADL) in MS patients. **PUPROSE:** To investigate the impact AD fatigue has on peak torque (PT) between limbs in MS patients compared to healthy individuals (Non-MS). **METHODS:** 26 individuals participated in the current study (MS: $n = 13$, Age = 50.3 ± 9.1 yrs, Expanded Disability Status Scale = 3.5 ± 1.8; Non-MS: $n = 13$, Age = 50.8 ± 8.5 yrs). Visit 1 & 2 consisted of test familiarization sessions. Visit 3 consisted of pre-exercise (PRE) maximal isometric contractions (MVC) of AD followed by fatiguing isometric exercise (FE) at 30% MVC until exhaustion. Immediately (POST) and 2 minutes (REC) after exercise subsequent MVCs were performed. Both limbs were tested with 15 minutes of rest between FE. Limbs were separated for analysis based on MVC PT (strong vs. weak). **RESULTS:** There was no group or limb difference in FE duration. When both limbs were collapsed for analysis,

FE duration was significantly lower in the MS group compared to the Non-MS group (161.14 ± 97.13 N vs. 226.24 ± 83.7 N, respectively; $p < 0.009$). PT significantly decreased PRE-POST, increased POST-REC, but still significantly less at REC from PRE for both limbs within each group ($p < 0.05$). The MS group showed a significant PT difference between limbs at PRE ($\Delta 4.34 \pm 5.88$ N; $p < 0.05$) and REC ($\Delta 3.94 \pm 7.14$ N; $p < 0.05$), while the Non-MS group showed no limb difference. PRE PT was significantly correlated to FE duration in the Non-MS group ($r = -0.55$; $p < 0.003$), but there were no significant correlations between PRE PT and FE duration in the MS group ($p > 0.11$). **CONCLUSION:** The MS group fatigued more quickly than the Non-MS group, however there was no fatigue asymmetries between limbs. The fatiguing exercise attenuated PT differences between limbs in the MS group but not in the Non-MS group. Strength was not related to FE duration in the MS group, but was so in the Non-MS group. The lack of a relationship between strength and fatigue in MS patients may help guide rehabilitation to improve ADLs.

3182 Board #228 May 31 3:30 PM - 5:00 PM
Benefits Of Whole Body Vibration Exercise For Non-specific Chronic Low Back Pain: An Assessor-blind, Randomized Controlled Trial

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(No relevant relationships reported)

PURPOSE: The purpose of this study was to confirm the benefits of whole body vibration (WBV) exercise for pain intensity and functional disability in patients with non-specific chronic low back pain (NSCLBP). **METHODS:** This was a 2-arm single-blind randomized controlled trial. Eighty-nine NSCLBP patients met the inclusion criteria, they were randomly allocated to either the WBV exercise group ($n=45$) or the control group ($n=44$). The WBV exercise group received WBV exercises three times a week for 12 weeks. The control group received general exercise protocol three times a week for 12 weeks. Primary outcome measures were pain intensity and functional disability measured by the visual analog scale (VAS) scores and Oswestry Disability Index (ODI). The secondary outcome measures included lumbar joint position sense, quality of life (Short Form Health Survey 36, SF-36) and overall treatment effect (Global Perceived Effect). **RESULTS:** A total of 84 NSCLBP patients completed the 12-week study program. After 12 weeks, compared with the control group, the mean VAS and ODI scores decreased by additional 1 point (95% CI, -1.22, -0.78; $P < 0.001$), 3.81 point (95% CI, -4.98, -2.63; $P < 0.001$) based on adjusted analysis in the WBV exercise group. And the WBV exercise group provided additional beneficial effects for in terms of lumbar joint position sense ($P < 0.05$), SF-36 ($P < 0.05$), and Global Perceived Effect ($P = 0.012$). **CONCLUSIONS:** The study demonstrated that WBV exercise could provide more benefits than general exercise for relieving pain and improving functional disability in patients with NSCLBP.

3183 Board #229 May 31 3:30 PM - 5:00 PM
The Synergic Impact of Sarcopenia and Dynapenia on Depressive Symptoms in Korean Older Adults

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(No relevant relationships reported)

The Synergic Impact of Sarcopenia and Dynapenia on Depressive Symptoms in Korean Older Adults

Purpose: To examine the synergistic impact of low appendicular skeletal muscle mass (ASM) and low muscle function (MF) on the risk of depressive symptoms in community-dwellers of Korean older adults.

Methods: Data obtained from a total of 446 participants aged 65 years or older (80% women) recruited from local communities were used in this analysis. ASM and MF were assessed with dual-energy X-ray absorptiometry (DEXA) and a 30-s chair stand test, respectively. Depressive symptoms were assessed with the center for epidemiologic studies depression Scale (CES-D). Logistic regression was used to estimate odds-ratios (ORs) and 95% confidence interval (CIs) for having depressive symptoms according to ASM and MF levels. Statistical significance was tested at $p=0.05$.

Results: The overall prevalence of depressive symptoms in this study population was approximately 16.4%, with 3.6 % of men and 12.8% women. With respect to depressive symptoms, individuals with low ASM alone or low MF alone had significantly higher ORs of 2.963 (95% CI=1.318-6.538, $p=0.019$) or 3.843 (95% CI=1.679-8.797, $p=0.002$), respectively, compared to individuals with normal ASM and MF (OR=1). In addition, individuals with low ASM and MF had a significantly higher risk of OR=7.907 (95% CI=3.354-18.640, $p<0.001$) compared to individuals with normal ASM and MF (OR=1).

Conclusion: The current findings suggest that both sarcopenia and dynapenia are independently and additively associated with an increased risk of depressive symptoms in elderly Korean adults, implying an urgency of an intervention targeting at both muscle mass and function for a healthy aging.

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3184 Board #230 May 31 3:30 PM - 5:00 PM
Effect of Resistance Training on Muscular Function and Functional Mobility in Adults with Cerebral Palsy

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(No relevant relationships reported)

Cerebral Palsy (CP) is a non-progressive neurological disorder due to damage in the brain leading to musculoskeletal dysfunction and immobility. Physical deconditioning of individuals with CP appears to accelerate muscle atrophy and osteoporosis; thus, adults with CP are more prone to fall and fracture. The lower state of balance and functional mobility is also related to the higher risk of fall in the general public, and resistance training is known to improve overall muscular strength and functional mobility. However, equivocal results were reported whether resistance training has a positive effect on muscular function and balance in CP population.

PURPOSE: To determine the influence of resistance training to muscular strength and balance in adults with CP who already developed muscle atrophy and osteoporosis.

METHODS: Twenty adults with and without CP were recruited. Seven CP participants completed post-exercise experiments after performing resistance training twice a week for three months. Muscular strength (torque, work, and power) at 90, 150, and 210 °/sec were assessed in the leg using the Humac Norm Isokinetic Dynamometer. Functional mobility was assessed from the Berg Balance Test, and limits of stability test using the Biodex balance system.

RESULTS: CP group had significantly lower knee extensor peak torque (e.g., 11.8 ± 2.3 CP vs. 68 ± 12.5 control, ft-lbs, $P < 0.05$), and lower knee flexor peak torque (e.g., 6.3 ± 1.6 CP vs. 43.8 ± 7.9 control, ft-lbs, $P < 0.05$) compared to control. After 3 months of training, CP group did not show statistical differences in muscular strength [e.g., extensor peak torque (27.5 ± 17.0 pre vs. 31.5 ± 24.2 post, ft-lbs, $P > 0.05$), and flexor peak torque (9.3 ± 5.6 pre, vs. 15.0 ± 10.9 post, ft-lbs, $P > 0.05$), or balance [e.g. overall score (25.2 ± 16.1 pre vs. 24.3 ± 11.4 post $p > 0.05$) on limit of stability test, total score (18.0 ± 19.5 pre vs. 24.4 ± 21.6 $p > 0.05$) on Berg Balance test. However, individuals who improved peak torque in knee flexors and extensors also improved postural stability via the Berg balance test.

CONCLUSIONS: These preliminary findings suggest that muscular strength influences functional mobility in adults with CP only after exercise training.

3185 Board #231 May 31 3:30 PM - 5:00 PM
Differential Effect of Obesity on Muscular Strength in Adults with Cerebral Palsy

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(No relevant relationships reported)

Cerebral palsy (CP) is a non-progressive and permanent neurological disorder that is characterized by muscular deterioration and atrophy. The major clinical problem with CP is early development of cardiovascular disease with increased rates of mortality. Due to the inevitability of motor dysfunction adults with CP can develop health risk factors such as obesity at a higher rate compared to the general population. Limited information is available to identify levels of obesity and its relation to muscular function in adults with CP.

PURPOSE: To determine whether severity of obesity may affect muscular function and strength in adults with CP.

METHODS: We studied total of sixteen adults with and without CP. Muscular strength (i.e., torque, work, and power) during knee extension and flexion was measured at 90, 150, and 210 °/sec in the lower extremity using Humac Norm Isokinetic Dynamometer. Maximal isometric forearm muscular strength was measured using a handgrip dynamometer. Body mass index (BMI), waist to hip ratio, and whole-body scan from Dual Energy X-Ray Absorptiometry were used to identify the levels of obesity.

RESULTS: Compared to control, individuals with CP had similar BMI (26.8 ± 3.0 CP vs. 22.9 ± 1.0 control kg/m²; $P > 0.05$), % body fat (35.2 ± 4.5 CP vs. 28.4 ± 3.7 control %; $P > 0.05$), and % leg fat (40.7 ± 4.3 CP vs. 30.5 ± 4.1 control %; $P > 0.05$). However, waist to hip ratio was significantly greater in CP (0.90 ± 0.02 CP vs. 0.80 ± 0.02 control; $P < 0.05$); muscular strength was significantly lower in CP compared to control (e.g., knee extensor peak torque at 90°/sec; 25.9 ± 8.1 CP vs. 72.5 ± 12.2 control ft-lb; $P < 0.05$). There was no relationship between BMI and extensor/flexor peak torque in both groups; however, there was a linear relationship between waist to hip ratio and extensor/flexor peak torque only in CP group ($R^2 = 0.34$). A strong inverse relationship between % leg fat and extensor/flexor peak torque was observed in both groups ($R^2 = 0.79$).

CONCLUSION: These findings suggest that central obesity rather than BMI appeared to influence muscular strength in CP adults. In addition, less fat in the legs rather than the total body may contribute for higher leg muscular strength in adults with CP. Supported by Central RSCA and Undergraduate Research Grant, SJSU

3186 Board #232 May 31 3:30 PM - 5:00 PM
Effects Of Fatigue On Isometric And Isokinetic Dorsiflexion Strength Asymmetry In Multiple Sclerosis

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Multiple Sclerosis (MS) is an autoimmune disease affecting the central nervous system. MS is characterized by a variety of symptoms, with fatigue being the most commonly reported symptom. Strength asymmetry (SA) of knee extensor/flexors has been documented in previous research in individuals with MS. However, SA of the dorsiflexors in MS patients has yet to be fully investigated in a fatigued state. **PURPOSE:** The aim of this study was to measure SA of the dorsiflexors during isometric/isokinetic maximal voluntary contractions (MVC/MVIC, respectively) before and after a fatigue test (FT). **METHODS:** Thirteen individuals with MS (8 Female (F), 5 Male (M), Age = 50.3 ± 9.1 yrs. and an expanded disability status scale (EDSS) score = 3.5 ± 1.8) and 13 Non-MS individuals (8 F and 5 M, Age = 50.8 ± 8.5 yrs.) participated in a three visit study. Visit 1 consisted of equipment and test procedure familiarization. The following two visits consisted of either a FT test at 30% of MVC or at 30% of MVIC. Prior to, and immediately following the FT, MVC or MVICs were performed. During each visit both legs were tested with a 15 minute break between assessments. The order of test (MVC or MVIC) and leg (left or right) was randomized. All MVIC's were performed at 60°/s. **RESULTS:** SA was calculated as the difference between limbs Pre and Post FT. Measurements of peak tension (PT), voluntary contraction time (VCT), and muscle tension maintaining capacity (MTMC) during MVC and MVIC between legs (within) and between groups were not statistically different (p>0.05). Although MVIC VCT and MVC PT between groups was not significantly different, notable effect sizes (ES) were shown between groups during MVIC for VCT (ES=0.67, MS vs. Non-MS= 0.12 ± 0.09 vs. 0.07 ± 0.06 sec, p= 0.12), and MVC for PT (ES=0.8, MS vs. Non-MS= 3.03 ± 2.67 vs. 1.35 ± 1.23 Nm, p=0.06). **CONCLUSION:** The moderate/large ES for MVC PT and MVIC VCT highlights the possibility of fatigue affecting SA and VCT differently between MS and Non-MS. In future studies, a larger sample size should be used to improve the statistical power of the analyses.

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Safety And Feasibility Of Strength Training In Patients With Duchenne Muscular Dystrophy

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Duchenne muscular dystrophy (DMD) is a rapidly progressive and currently incurable neuromuscular disease. Understanding the role of exercise is important for these patients as high-intensity or eccentric actions can be damaging in DMD yet a lack of loading may exacerbate muscle dysfunction. While a few studies show submaximal exercise may be safe and potentially delay the loss of muscle function in DMD, no study has systematically examined the potential of strengthening exercise to improve muscle function or attenuate disease progression. **PURPOSE:** To examine the safety and feasibility of a pilot, in-home strengthening intervention consisting of knee extensor (KE) and flexor (KF) exercise in DMD. **METHODS:** Eight ambulatory boys with DMD [9.3 (0.8) yrs, BMI 19.0 (4.6) kg/m²] on corticosteroid therapy were recruited to undergo 12 weeks of isometric exercise training of the bilateral KE and KF. Exercise prescription consisted of 4 sets x 6 reps, 3x/week at a target intensity of 50% maximal volitional contraction (MVC). At baseline (BL), MVC testing and training familiarization were done for one week on site. The exercise equipment (custom built chair, laptop, and load cell) was subsequently shipped allowing for in-home training and supervision via live video conferencing for each session. Safety outcome measures to assess muscle damage included magnetic resonance proton transverse relaxation time (T₂) of KE and KF, pain assessment, and creatine kinase levels at BL, 1, 6, and 12wks. Peak strength (KE and KF MVC) and time to ascend/descend 4 steps were also assessed at BL and 12wks. **RESULTS:** The 7 boys who completed the strength training program had a compliance of 84.9 (9.0)% for the exercise sessions. The safety measures did not indicate signs of muscle damage [non-

significant change in mean T₂: KE=2.3 (3.6)% and KF= 0.4 (4.6)%]. Peak torque increased by 20.6% for KE (p<0.01) and 14.3% for KF (p<0.05), and the time to ascend (13.5%, p<0.05) and descend (22.7%, p<0.05) steps improved after exercise training. **CONCLUSION:** This in-home, 12-week supervised strength training program was safe, feasible, and improved strength and function in boys with DMD. Future research is required to optimize the strengthening protocol and further explore its potential efficacy and clinical application.

3188 Board #234 May 31 3:30 PM - 5:00 PM
The Characteristics of Muscle Tone and Stiffness in Young Adults with Chronic Low Back Pain

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The prevalence of chronic low back pain (CLBP) in young adults is increasing; however, the biological mechanism of CLBP in this population remains unknown.

PURPOSE: To observe the characteristics of muscle tone and stiffness (MTS) of relevant muscle groups in young adults with CLBP, in order to provide reference for rehabilitation and prevention of CLBP.

METHODS: Twenty six subjects with CLBP (age: 22±2 years, 14 males and 12 females) were recruited as the experimental (E) group, while 29 healthy subjects (age: 25±2 years, 16 males and 13 females) were recruited as the control (C) group. The degree of pain (Visual Analogue Scale/Score, VAS) was recorded, and the MTS (indicators including F-Frequency, D-Logarithmic Decrement and S-Stiffness) of three muscle groups (para-spinal, hamstring and tensor fascia lata muscles) was assessed using the Myoton-3 equipment. Group differences were determined by using independent-sample t-tests; within the E group, MTS was compared between gender and degree of pain (VAS) using ANOVA.

RESULTS: Compared with C group, the E group's MTS of all three muscles were significantly higher (p<0.05), and the differences were 11.4%, 10.0% and 14.9% respectively; E group showed bilateral imbalance in all three muscles, while C group did not show imbalance. With the E group, compared with female subjects, male subjects had higher MTS of tensor fascia lata and para-spinal muscles (p<0.05), and the differences were 12.8% and 20.0%, respectively; in addition, the MTS values of tensor fascia lata, hamstring and para-spinal muscles in the subjects with moderate pain (VAS 4-7) were higher than those with mild pain (VAS 1-3) (p<0.05), and the differences were 12.7%, 14.9% and 22.2% respectively.

CONCLUSIONS: MTS is associated with considerable increase of hamstring, para-spinal muscle and tensor fascia lata in young patients with CLBP; Young CLBP patients had significant bilateral MTS imbalance of all these muscles; Young male CLBP patients had higher MTS in para-spinal muscle and tensor fascia lata than female patients; The more painful, the higher of the MTS in young CLBP patients.

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Differential Effect of Resistance Training on Musculoskeletal Architecture and Strength in Adults with Cerebral Palsy

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 (No relevant relationships reported)

Cerebral Palsy (CP) is a neurological disorder caused by lesions in the brain and is characterized by impaired motor function, musculoskeletal deformity, and atrophy. Individuals with CP appear to develop osteoporosis at an earlier age compared to general population. Bone weakness has adverse effects on the muscular system, which causes CP population to be more prone to fractures and further immobility. Bone mineral density (BMD) improves in the general population via resistance training. However, it is still uncertain whether resistance training alters skeletal strength in the CP population and whether it influences musculoskeletal architecture and strength. **PURPOSE:** To determine the effect of resistance training on BMD, skeletal architecture, and muscular strength in adults with CP. **METHODS:** We studied 14 adults with and without CP. CP participants went through 3 months of resistance training twice per week. Dual-energy X-ray absorptiometry was used to measure local BMD at the lumbar spine (L1-L4), proximal femur, and radial/ulnar regions. Architectural differences were identified by measuring various angles and lengths on the proximal femur. Leg muscular strength was measured during knee extension and flexion using the Humac Norm Isokinetic Dynamometer. **RESULTS:** There was a significant increase in BMD at femur in CP group after 3 month exercise (0.6±0.1 CPpre vs. 0.9±0.1 CPpost g/cm²; P<0.05). BMD at lumbar and forearm regions in CP group was similar to control group even though BMD in CP group seemed to improve after training (P>0.05). Skeletal architecture and muscular strength were significantly lower in CP compared to control, but it did not change after resistance

training (architectural angle; 64±5 CPpre vs. 70±2 CPpost degree; $P>0.05$). While control group showed a strong linear relationship between femoral neck BMD and knee extensor peak torque ($R^2=0.83$), CPpre showed no relationship ($R^2=0.01$). After 3 months of training, CP participants who exhibited higher BMD appeared to develop greater muscular strength ($R^2=0.26$). **CONCLUSION:** These findings suggest that short term resistance training improved skeletal strength in CP adults without alterations in skeletal architecture. Skeletal strength appeared to play a role in enhanced muscular strength in adults with CP only after exercise training.

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Effects Of Eccentric Training Combined To Neuromuscular Electrical Stimulation On Electromechanical Delay Of Peroneal Muscles In Individuals With Functional Ankle Instability

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(No relevant relationships reported)

The electromechanical delay (EMD) represents the time required by the muscles to provide a protective response to an injurious mechanism. Individuals with functional ankle instability (FAI) have showed longer EMD times for the peroneal muscles (EMD-P) than ankles of healthy individuals; which is thought to increase the risk of the recurrence of ankle sprains. However, there's currently no noninvasive treatment to shorten EMD-P. **PURPOSE:** The aim of this study was to investigate the effects of eccentric training combined with neuromuscular electrical stimulation (NMES) on the EMD time of peroneal muscles during eccentric muscle action in individuals with FAI. **METHODS:** This was a three-arm, single-blinded, randomized controlled trial. Thirty-nine volunteers (21 ± 3 yrs) with FAI were randomly assigned to control (CON; $n = 13$), eccentric training (ECC; $n = 13$), or eccentric training combined with neuromuscular electrical stimulation groups (ECC+NMES; $n = 13$). The control group received conventional rehabilitation therapy (CRT), involving strength and balance training. The ECC group performed isokinetic concentric and eccentric training of the peroneal muscles based on CRT. The ECC+NMES group received NMES simultaneous to the isokinetic training. Both groups trained 3 days/week for eight weeks. The EMD-P was calculated when peroneal muscles contracted eccentrically at 90/s using the isokinetic system before and after training. A one-way ANOVA was used to look at the differences in EMD-P between three groups. **RESULTS:** No significant differences existed for EMD-P among the groups before training ($F = 0.295$, $P > 0.05$). Compared with pre-training, the EMD-P was significantly shorter in the ECC group (133 ± 8 vs. 127 ± 8 ms, $P < 0.05$) and ECC+NMES groups (135 ± 11 vs. 119 ± 9 ms, $P < 0.05$). However, no change occurred in CON (134 ± 7 vs. 135 ± 10 ms, $P > 0.05$). The ECC group showed a significant lower EMD-P compared with CON after training (127 ± 8 vs. 135 ± 10 ms, $P = 0.027$), whilst EMD-P was shorter after training in ECC+NMES compared with ECC (119 ± 9 vs. 127 ± 8 ms, $P = 0.03$). **CONCLUSION:** Eccentric training effectively shortened the EMD-P in individuals with FAI compared with conventional treatment. However, ECC combined with NMES further enhanced the reduction in EMD-P. Therefore, ECC+NMES could be an effective treatment for FAI.

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Passive Hallux Adduction Decreases Lateral Plantar Artery Blood Flow in Low Arch Feet

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(No relevant relationships reported)

PURPOSE: Due to the vital role that blood flow (BF) plays in maintaining tissue health, compromised BF can affect tissue healing. An adducted hallux, as often seen inside a narrow shoe, may put passive tension on the abductor hallucis, consequently compressing the lateral plantar artery (LPA) into the calcaneus and restrict BF. This may negatively affect the health of tissues within the foot such as the plantar fascia and may contribute to plantar fasciopathy. The purpose of this study was to compare BF within the LPA before and after passive hallux adduction (PHA). **METHODS:** Forty-five healthy volunteers (20 female, 25 male; age = 24.8 ± 6.8 yr; height = 1.7 ± 0.1 m; body mass = 73.4 ± 13.5 kg) participated in this study. Blood velocity and vessel diameter measurements were obtained using ultrasound imaging (L8-18i transducer, GE Logiq S8). The LPA was imaged deep to abductor hallucis for 120 seconds: 60 seconds at rest followed by 60 seconds of PHA. Maximal PHA was performed by applying pressure to the medial side of the proximal phalanx of the hallux. BF was then calculated in mL/min, and measurements before and during PHA were compared. Arch height index (AHI) was assessed for all volunteers.

RESULTS: Log transformed data was used to run a paired t-test between BF measured before and during PHA. The overall volume of BF over the 60 seconds during PHA was 22% lower compared to before (-0.250 ± 0.063 mL/min, $p < 0.001$), with an initial decrease of 60%. As AHI decreased, there was a greater negative Δ BF. As baseline BF increased, there was also a greater negative Δ BF.

CONCLUSIONS: Our preliminary findings of decreased BF through PHA indicate conditions that elicit PHA (e.g. wearing narrow-toed shoes) may affect BF and tissue health.

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A Randomized Controlled Trial Comparing Physiotherapy And Extracorporeal Shockwave Therapy In Treatment Of Plantar Fasciitis

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(No relevant relationships reported)

Purpose Plantar fasciitis is postulated to arise from chronic overload. First line treatment includes non-steroidal anti-inflammatory drugs, orthotics, physical therapy and stretching exercises. Patients who do not respond to the above after a 6-month period can be considered for extracorporeal shock wave therapy (ESWT). In this study, we evaluated the outcomes of conventional physiotherapy alone versus physiotherapy together with ESWT over a 6-month period for patients diagnosed with plantar fasciitis.

Methods Patients with heel pain who presented to the Specialist Orthopaedic Clinic from April 2017 to Apr 2018 were assessed for eligibility criteria. Enrolled patients were randomized into 2 arms: physiotherapy alone, or physiotherapy together with ESWT. Clinical and functional outcomes were evaluated using the SF 36 score, the American Orthopaedic Foot-Ankle Society (AOFAS) hindfoot score, as well as the Visual Analogue Scale (VAS) at baseline, 3 months, and 6 months. **Results** A total of 26 subjects were recruited. 1 dropped out of the study, and 5 defaulted follow-up. Results from the remaining 20 subjects were analysed. No significant difference in SF 36 score was found at 3-month follow-up (physical functioning $p=0.806$, physical limitations $p=0.624$, body pain $p=0.075$, general health $p=0.879$, vitality $p=0.119$, social functioning $p=0.419$, emotional limitations $p=0.958$, mental health $p=0.770$). The differences in AOFAS and VAS at 3-month follow-up were not statistically significant ($p=0.222$ for AOFAS, $p=0.329$ for VAS).

There was also no significant difference in SF 36 score after 6 months (physical functioning $p=0.814$, physical limitations $p=0.481$, body pain $p=0.091$, general health $p=0.427$, vitality $p=0.839$, social functioning $p=0.680$, emotional limitations $p=0.299$, mental health $p=0.416$). 6-month post-intervention AOFAS and VAS were not significantly different ($p=0.978$ for AOFAS, $p=0.372$ for VAS).

Conclusion Our study showed no significant differences in SF 36 score, AOFAS, and VAS after a 6-month period between participants who underwent physiotherapy alone as compared with those who received ESWT in addition to physiotherapy. No serious adverse events were noted at the 6-month follow-up visit. Further studies need to be undertaken with a larger sample size, and a longer follow-up period.

3193 Board #239 May 31 3:30 PM - 5:00 PM

Effect Of A Virtual-exercise Program On Physical Function And Activity: Findings From The VERITAS Trial

Janet P. Bettger¹, Cynthia L. Green¹, DaJuanicia Holmes², Anang Chokshi³, Bryan T. Hoch⁴, Arthur J. DeLeon⁴, Laura Webb², Vincent Miller², Joseph M. Smith³, Eric D. Peterson¹. ¹Duke University, Durham, NC. ²Duke Clinical Research Institute, Durham, NC. ³Reflexion Health, San Diego, CA. ⁴Duke Health, Durham, NC.

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Reported Relationships: J.P. Bettger: Industry contracted research; Reflexion Health.

PURPOSE: To determine the effect of a virtual exercise program versus usual care on physical function and activity 6 and 12 weeks after total knee arthroplasty (TKA). **METHODS:** We conducted a multicenter, randomized controlled trial with adults undergoing unilateral TKA. At least 10 days before surgery, participants were randomized 1:1 to the virtual exercise program with an avatar coach, in-home 3D biometrics and weekly telehealth clinician support versus usual care (referral to home health or outpatient physical therapy as determined by the surgeon and clinical team). Intention-to-treat analysis was used for the following 6- and 12-week secondary patient-reported outcomes: physical function (in five domains of the Knee injury and Osteoarthritis Outcome Score [KOOS], higher score is better function) and minutes per week of moderate-to-vigorous physical activity (MVPA). Patient satisfaction with the virtual exercise program was assessed of intervention group patients 12-weeks after surgery. **RESULTS:** From November 2016-December 2017, 306 patients were randomized (mean age, 65 years; 62.5% women); 287 completed the trial (143 virtual, 144 usual care). At 6 weeks, there was no difference between groups in pain, symptoms, quality of life, difficulty with daily activities, and with function needed for sports and recreation ($p>0.05$). Patients in the virtual exercise group reported a mean of 119.9 (SD 197.4) min/week of MVPA at 6 weeks compared with 68.9 (SD 112.0) min/week for usual care patients ($p=0.089$). At 12 weeks, physical activity, pain, symptoms, quality of life and daily activities were not significantly different between groups but

patients in the virtual exercise group reported less difficulty with function related to sports and recreation than usual care patients (intervention 75.6 [SD 19.2] vs usual care 61.5 [28.3], $p=0.006$). Patients in the virtual exercise group reported high likelihood of recommending the program to others (mean score 9.1 ± 2.1) on a scale of 0-10.

CONCLUSIONS: Among patients receiving TKA, the virtual exercise program increased MVPA in the first 6-weeks after surgery and resulted in measurable gains to physical function for sports and recreation activities at 12-weeks.

F-67 Basic Science World Congress/Poster - Sleep and Cardiometabolic Effect

Friday, May 31, 2019, 1:00 PM - 6:00 PM
Room: CC-Hall WA2

3194 Board #240 May 31 3:30 PM - 5:00 PM Impact Of Anxiety-state On Moderate Continuous And 3-km Time-trial Exercise After 36h Of Sleep Deprivation

Carina Faggiani Dias, Marcos Mônico Neto, Sérgio Tufik, Hanna Karen Moreira Antunes. *UNIFESP, Santos, Brazil.*
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(No relevant relationships reported)

Carina Faggiani Dias, Marcos Mônico-Neto, Sergio Tufik, Hanna Karen Moreira Antunes.

Universidade Federal de São Paulo, UNIFESP.

Several evidences suggest that aerobic exercise performance decrease after sleep deprivation (SD) and psychobiology aspects could explain these effects, however, the role of anxiety on this way is poorer explored. **Purpose:** Investigate the role of anxiety-state on moderate continuous and 3-km time-trial exercise in subjects sleep deprived. **Methods:** Eleven healthy male subjects (32.72 ± 6.73 yrs; 70.93 ± 7.79 kg; 1.74 ± 0.05 m; 23.37 ± 2.74 kg/m²), were submitted to 30 min of moderate continuous exercise followed a 3-km Time-Trial test in treadmill in two conditions separated by 15 days: Normal Sleep (7-8 hours of sleep) and SD (36 consecutive hours). The subjects answered an anxiety state questionnaire (I date Trait-State) before (B), immediately after aerobic moderate continuous exercise (AM), immediately after 3-Km time-trial (AT-T) and 30 minutes recovery (R). The time to finish the time-trial was used as performance index, and the time to partial distances was accompanied to observed strategy performance. The time-course and groups differences were compared by ANOVA repeated measures with post-hoc Duncan test, with significance $P \leq 0.05$. The protocol was approved by Unifesp Ethics Committed (#2.00.369). **Results:** The mean score of anxiety were higher in SD condition in B (34.9 vs 38.18 ; $P=0.03$), AM (31.8 vs 38.6 ; $P=0.006$) and R (30.90 vs 37.23 ; $P=0.01$) time-courses. No differences were found in the total and partial time to complete the 3-km test. The initial velocity of the time-trial test was higher in the normal sleep condition (15.45 vs 13.95 ; $p=0.005$). **Conclusion:** We observe that although the SD is not able to affect the total time to complete the 3-Km test, the score of anxiety in different time-courses (before, during and after exercise) was higher in the SD condition. In addition, the strategy used were different, demonstrated by the lower initial velocity chosen by the volunteers sleep deprived. These findings suggest that the level of anxiety associated with SD can alter strategies by underestimating the performance.

Financial Support: AFIP, CAPES (#1719687), CNPq (400129/2016-7).

3195 Board #241 May 31 3:30 PM - 5:00 PM Effects Of Bariatric Surgery On Cardiac Autonomic Parameters During Sleep

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(No relevant relationships reported)

PURPOSE: To analyze the effects of bariatric surgery on cardiac autonomic modulation in morbid obese patients. **METHODS:** The study included 14 morbid obese patients that were submitted to bariatric surgery. Before and after surgery subjects were submitted to body mass index (BMI) assessment, answered, and were submitted to polysomnography. During polysomnography, AHI and cardiac autonomic modulation were assessed during sleep. **RESULTS:** After surgery BMI and AHI reduced significantly ($p<0.05$) from 48.7 ± 5.6 kg/m² to 41.9 ± 5.7 kg/m² and from 34 ± 29 events/h to 18 ± 16 events/h, respectively. Standard deviation were used as a measure of variability in pre and postoperative period and values were calculated with pre 829.20 ± 82.84 and post 972.24 ± 146.20 with $p \leq 0.001$ demonstrating gains in HRV in all patients. [1] Additional information with the application of the spectral wavelet analysis in the frequency decomposition provided values pre 2.8775×10^5 and post 2.3440×10^5 ($p<0.05$). **CONCLUSIONS:** Morbid obese submitted to bariatric surgery presents improvement in cardiac autonomic modulation during sleep.

3196 Board #242 May 31 3:30 PM - 5:00 PM Oxygen Desaturation in Sleep Apnea is Inversely Associated with Vascular Changes Following Exercise Training

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(No relevant relationships reported)

PURPOSE: Obstructive sleep apnea (OSA) is characterized by reductions in nocturnal mean O₂ saturation (meanSpO₂) that may increase cardiovascular disease morbidity. The extent to which exercise confers cardioprotection in overweight adults with different meanSpO₂ profiles is not known. The purpose of this study was to examine the association of meanSpO₂ with vascular function changes following exercise training in adults with and without OSA. **METHODS:** At baseline, participants underwent overnight polysomnography to determine the presence and severity of OSA. Tertile-based cut-off points were used to categorize meanSpO₂ and apnea hypopnea index (AHI). Body fat was analyzed using dual energy X-ray absorptiometry. Vasoreactivity of the brachial artery was measured using flow-mediated dilation (FMD), while microcirculatory function was assessed via the total shear stress area under the curve (SSAUC) response during FMD. Body fat and vascular measures were repeated upon completion of a 6 week (3 sessions/wk; 1 hr/session) exercise training program. **RESULTS:** Thirty (age: 49 ± 9 years; BMI: 32.0 ± 3.8 kg/m²; 18 men: 12 women) adults with and without OSA completed the study. At baseline, adults in the highest tertile of meanSpO₂ were younger than those in the lowest tertile (43 ± 9 yrs vs. 53 ± 7 yrs, $p=0.017$), yet no differences in vascular measures, AHI or total body fat percentage were observed across the tertiles. No changes in brachial artery diameter or FMD were observed across tertiles following exercise. However, the change in SSAUC in the highest tertile of meanSpO₂ was greater, compared to the lowest tertile ($13,636 \pm 15,898$ A.U. vs. $-1,86 \pm 10,879$ A.U., $p=0.041$). Forward stepwise linear regression revealed that the highest tertile of meanSpO₂ was a significant ($F=5.15$, $p=0.036$) determinant of the increased SSAUC with exercise, independent of age and baseline SSAUC. **CONCLUSIONS:** Severe oxygen desaturation during sleep was inversely associated with improvements in microcirculatory function following exercise training.

3197 Board #243 May 31 3:30 PM - 5:00 PM Shorter Sleep Duration Is Associated With Increased Sedentary Duration In Lean, But Not Overweight Or Obese, Individuals

Saurabh S. Thosar, Isabel Katlaps, Nicole P. Bowles, Andrew W. McHill, Steven A. Shea. Oregon Health & Science University, Portland, OR.

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(No relevant relationships reported)

PURPOSE: Sedentary behavior and insufficient sleep both can independently increase the risk for chronic diseases such as obesity and cardiovascular disease. However, whether or not prior nocturnal sleep duration influences daytime sedentary behavior is not well understood. We hypothesized that total sleep duration at night will be inversely associated with the subsequent day's total sedentary time. We also explored if this relationship is different in lean compared to non-lean individuals. **METHODS:** 27 adults (10 lean, 50 ± 2 years) chose a self-selected 8-h sleep opportunity for 5-14 days ($\mu = 11$). Adherence to the self-selected sleep period was verified using a sleep diary and phone calls to a time stamped mailbox at bedtime and upon awakening. Sleep duration was manually scored from wrist actigraphy (wGT3X-BT); and activity levels and sedentary duration were scored using 'Frederickson Adult' algorithm'. To test whether total sleep duration (TSD) influenced subsequent sedentary duration (SD), a mixed model analysis was conducted with TSD as the independent variable, and subject as random factor. We further tested the associations between TSD and SD separately in lean and non-lean individuals. Finally, independent sample t-tests were used to determine whether TSD and SD differed between lean and non-lean individuals. **RESULTS:** TSD was negatively associated with the subsequent day's SD [$F(1, 289) = 4.8$; $p=0.03$]. SD was significantly higher in non-lean as compared to lean individuals [mean 386 minutes vs 302 minutes per day; $t(25) = 2.9$; $p = 0.02$]. TSD was not different between groups; $p = 0.64$. When lean and non-lean groups were analyzed separately, there was a significant inverse relationship between TSD and subsequent ST in lean [$F(1, 117) = 9.69$, $p = 0.002$] but not in non-lean individuals ($p>0.05$). **CONCLUSIONS:** We discovered that shorter sleep duration during an 8h scheduled sleep opportunity is associated with increased SD during the subsequent day. This relationship was only found in lean individuals, possibly due to the higher ST in non-lean compared to lean individuals. Experimental studies investigating the bidirectional effects of sedentary behavior and sleep and the subsequent effect on cardiometabolic physiology are recommended to better understand the effect of these behaviors on the risk for chronic disease.

3198 Board #244 May 31 3:30 PM - 5:00 PM
Associations Of Sleep Metrics, Body Composition, And
Cardiorespiratory Fitness In Older Women

Erin E. Kishman, Joshua R. Sparks, Charity B. Breneman,
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 (No relevant relationships reported)

Sleep duration and quality have been associated with obesity risk. Most previous studies used body mass index (BMI) as a proxy of obesity and subjectively evaluated sleep. Older adults often suffer from poor sleep quality, high body fat, and low cardiorespiratory fitness (CRF), especially women after menopause. **PURPOSE:** To investigate if sleep duration and quality are associated with BMI, body composition, and CRF in older women. **METHODS:** Older women ($n=115$; age: 65.61 ± 4.32) wore an actigraph monitor for 7 days to measure sleep metrics. Total sleep time and sleep quality, which included wake after sleep onset, activity counts during sleep, sleep onset latency, and number of awakenings, were determined using manufacturer provided software. BMI was calculated, and a dual x-ray absorptiometry scan was performed to assess body composition. A graded exercise test was used to measure CRF. Data was collected in two locations ($n=89$ and 26 , respectively). Pearson product correlations were used to determine associations and study location was controlled for. **RESULTS:** Total sleep time negatively associated with lean mass and fat free mass ($r=-0.28$, $p=0.012$; $r=-0.28$, $p=0.012$), but positively associated with percent body fat ($r=0.26$, $p=0.025$). There were no associations between sleep metrics and CRF. **CONCLUSIONS:** Our data indicates longer total sleep time was associated with less lean mass but greater body fat in older women. This suggests in older women longer total sleep time may be linked with less physical function and worse health condition. Further examination of the association between sleep with physical function and biomarkers in this population is recommended.

3199 Board #245 May 31 3:30 PM - 5:00 PM
Sleep Restriction during 8-Week Calorie Restriction
on Physical Activity and Lipoprotein Particle
Concentrations and Sizes

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 Youngstedt², Ryan R. Porter³, Mark A. Sarzynski, FACSM¹,
 Xuewen Wang¹. ¹University of South Carolina, Columbia, SC.
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 Carolina School of Medicine, Greenville, SC. (Sponsor: J. Larry
 Durstine, FACSM)
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Overweight and obesity and having an abnormal lipoprotein profile are associated with increased risk of cardiovascular disease (CVD). Increased sedentary time, decreased physical activity (PA), and restricted sleep are risk factors for obesity and CVD. Calorie restriction is often used to induce weight loss. However, little information exists concerning how caloric restriction, sleep restriction, and PA interact, and their overall impact on CVD risk.

PURPOSE: To examine changes in body weight, PA, and lipoprotein particle concentrations and sizes following caloric restriction (CR) and sleep restriction (SR) intervention (CR+SR) compared to CR alone in overweight or obese adults.

METHODS: 28 adults (age= 44.5 ± 5.8 years) were randomized into an 8-week CR or CR+SR group. Both groups consumed a diet equivalent to 95% of the individual's resting metabolic rate. Participants in the CR+SR were instructed to restrict time-in-bed up to 90 minutes 5 days per week. Sedentary and PA time was measured utilizing a Sensewear Mini Armband. Fasting serum samples were collected for analysis of lipoprotein particle concentrations and sizes by nuclear magnetic resonance spectroscopy. Repeated measure analyses included a group \times time interaction to compare changes in weight, sedentary and PA time, and lipoprotein particle concentrations and sizes between groups.

RESULTS: Body weight significantly decreased in both groups with no difference between groups ($p=0.748$; weight loss: 2.5 ± 0.2 kg in CR and 2.2 ± 0.5 kg in CR+SR). A significant difference in the change in total PA time between CR and CR+SR ($p=0.044$) was found. Total PA time significantly increased in CR (256.7 ± 87.6 to 320.1 ± 122.7 minutes, $p=0.025$) only. No differences in the changes in lipoprotein particle concentrations or sizes between CR and CR+SR were found. Large HDL particle concentration decreased in the entire sample (7.5 ± 3.4 to 6.6 ± 3.4 $\mu\text{mol/L}$, $p=0.004$). **CONCLUSIONS:** The CR+SR did not result in increased PA as in the CR; however, weight loss and lipoprotein particle concentration or size changes for the two groups were similar. These results suggest that moderate SR on 5 days a week may not significantly alter lipoprotein metabolism during weight loss, which may partly be due to compensated sleep on the other 2 days of the week. Supported by AHA Grant 14BGIA20380706

3200 Board #246 May 31 3:30 PM - 5:00 PM
Relationships Among BMI, Estradiol, And Sleep-wake
Behavior In Women

Shannon K. Crowley, Julia Rebellon, Abigail J. Leonard,
 Christina Huber, Lyndsay Wolfe, Andrea Tobar, Sierra Hayden,
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PURPOSE: It has been estimated that women are at 40% increased risk for developing clinically significant sleep disturbances (such as insomnia) compared to men. Reproductive-related hormones, such as estradiol (E2), have been shown to play a key role in sleep-wake behavior in women, and pharmacological interventions which target the regulation of E2 have been shown to improve sleep in women. Importantly, body mass index (BMI) has been shown to be inversely associated with E2 levels in premenopausal women, and previous studies have also suggested that women who are overweight or obese are significantly more likely to report clinically-significant sleep disturbances. Thus, this study aimed to examine associations between BMI, E2, and sleep disturbances in premenopausal women in order to identify a non-pharmacological, physical activity (PA) related modifiable target for the prevention of clinically significant sleep problems in women. **METHODS:** Following a two-tiered screening process, 28 healthy women (18-45y, mean age: 24.6y) who were medication-free and had regular menstrual cycles completed: (1) enrollment visit, (including mood and sleep assessment and assessment of cardiorespiratory fitness via maximal oxygen consumption during exercise); (2) one-week sleep monitoring period (objective and subjective measures of sleep-wake behavior); and (3) saliva collection for the assessment of salivary E2 levels. Saliva collection occurred during the follicular phase of the menstrual cycle to control for ovarian cycle E2 fluctuations. **RESULTS:** Higher BMI was significantly associated with lower E2 levels ($r=-.38$, $p=0.04$), and also longer objectively-measured sleep onset latency (SOL) duration ($r=.51$, $p=0.004$). Consequently, lower E2 levels were significantly associated with increased objectively-measured wake after sleep onset (WASO) duration ($r=-.43$, $p=0.03$) and increased number of awakenings during the sleep period ($r=-.48$, $p=0.01$). **CONCLUSIONS:** Results suggest that, in premenopausal women, higher BMI may be associated with increased sleep disturbances, and that this relationship may be mediated by E2 levels. It is therefore possible that regular PA, which has been shown to be inversely associated with BMI, may improve sleep via its positive effects on adiposity and associated regulation of E2.

3201 Board #247 May 31 3:30 PM - 5:00 PM
Associations Among Sedentary Time, Feeding
Duration, And Sleep Duration In Adults With
Overweight And Obesity

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 Tussey¹, Isaac Debache², Audrey Bergouignan¹, Adnin Zaman¹,
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 Campus, Aurora, CO. ²CNRS IPHC UMR7178, Strasbourg,
 France. (Sponsor: Edward Melanson, PhD, FACSM)
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 (No relevant relationships reported)

PURPOSE: Reducing daily sedentary time, decreasing daily feeding duration, and increasing total sleep duration are important lifestyle targets for improving the metabolic health of adults undergoing weight loss. However, objective methods for simultaneous measurement of sedentary time, meal timing, and sleep in free-living adults are lacking and it is unclear how these variables are related in overweight adults or change in response to weight loss.

METHODS: Thirty-two overweight and obese adults were recruited to participate in an ongoing weight loss study (90% female, Age= 36.4 ± 6.4 yr, BMI= 33.4 ± 5.5 kg/m²). Participants simultaneously wore an activPAL accelerometer on the thigh and an Actiwatch on the non-dominant wrist for 7 days in a free-living environment to assess waking sedentary behavior and nighttime sleep, respectively. A cell phone application (MealLogger) was used to photograph and timestamp all caloric events during the 7-day period to determine daily feeding duration which was verified using a continuous glucose monitor. Assessments were performed at baseline and will be repeated at 12 weeks following completion of the weight loss intervention. Correlation analyses were performed on baseline data to determine associations among sitting time during waking hours, daily feeding duration, sleep duration, and sleep timing.

RESULTS: On average participants were sedentary for $67.5\pm8.5\%$ of waking hours, consumed energy over 11.0 ± 1.9 hours during the day and slept for 7.2 ± 0.7 hours at night. Sedentary time (as a percent of the waking day) was negatively correlated with sleep duration (Spearman $\rho=-0.48$, $P=0.006$) but was not related to later sleep timing (sleep midpoint), longer feeding duration, or timing of the last meal.

CONCLUSIONS: Using a novel set of methods, we show that higher levels of sedentary time during waking hours are associated with shorter total sleep duration in adults beginning a weight loss intervention, however cause and effect cannot be

established in this analysis. Our future studies are aimed at understanding whether reducing sedentary time leads to increased sleep duration (or vice versa) and measuring how sleep, activity, and meal timing change with weight loss.

G-11 Highlighted Symposium - Make No Bones About It: Bone Loading in Relation to Bone Stress Injuries

Saturday, June 1, 2019, 9:00 AM - 11:00 AM
Room: CC-303

The skeleton adapts and responds to repetitive mechanical loading. The same loading features that induce favorable bone adaptation can also lead to bone stress injuries, including stress fractures. This symposium will discuss the loading and response of bone as it relates to bone stress injuries.

3218 Chair: Stuart J. Warden, FACSM. *Indiana University, Indianapolis, IN.*

Reported Relationships: S.J. Warden: Industry contracted research; GE/ NBA Orthopedics and Sports Medicine Collaboration.

3219 June 1 9:10 AM - 9:40 AM
Keynote

Stuart J. Warden, FACSM. *Indiana University, Indianapolis, IN.*
Reported Relationships: S.J. Warden: Industry contracted research; GE/ NBA Orthopedics and Sports Medicine Collaboration.

3220 June 1 9:40 AM - 9:55 AM
Changes in Bone Microarchitecture and Estimated Bone Strength Over 12 Months After Tibial Stress Fracture Diagnosis: Implications for Return to Sport

Kristin L. Popp¹, Sara G. Rudolph², Signe Caksa², Amy Yuan², Julie M. Hughes³, Kathryn E. Ackerman, FACSM⁴, Adam S. Tenforde⁵, Chun Xu⁶, Ginu Unnikrishnan⁶, Jaques Reifman⁶, Mary L. Bouxsein⁷. ¹*Massachusetts General Hospital, Harvard Medical School, United States Army Research Institute of Environmental Medicine, Boston, Natick, MA.* ²*Massachusetts General Hospital, Boston, MA.* ³*United States Army Research Institute of Environmental Medicine, Natick, MA.* ⁴*Massachusetts General Hospital, Harvard Medical School, Boston Children's Hospital, Boston, MA.* ⁵*Spaulding Rehabilitation Hospital, Boston, MA.* ⁶*High Performance Computing Software Applications Institute, Frederick, MD.* ⁷*Massachusetts General Hospital, Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, MA.*

(No relevant relationships reported)

Stress fractures (SF), common injuries among athletes, have been reported in up to 20% of track and field athletes. Typically, after a period of unloading and gradual return to weight-bearing activities, athletes return to unrestricted participation in their given sport 12-14 weeks after SF diagnosis. However, the time course of the recovery of mechanical competence of the bone is not well characterized, and reinjury rates are high. **PURPOSE:** To determine changes in bone microarchitecture and estimated bone strength over 12 months following tibial SF diagnosis. **METHODS:** We enrolled 30 women, ages 18-35, with a tibial SF (grade 2 or higher) for this prospective observational study. Participants completed a baseline visit within 3 weeks of SF diagnosis. At baseline, 6, 12, 24, and 52 weeks following SF diagnosis, we collected high-resolution peripheral quantitative computed tomography (HR-pQCT) scans of the ultradistal tibia (4% of tibia length), background and lifestyle questionnaires, and a physical activity assessment. **RESULTS:** Over the initial 12 weeks, total volumetric bone mineral density (vBMD) declined by 1.2% ($p=0.001$), trabecular vBMD by 1.2% ($p=0.006$), cortical thickness by -1.0% ($p=0.007$), and bone volume/total volume by 1.2% ($p=0.008$). At 24 weeks, mean values for all bone parameters were nearing baseline values, and by 52 weeks, mean values had surpassed baseline values. A similar trend was seen in estimated bone strength, though changes did not reach statistical significance. Of the 30 participants, 7 incurred a subsequent SF during the course of the 12 month-follow up and 2 incurred ≥ 2 subsequent SFs. **CONCLUSION:** Persisting decrements in bone microarchitecture and estimated bone strength suggest bone mechanical integrity does not return to baseline for 3-6 months after tibial SF diagnosis. This, coupled with the high rate of recurrent SFs, suggests more conservative return to sport guidelines may be in order.

The opinions and assertions contained herein are the private views of the authors and are not to be construed as official or as reflecting the views of the U.S. Army or of the U.S. Department of Defense. This abstract has been approved for public release with unlimited distribution.

3221 June 1 9:55 AM - 10:10 AM
Changes in Tibial Bone Microarchitecture in Response to 8 Weeks of US Army Basic Combat Training in Men and Women: A Preliminary Analysis from a Large Field Study

Julie M. Hughes¹, Katelyn I. Guerriere¹, Kathryn M. Taylor¹, Kristin L. Popp², Ronald W. Matheny, Jr.¹, Stephen A. Foulis¹, Mary L. Bouxsein³. ¹*United States Army Research Institute of Environmental Medicine, Natick, MA.* ²*United States Army Research Institute of Environmental Medicine, Massachusetts General Hospital, Natick, MA.* ³*Massachusetts General Hospital, Harvard Medical School, Beth Israel Deaconess Medical Center, Boston, MA.*

(No relevant relationships reported)

Stress fractures are overuse injuries in bone tissue that are common during Army Basic Combat Training (BCT) when recruits undergo a period of heightened physical activity. The pathophysiology and mechanoadaptive biology that underlie stress fracture development and prevention continue to be characterized. Mechanoadaptation to BCT has been demonstrated in the tibial microarchitecture of female military recruits. Whether male military recruits are able to mount an analogous response to BCT remains to be determined. **PURPOSE:** To analyze preliminary data from a large prospective field study (427 men and women from a larger cohort of ~4000 recruits to be studied) with the goal of characterizing changes in tibial bone microarchitecture in male and female recruits as a result of 8 weeks of BCT. **METHODS:** We collected high-resolution peripheral quantitative computed tomography images of the distal tibia (4% from the distal tibial plateau) before and after BCT and analyzed data on 303 male and 124 female recruits who volunteered and completed BCT. Linear mixed models were used to estimate the mean difference for each outcome from pre- to post-BCT, while controlling for race/ethnicity, age, and body mass index. **RESULTS:** Mean age of male (20.7 ± 3.4 yrs) and female (20.6 ± 3.6 yrs) recruits was similar. At the distal tibia, cortical thickness, trabecular thickness, bone volume/total volume, and total, trabecular, and cortical volumetric bone mineral density (vBMD) increased significantly by 0.50-2.28% (all $p < 0.0001$) over the BCT period in women and by 0.32-1.84% (all $p < 0.0001$) in men. **CONCLUSIONS:** This preliminary view of data collected to date found that following BCT, both men and women mounted an adaptive response in tibial trabecular bone microarchitecture, indicative of de novo trabecular bone formation. The responses in tibial bone microarchitecture were of greater magnitude in women than in men, which may be due to lower average baseline values in bone microarchitectural properties in women, and therefore potentially greater loading stimuli. Other lifestyle and demographic factors may also influence the adaptive bone response to BCT and will be investigated in the larger sample following study completion.

3222 June 1 10:10 AM - 10:40 AM
Keynote

Irene S. Davis, FACSM. *Harvard Medical School, Cambridge, MA.*

(No relevant relationships reported)

G-17 Thematic Poster - Athlete Nutrition II

Saturday, June 1, 2019, 9:00 AM - 11:00 AM
Room: CC-101A

3248 Chair: Lynn Cialdella-Kam. *Case Western Reserve University, Cleveland Heights, OH.*

(No relevant relationships reported)

3249 Board #1 June 1 9:00 AM - 11:00 AM Effects Of An Online Sports Nutrition Curriculum On Biomarkers Of Iron Status In Youth Athletes

Marni E. Shoemaker, Zachary M. Gillen, Brianna D. McKay, Nicholas A. Bohannon, Alegria I. Mendez, Joel T. Cramer, FACSM. *University of Nebraska-Lincoln, Lincoln, NE.*
(Sponsor: Dr. Joel T. Cramer, FACSM)

(No relevant relationships reported)

Online nutrition education curricula framed around concepts of sports nutrition may improve accessibility as well as engagement, awareness, and adherence for active high school athletes.

Purpose: Examine the effects of an online sports nutrition curriculum on ferritin, soluble transferrin receptor (sTfR), and hemoglobin (Hb) biomarkers of iron status in high school athletes.

Methods: One hundred twenty-three male (n=56, age: 17 ± 1 y, stature: 76 ± 20 kg, mass: 176 ± 6 cm) and female (n=67, 16 ± 1 y, 67 ± 16 kg, 164 ± 6 cm) high school athletes were tested for ferritin, sTfR, and Hb concentrations before and after participating in seven online sports nutrition modules (~1 module per week) focused on macronutrients, micronutrients, performance plate, energy balance, nutrient timing, and supplements. Pre- and post-education prevalence of poor iron status for each biomarker was calculated, while individual subject's iron status classification was tracked. Mixed factorial ANOVAs (time x sex) compared mean biomarker concentrations.

Results: Prevalence of iron depletion (ferritin cutoffs) increased from 48 to 52% and decreased from 79 to 75%, low iron levels (sTfR cutoffs) decreased from 38 to 30% and increased from 29 to 33%, and anemia (Hb cutoffs) decreased from 20 to 14% and 29 to 23% in males and females, respectively. Subjects classified as iron depleted (n=65) did not change, one subject improved iron levels, while six subjects (6%) improved their classification from anemic (n=25) to non-anemic (n=19) from pre- to post-education. There were no interactions (p>0.05) or main effect for time (p>0.05) for ferritin (pre 28.4 ± 15.1 to post 28.0 ± 14.2), sTfR (19.0 ± 8.2 to 20.1 ± 7.4), or Hb (13.5 ± 2.2 to 13.9 ± 1.8). There was no main effect for sex (p>0.05) for sTfR (m: 19.2 ± 6.4, f: 19.8 ± 6.4), but males exhibited higher (p≤0.05) concentrations of ferritin (m: 32.5 ± 18.2, f: 23.8 ± 18.2) and Hb (m: 14.3 ± 1.7, f: 13.2 ± 1.7).

Conclusions: Females present a greater risk of poor iron status, suggesting a need to focus on dietary iron in young female athletes. Participating in the online sports nutrition curriculum did not improve mean concentrations of ferritin, sTfR, or Hb, but did improve anemia classifications for six subjects (n=3 males, n=3 females).

Acknowledgments: This study was funded by the Nebraska Beef Council.

3250 Board #2 June 1 9:00 AM - 11:00 AM NCAA Division I Women's Cross Country Consumes Adequate Energy Midseason Following Nutrition Education Seminars

Catherine Saenz¹, Jared A. Mallard¹, Kelsey M. Beckmann¹, Terrance Orange¹, Kevin RM Coyle¹, Kara L. Conway¹, Jeff T. Wight¹, George G.A. Pujalte, FACSM², David R. Hooper¹.
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(No relevant relationships reported)

Elite-level endurance athletes are prone to low energy availability due to the high energy demands of the sport and the propensity to emphasize low body compositions. Low energy availability may lead to nutrient-related deficiencies such as low iron and low vitamin D. Chronic deficiency in these essential nutrients may lead to health issues, including symptoms related to the female athlete triad. Women endurance athletes are at a particular risk for low energy availability mid-season due to the high energy demands. Previous studies indicate that collegiate-level women's cross country runners do not have enough knowledge on how nutrition and energy availability affect health. Little is known on how nutrition education may affect energy intake mid-season and how it may affect circulating markers commonly associated with the female athlete triad. **PURPOSE:** To observe: 1) If collegiate women cross country runners consumed adequate energy mid-season after receiving nutrition education. 2) To observe how mid-season nutrition affected serum Iron and serum Vitamin D values. **METHODS:** Five women from a NCAA Division I cross-country team (age: 20.8±1.5 years, height: 169.6±5.7 cm, weight: 58.3±4.1 kg) received nutrition education starting at pre-season and continuing on throughout the season. Three-day diet records were collected and analyzed by a registered dietician. After an overnight fast, blood samples were collected and measured for total ferritin and circulating Vitamin D by immunoassay. **RESULTS:** Athletes consumed an average (95% CI) of 1980 kcal/d (1740-2220kcal/day). Dietary carbohydrate was 4.2g/kg/d (95% CI: 3.4-5.0g/kg/d), dietary fat was approximately 28% (95% CI: 25-33%), and dietary protein was 1.5g/kg/d (95% CI: 1.3-1.6g/kg/d) of the diet. Serum ferritin was 28.1 ng/mL (95% CI: 14-35ng/mL) and Vitamin D was 46.8ng/mL (95% CI: 39.6-54.6ng/mL). **CONCLUSION:** Despite the demanding training volume mid-season, collegiate women's cross country runners were able to maintain adequate calories and recommended intake for dietary fat and

dietary protein. Circulating markers commonly associated with female athlete triad were also within the recommended ranges for optimal health. A nutrition education program may help bring awareness and knowledge on how adequate energy is vital to health and performance.

3251 Board #3 June 1 9:00 AM - 11:00 AM Nutrition and the Female Athlete: Macronutrient Consumption and Body Composition Changes among Collegiate Volleyball Players.

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(No relevant relationships reported)

An athlete's diet and physical training have been reported to have direct positive influences on performance variables including strength and power which are strategic to athletic performance. According to nutritional recommendations, however, female athletes consume far less total calories, carbohydrates, and proteins when compared to male athletes of similar lean body mass (LBM). **PURPOSE:** To determine 1) whether collegiate volleyball players meet nutrition recommendations and 2) whether there are significant changes in macronutrient consumption and body composition after an eight-week, off-season resistance training program. **METHODS:** Eleven collegiate-level competitive female volleyball players were examined for total calorie, carbohydrate, and protein consumption using three-day food logs. A body height/weight scale and hydrodensitometry were used to compute body mass index (BMI), LBM, and percent body fat (BF). **RESULTS:** The volleyball players reported total calorie consumption 15.06% and 10.79% below recommended guidelines before and after training, respectively, while carbohydrate intake was 7.27% and 4.77% below recommended guidelines before and after training, respectively. Protein intake levels met recommended guidelines and did not change throughout the training program. Paired samples t-tests showed increases in LBM, and decreases in BMI and BF following eight weeks of training (p<0.05 for all). **CONCLUSION:** Our study showed that despite positive improvements in body composition, collegiate volleyball players are not meeting current nutritional recommendations for optimal athletic performance. These findings may have important health and performance implications specific to collegiate female athletes.

3252 Board #4 June 1 9:00 AM - 11:00 AM Examination Of Energy Availability On The Hormonal Profile Of Endurance-trained Male Athletes

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Currently, there is inadequate literature existing for male athletes who participate in high-energy expenditure activities with decreased energy needs. Understanding the physiological demands and consequences of decreased energy availability (EA) in male athletes is critical for acute and long-term health and prevention of injuries and illness. **Purpose:** Examine the effect of EA on reproductive (Testosterone [T] and Luteinizing Hormone [LH]) and metabolic hormones (Insulin, Leptin, Cortisol, and Interleukin-6 [IL-6]) in male endurance-trained athletes. **Methods:** A cross-sectional design on 14 endurance trained male athletes (age: 26.4 ± 4.2 yrs.; weight: 70.6 ± 6.4 kg; height: 179.5 ± 4.3 cm, BMI: 21.9 ± 1.8, Body Fat% (BFP): 13.6 ± 3.5%) were recruited from the local community. Participants completed 2 separate training weeks (low [LV] and high [HV] training volumes) and each week included: 7-day dietary logs, 7 day-exercise logs, and 1 blood draw each week to determine concentrations for 6 hormones (reproductive and metabolic). Anthropometric measurements (height, weight, and body composition) were taken prior to data collection. LEA was defined as (≤ 20 kcal/kg FFM·d. **Results:** Participants at risk for LEA (41.2%: n = 7; HV: 50%: n = 4; LV: 33.3%, n = 3) had increased T levels (p = 0.20) and 21.7% (n = 5) (HV: 18.2%, n = 2; LV: 25%, n = 3) presented with low Leptin levels (p = 0.01). A significant difference was found between the 2 training weeks - Leptin (t₍₁₃₎ = 1.61 p < 0.001; HV: 78.6%, n=11; LV: 85.7%, n=12), EA - overall T (χ² (2) = 4.4, p = 0.04), and HV week - T (χ² (2) = 5.8, p = 0.02). A strong negative correlation was found for overall Leptin to BFP: (r₍₂₄₎ = -0.73, p < 0.001) and T-RMR (F(1, 23) = 16.23, p < 0.001). A weak negative correlation for T-EI (F(1, 24) = 6.7, p = 0.02) and a strong positive correlation was found for overall T- BFP (F(1, 24) = 51.9, p < 0.001). **Conclusion:** Overall, participants who demonstrated LEA, highlighted a significant negative relationship between LEA and Leptin. Due to Leptin's negative response to EA below 20 kcal/kg FFM·d; male runners should monitor their exercise expenditure and dietary intake to maintain appropriate levels of EA (> 20 kcal/kg FFM·d). Valid and reliable predictive equations for hormones should be examined to become useful tools for clinicians whom do not have access to blood work.

3253 Board #5 June 1 9:00 AM - 11:00 AM Sources Of Nutrition Information And Knowledge For Ultra-runners

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(No relevant relationships reported)

PURPOSE: Ultra-marathon events (i.e., >42.2-km) continue to grow in popularity; however, little research exists on the typical dietary intake of ultramarathon participants, or the sources of information which influence their habits and beliefs. The objectives of this study were to characterize the acquisition of nutrition information among ultra-endurance athletes, and to determine the relationship between the use of different sources of information and nutritional knowledge (relative to current evidence-based recommendations). **METHODS:** Participants (n=196) were adults who had completed an ultramarathon at least once in the past 2 years. Measures included: a demographic questionnaire; the Sources of Nutrition Information (SONI) questionnaire, which included 7 major sources of nutrition information, as well as their credibility, accessibility, frequency, interest; and the General Nutrition Knowledge Questionnaire - Revised (GNKQ-R). Repeated measures ANOVA was used to analyze differences between items on the SONI scale. Spearman rank correlation was used to test for a relationship between sources of information and GNKQ-R score. **RESULTS:** 18% self-identified as vegan/vegetarian, 6% paleo/ketogenic, 20% traditional American diet, 54% "healthy" and 12% "other". Peer reviewed literature was reported as the most frequently used (mean score=1.64, $p<0.001$), credible (3.02, $p<0.001$), and interesting (2.62, $p=0.002$). Social media was the most accessible (2.81, $p<0.001$), but the least credible (1.87, $p<0.001$). A modest, significant correlation ($r=0.185$, $p=0.015$) exists between use of peer-reviewed literature and nutrition knowledge. **CONCLUSIONS:** Ultrarunners report high usage of peer-reviewed literature for nutrition information, which is related with improved nutritional knowledge. Because of its accessibility, social media may be a promising tool to provide nutrition information to this population.

3254 Board #6 June 1 9:00 AM - 11:00 AM Lack Of Nutrition Knowledge In Division II Athletes Associated With Limited Access To Registered Dietitians

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Limited nutrition knowledge is prevalent among all types of athletes, which is correlated with negative health consequences. Eating disorder (ED) etiology is the most documented, dire issue facing athletes, especially those in lean-emphasized sports (LES) such as gymnastics and tennis, primary contributor to ED in LES is athletes' lack of nutrition knowledge of carbohydrates (CHO), fats, and weight management (WM). **PURPOSE:** To assess NCAA Division II (DII) athletes' knowledge in distinct domains: (1) CHO, (2) fats, and (3) WM. **METHODS:** The Macronutrient and Energy Metabolism Expertise Survey (MEMES) was created through modification of Reagan's NET Survey. Changes included different domains (e.g. WM questions vs. Etiology) and expanding number of questions (5 to 10). An expert panel confirmed the face and construct validity of the MEMES before it was piloted. Athletes signed informed consent and then voluntarily completed the MEMES via Qualtrics in a designated computer lab on one test date. Email reminders were sent 1 month, 1 week, and 1 day prior to test date. The criterion for "Adequate Knowledge" (AK) was set at 80% for each domain and total score correct. Pearson product moment correlations were calculated between variables (e.g. percent correct, gender, sport). **RESULTS:** Eighty-eight males and eighty females completed the MEMES (35.8% return rate). Males scored significantly higher on CHO ($p=0.017$) and athletes ($n=16$) who reported having access to a Registered Dietitian (RD) scored significantly higher on the CHO and fat domains ($p=0.00$ and 0.042 , respectively). The majority (28.6%) reported "experience as an athlete" as their primary source for nutrition knowledge. The least cited source was a RD (8.9%). Also, the athletes lacked knowledge: the mean total score was 14.4 correct out of 40 or 36%, falling below the established AK of 80%. The mean of correct scores were 29.1%, 37.0%, and 41.9% for fats, CHO, and WM, respectively. **CONCLUSION:** The results suggest that athletes are at a high risk of health consequences such as ED. Likewise, they are likely to be misinformed about sound sports nutrition by relying on their self-knowledge rather than a professional advice from a RD. This challenges the notion that experience as an athlete is a source of nutrition knowledge.

3255 Board #7 June 1 9:00 AM - 11:00 AM Evidence Of A Relationship Between Dietary Fat Intake And Inflammation Among Professional Soccer Players

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(No relevant relationships reported)

Reducing background inflammation in athletes may be a medical and performance objective. Data describing the relationship between erythrocyte membrane fatty acids (EMFA) and low grade inflammation in soccer players are absent from the literature. EMFA reflects dietary fat intake in the weeks preceding the blood test. **PURPOSE:** To investigate the strength and reproducibility of the relationship between EMFA and inflammation in a group of professional soccer players. **METHODS:** We conducted an observational study, collecting venous blood samples measuring high-sensitivity C-reactive protein (CRP) and EMFA in the early season (T1) and late season (T2). A total of 47 blood samples were collected from 29 different athletes, with 25 athletes tested at T1, and 22 athletes at T2. A cut off point of $>5\text{mg/L}^1$ was set to minimise the effect of acute inflammation, and these samples were removed from the analysis. Linear relationships between biomarker variables were examined using Pearson correlation tests. **RESULTS:** At T1, we report significant positive correlations between CRP and the following EMFA variables: Omega6:Omega3 ratio and the Arachidonic Acid: Eicosapentaenoic acid (AA:EPA) ratio (0.566, $p<0.003$, and 0.582, $p<0.002$ respectively) and significant negative correlations with the Omega 3 index and the anti-inflammatory fatty acid index (AIFAI; -0.495, $p<0.011$, and -0.465, $p<0.018$ respectively). However, at T2, the relationship between EMFA variables and inflammation had attenuated, with no strong linear correlations observed. The correlation analysis of all the blood samples collected ($n=47$) showed significant correlations between the Omega-3 Index, the AIFAI and CRP (-0.319, $p<0.028$, and -0.299, $p<0.040$ respectively). **CONCLUSION:** There is a relationship between inflammation and EMFA variables in professional soccer players and the strength of this relationship appears to depend on the sampling occasion. Future research should explore augmenting EMFA as an anti-inflammatory strategy.

3256 Board #8 June 1 9:00 AM - 11:00 AM Sex Differences in Nutrition Knowledge of Division I College Athletes

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Appropriate nutrition is imperative for participation in, and recovery from, exercise. However, many college athletes do not have a sufficient nutrition knowledge base to help them stay healthy during their physically taxing sports. **PURPOSE:** To assess the nutrition knowledge base of NCAA Division I college athletes using a validated nutrition knowledge survey. **METHODS:** Varsity athletes at a Division I university were recruited via word-of-mouth. A validated nutrition knowledge survey (Callella et al., 2017) that contained both general- and sport nutrition-specific sections, was administered at different settings convenient to the athletes (e.g., team meetings or training table). Participants were asked not to share answers or use any outside resources (e.g., internet). Scores were summed as +1 for a correct answer or +0 for no answer, an incorrect answer, a double-answer, or the "I don't know" option. The maximum possible score was 97. Knowledge was categorized as low ($<33^{\text{rd}}$ percentile), medium (33^{rd} to 66^{th} percentile), and high ($>66^{\text{th}}$ percentile). Frequencies of knowledge categories were tallied, and an independent t-test was run to determine sex differences. Alpha level was set at $p<0.05$. **RESULTS:** Athletes ($n=128$; $n=70$ female, $n=58$ male) from eight different sports completed the nutrition knowledge survey. Frequencies of each knowledge category were 42 ($n=11$ female, 31 male) with low knowledge, 24 ($n=7$ female, 17 male) with medium knowledge, and 62 ($n=52$ female, 10 male) with high knowledge. Average scores for females were 64.5 ± 15.9 , 43.1 ± 11.0 , and 21.4 ± 5.9 for the total survey, general nutrition, and sport nutrition sections, respectively. On average, males scored significantly lower, with scores of 43.6 ± 15.1 , 27.6 ± 10.1 , and 16.0 ± 6.7 for the total survey, general nutrition, and sport nutrition sections, respectively ($p<0.001$). **CONCLUSION:** Based on survey results, the majority of NCAA Division I athletes assessed fell into the high nutrition knowledge category, with most in the category being female. Future research should expand on this to assess knowledge of specific nutrition concepts.

G-18 Thematic Poster - Behavioral Aspects of Exercise

Saturday, June 1, 2019, 9:00 AM - 11:00 AM
Room: CC-102A

3257 Chair: Erica M. Taylor, FACSM. *Columbus State University, Columbus, GA.*

(No relevant relationships reported)

3258 Board #1 June 1 9:00 AM - 11:00 AM
The Physical and Mental Rehabilitation Effect of Healthy-mind Exercise intervention on Individuals of Illicit Drug Dependent

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(No relevant relationships reported)

PURPOSE: Healthy-mind exercise is an exercise of a low-medium intensity and benefit to both physically and mentally. The exercise is composed of Tai Chi, Healthy Qi Gong and Yoga. The hypothesis of this experiment was that the healthy-mind exercise intervention is superior to the conventional physical rehabilitation methods in Shanghai compulsory detoxification and rehabilitation centers on the effect of fitness and quality of life.

METHODS: A total of 100 male individuals of illicit drug dependent who met the inclusion criteria were recruited and randomly assigned to two groups. In the experimental group (n=50), subjects practiced three times of healthy-mind exercise in the morning, noon and evening for 20 minutes for each exercise session. The total time of the exercise was 60 minutes, 5 times a week. The control group was treated with the conventional rehabilitation method (n=50). The contents of the exercises in control group included recreational gymnastics, gesture exercise, the times of daily practice, duration of each session, total duration of a day and the repetitions per week were the same as those of the experimental group. Outcomes of fitness, quality of life for drug addiction questionnaire (QOL-DA) were measured at the baseline, 3 month and 6 month. Data analysis was applied with SPSS 19.0. A two-way repeated measures analysis of variance (ANOVA) was applied to test whether the treatments were different after 6 months.

RESULTS: At baseline, no statistically significant differences were observed between two groups in terms of demographic outcomes, fitness and the scores of QOL-DA. After 6 months of exercise intervention, there were significant differences found in systolic ($F_{(2,166)}=11.77$), diastolic ($F_{(2,166)}=8.96$), heart rate ($F_{(2,166)}=7.82$), vital capacity ($F_{(2,166)}=3.08$), flexibility ($F_{(2,166)}=13.85$), aerobic endurance ($F_{(2,166)}=15.05$). The results of QOL-DA showed that there were significant differences between experimental group and control group in physical function ($F_{(2,170)}=10.32$), psychological function ($F_{(2,170)}=9.71$), symptom function ($F_{(2,170)}=6.42$), social function ($F_{(2,170)}=14.91$) and total score ($F_{(2,170)}=15.95$). **CONCLUSIONS:** This study proved that the healthy-mind exercise was suitable for substance dependent individuals.

3259 Board #2 June 1 9:00 AM - 11:00 AM
Confirmation of Self-Reported Ambulatory Exercise Bouts During Ecological Momentary Assessment

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(No relevant relationships reported)

Ecological momentary assessment (EMA) is a method of self-report (SR) that can be used to examine how fluctuations in physical activity (PA) behavior are related to affective, contextual, and cognitive antecedents. Concurrent objective PA monitoring is recommended with EMA to supplement retrospective questions about PA. The objective PA data could be useful for confirming that SR bouts of ambulatory exercise occurred as described (timeframe, duration, intensity). To date, such a confirmation process has not been described in the literature. **PURPOSE:** Assess the use of accelerometry to confirm EMA of ambulatory exercise. **METHODS:** Participants (N=29, age 24±6y) completed four mobile surveys/d for 14-d (82% response rate) denoting exercise type and duration over the preceding 4-h. Throughout the 14-d period, participants wore an ActiGraph GT3X+ (AG) on the hip (14.0±3.5h/d). To confirm EMA reported exercise bouts, survey meta-data (date, time-stamp) and bout durations were used to guide visual inspection (VI) of AG data within the corresponding 4-h time blocks by two independent reviewers (inter-observer agreement=84% and after deliberations=100%). The Crouter 2-Regression Model (C2RM) was applied to AG counts to determine a min-to-min coefficient of variation (CV). SR bouts were confirmed when the C2RM CV ranged between 1% and 10%

continuously and step counts were above 5 steps per 10s epoch for the approximate SR duration. Descriptive statistics and frequency analyses were conducted. **RESULTS:** 93 of 128 bouts were confirmed, and the average SR bout duration (29±20min) was slightly greater than VI bouts (25±20min). Ten bouts were unable to be confirmed due to AG non-wear. In the 25 remaining unconfirmed cases, no continuous bouts matching the SR durations were observed. **CONCLUSIONS:** Processing AG data using C2RM allowed intuitive and reliable VI for confirmation of continuous ambulatory exercise bouts reported via standard EMA survey items. Feasibility of applying this process may be limited by large sample sizes.

3260 Board #3 June 1 9:00 AM - 11:00 AM
Feasibility Of A Novel Video Game-based EMG Biofeedback System In Patients With Knee Osteoarthritis

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(No relevant relationships reported)

PURPOSE: Rehabilitation through quadriceps strengthening is a well-established treatment for patients with osteoarthritis (OA) of the knee. Electromyography (EMG) biofeedback units provide an interactive mechanism to increase motivation during exercise, but conventional systems are expensive, and their simplistic interface may not be engaging to the user. The purpose of this study was to compare technology acceptance and knee extension torque production using EMG biofeedback presented to patients from within a video game interface.

METHODS: A novel virtual world game system ("KneeBRIGHT") was developed that integrated electromyography (EMG) biofeedback and guided patients through quadriceps strengthening routines. Feasibility testing was completed with 19 patients with a prior diagnosis of knee joint osteoarthritis (51.9±7.5yrs, 88.7±19.8kg, 170.5±7.4cm). Participants conducted 2 testing sessions on separate days. During the first session, participants performed 3 sets of lower body exercises with emphasis on maximal muscle activation, endurance, and motor control/precision. These exercises were conducted with a commercially available EMG biofeedback unit (Pathway MR-20, Promethius Group, Dover, NH). During the second session, participants used the KneeBRIGHT game that was designed to match the exercise sets in the first session. For all sessions, knee extension torque was recorded during the isometric muscle activation exercises using a dynamometer, and patient engagement was assessed using the technology acceptance model (TAM) questionnaire. Peak torque and TAM scores obtained during the KneeBRIGHT and traditional biofeedback sessions were compared using paired t-tests.

RESULTS: Knee extension torque generated during KneeBRIGHT game exercise sessions was increased by an average of 25% compared to the torque generated during conventional EMG biofeedback sessions (2.14 Nm/kg vs. 1.77 Nm/kg, p=0.02). There was no significant difference in TAM scores between the sessions (3.42±0.4 vs 3.2±0.5, p=0.25).

CONCLUSIONS: Patients exercising with the KneeBRIGHT game produced greater knee torque than patients exercising with the conventional system, and demonstrated positive levels of engagement.

3261 Board #4 June 1 9:00 AM - 11:00 AM
Exploring Qualitative Determinants of Regular Group Indoor Cycling Participation in a Diverse Sample of Adults

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While U.S. adults generally do not acquire adequate amounts of physical activity, non-Hispanic Blacks (NHB) obtain less physical activity than non-Hispanic Whites (NHW). Identifying reasons why NHB regularly participate in a given exercise modality may help tailor future recommendations in this population. Group indoor cycling (GIC) classes have gained popularity and are offered widely in fitness facilities. **PURPOSE:** To qualitatively investigate the motivation for regular GIC class participation in a racially diverse sample.

METHODS: Women and men attending GIC classes at a rhythm-based cycling studio ≥ 1 day/week for the preceding three consecutive months were recruited. Participants completed a questionnaire that included two open-ended questions: 1) "Why do you continue to regularly choose GIC classes for exercise?" and 2) "How does the environment at this cycling studio motivate you to continue to choose GIC for exercise?" Three investigators independently analyzed data using established procedures for thematic analysis. Data from the two questions were reported in

aggregate. **RESULTS:** Seventeen adults (88% female; 71% NHB; 29% NHW; mean \pm SD age: 32.1 \pm 7.4 yrs.; body mass index: 26.2 \pm 3.6 kg/m²) completed the study. Five main themes emerged as reasons for regular GIC class participation in NHB and NHW, respectively: music selections (83 and 80%), studio atmosphere (67 and 40%), social support (67 and 80%), physical health (58 and 100%), and enjoyment/fun (42 and 60%). **CONCLUSIONS:** The music (majority hip-hop and rap) in this studio may have played an integral role in attracting NHB to participate in GIC classes at this studio on a regular basis. NHW participants indicated physical health as a key motivator for class attendance. More research is needed to gain a deeper understanding of cultural relevance as it relates to motivational factors for exercise, which could inform future strategies for promoting regular exercise in various populations.

3262 Board #5 June 1 9:00 AM - 11:00 AM
Creativity In Children With Different Level Of Cardiorespiratory Fitness And Fat Mass: A Cross-Sectional Study

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Low cardiorespiratory fitness and accumulated fat mass have been widely associated with impaired cognitive performance in children, however, their influence on creativity remains unclear. The creativity is a component of cognition and is defined as the process of identifying the difficulty, formulating hypotheses about the deficiencies and solving the problems. Actually, the creativity has become an element key to cognition because contribute to personal and professional success of the subject. **PURPOSE:** Here, we compare creativity in children with different levels of cardiorespiratory fitness (CF) and fat mass (FM), as well as their relationship. **METHODS:** In this cross-sectional study, 73 children with age ranging from 10.1 to 11.5 participated while attending two testing sessions. On the first testing session, all children had general anthropometric assessments and completed a graded shuttle run test to estimate cardiorespiratory fitness (VO₂ max). On the second session, they perform the Children's Figural Creativity Test, scholar performance test and have the fat mass (FM) measured by the Dual-energy X-ray Absorptiometry. Children were divided in two groups (Lower x Higher) separated by the median value of CF and FM. Creativity was compared between groups by a paired t test and unpaired Mann-Whitney (P<0.005). Pearson or Spearman correlations were used to compare the associations between the variables. **RESULTS:** The results demonstrate no significant differences on creativity between VO₂ max (p=0.75) and FM (p=0.56) levels. In addition, no correlation was identified between creativity with CF (r=-.031; p=.828) and FM (r=.174; p=.218). **CONCLUSIONS:** In conclusion, creativity is similar in children with different VO₂ and FM level and there is not relationship between these variables. However, are necessary more studies with a robust creativity measurement technique, based in neurobiological markers (NIRS, fMRI).

3263 Board #6 June 1 9:00 AM - 11:00 AM
The Relationships between Cell Phone Use and Sedentary Behavior in Samples of Japanese and American College Students

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Previous work from our research group has indicated a significant, positive relationship between cellular telephone (cell phone) use and sitting or sedentary behavior in college students. However, this work has been limited to only a single, large, public university in the Midwestern United States. Therefore, it remains unknown if this relationship would be present in groups of college students from different geographic regions and/or cultural backgrounds.

PURPOSE: To compare the relationship between daily cell phone use and sedentary behavior in samples of college students from Japan and the United States.

METHODS: A sample of college students (N = 808, 20.2 \pm 1.8 years old) from either a university in Japan (n = 534, 19.8 \pm 1.1 years old) or the United States (n = 274, 21.71 \pm 2.4 years old) completed validated surveys assessing age, daily cell phone use (min) and daily total sedentary behavior (min). Surveys were administered in English for American students and Japanese for students from Japan.

RESULTS: Independent samples t-tests revealed that Japanese students reported greater daily sitting (420 \pm 264 min/day) and less daily cell phone use (215 \pm 125 min/day) than American students (360 \pm 198 min/day sitting, 274 \pm 150 min/day cell phone use). Because of these differences, Pearson's correlation analyses assessing the relationship between cell phone use and sedentary behavior were performed

for Japanese and American students separately. There were significant, positive relationships between cell phone use and sedentary behavior in both Japanese (r = 0.132, p = 0.002) and American (r = 0.166, p = 0.006) college students.

CONCLUSION: While there were differences in sedentary behavior and cell phone use in Japanese versus American college students, the relationships between these variables was positive and significant regardless of group. This finding supports previous data indicating that elevated cell phone use is predictive of greater daily sitting in college students. Furthermore, present results indicate that this relationship extends beyond American college students.

3264 Board #7 June 1 9:00 AM - 11:00 AM
Investigating the Impact of Acute Exercise and Brain Stimulation on Cognitive Control in Healthy Adults

Erika K. Hussey¹, Eduardo B. Fontes², Nathan Ward², Daniel R. Westfall³, Shih-Chun Kao⁴, Arthur F. Kramer³, Charles H. Hillman³. ¹US Army, NSRDEC, Natick, MA. ²Tufts University, Medford, MA. ³Northeastern University, Boston, MA. ⁴Purdue University, West Lafayette, IN.
 (No relevant relationships reported)

The field of cognitive enhancement has grown in popularity in recent years. Exercise and transcranial direct current stimulation (tDCS) are two approaches for which there is some evidence of transiently improved cognitive control. Yet, no research has systematically compared both approaches, so the degree to which these techniques influence similar mechanisms of improvement remains unknown. **PURPOSE:** We parametrically compared the acute effects of aerobic exercise and tDCS over left prefrontal regions on cognitive control. **METHOD:** 96 young healthy individuals (22.4 \pm 4.1 years old) completed two testing sessions. The first session included baseline measurements of cognitive control on a flanker inhibition task and an n-back working memory task, followed by a maximal graded exercise test. During the second session, participants were randomly assigned to either 20 minutes of running on a treadmill at moderate intensity (60-70% of maximal heart rate) or 20 minutes of seated rest. After a 10-minute interval, participants were randomly assigned to receive 30 minutes of active tDCS (2mA anode over left prefrontal cortex; cathode over right bicep) or sham stimulation as they completed the flanker and n-back tasks. We compared baseline-corrected cognitive control performance as a function of Exercise (running vs. seated rest) and Stimulation (active vs. sham tDCS) using linear mixed effects models. **RESULTS:** Models revealed a main effect of Condition on n-back sensitivity (nonparametric signal detection A': t=2.45, p=0.014), but no significant effects of Stimulation, and no interaction of Exercise and Stimulation. Specifically, the individuals who exercised were better able to discriminate n-back targets from nontargets compared to the seated group. We did not observe any effects of Exercise or Stimulation on flanker performance (accuracy and response times on incongruent or congruent trials). **CONCLUSION:** Whereas noninvasive brain stimulation produced no effects on cognitive control, acute aerobic exercise significantly improved working memory performance. This suggests that the neuroenhancement mechanisms impacted by short bouts of exercise and tDCS may be distinct. Further, this pattern hints that aerobic exercise may have broader effects on cognitive control than non-invasive brain stimulation.

3265 Board #8 June 1 9:00 AM - 11:00 AM
The Individual and Combined Effect of Hypoxia and Music on Physical Performance

Kate O'Keeffe, Jacob Dean, Dr. Simon Hodder, Dr. Alex Lloyd. Loughborough University, Loughborough, United Kingdom.
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 (No relevant relationships reported)

Humans ascending to high altitude are susceptible to debilitating psychological alterations which include severe mood changes, cognitive fatigue, and neuropsychological impairments. The combination of environmental stressors that occur at altitude can further inhibit both physical and cognitive performance.

PURPOSE: Music has ergogenic effects on physical performance through enhancing psychological factors such as mood, emotion and cognition. This study aimed to explore the impact of music as a tool for mitigating the performance decrements observed at altitude. **METHODS:** Following ethical approval from Loughborough University, 13 healthy males (mean \pm SD: 23.9 \pm 4.01 years) completed one familiarisation session and four counterbalanced experimental trials; 1) normoxia (0.209 FiO₂) and no music; 2) normoxia (0.209 FiO₂) with music; 3) normobaric hypoxia (0.13 FiO₂) and no music; 4) normobaric hypoxia (0.13 FiO₂) with music. All conditions were completed at 21°C with 50% relative humidity. Music was self-selected by each participant prior to the familiarisation session. The songs were assessed for their motivational qualities using the Brunel Music Scale Inventory (BMRI-2). Each experimental trial included a 15-min self-paced time trial on an arm bike, followed by a 60-s isometric maximal voluntary contraction (MVC) of the biceps brachii. Supramaximal nerve stimulation was used to quantify central and peripheral

fatigue with voluntary activation (VA%) calculated using the twitch interpolation method. Subjective measures included motivation (MS) and mood using the Brunel Mood Scale (BRUMS). **RESULTS:** Average power output (W) was reduced with a main effect of hypoxia ($p = 0.02$) and significantly increased with a main effect of music ($p = 0.001$). When combined the interaction was additive ($p = 0.87$). Average MVC force (N) was reduced in hypoxia ($p = 0.03$) but VA% of the biceps brachii was increased with music ($p = 0.02$). MS and BRUMS remained unchanged across all conditions ($p > 0.06$). Music reduced subjective scores of mental effort, breathing discomfort, and arm discomfort in hypoxia ($p < 0.001$). **CONCLUSION:** Music increased self-paced and maximal physical exertion through enhancing neural drive and diminishing detrimental mental processes, enhancing performance at both sea level and high altitude.

G-19 Thematic Poster - Endocrine Responses to Exercise and Occupational Stressors

Saturday, June 1, 2019, 9:00 AM - 11:00 AM

Room: CC-101B

3266 Chair: Jay Heaney. *Naval Health Research Center, San Diego, CA.*

(No relevant relationships reported)

3267 Board #1 June 1 9:00 AM - 11:00 AM
Coupling of Adrenal and Gonadal Hormones: Potential Relationship to Occupational Demand

Matthew R. Schoenherr, Lisa M. Hernandez, Marcus K. Taylor, Ph.D., FACSM. *Naval Health Research center, San Diego, CA.*
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(No relevant relationships reported)

The positive coupling hypothesis describes the hypothalamic-pituitary-adrenal and -gonadal systems as parallel, cooperative processes that represent joint calibration to meet internal, and/or environmental, demands. We recently tested this hypothesis in Naval Special Warfare (NSW) personnel and found positive coupling between the adrenal hormones, cortisol (CORT) and dehydroepiandrosterone (DHEA), and the gonadal hormone, testosterone (TESTO).

PURPOSE: To test the positive coupling hypothesis in Explosive Ordnance Disposal (EOD) personnel; a specialized military population whose mission is to ensure that hazardous explosives are rendered safe for unit preservation and security. **METHODS:** Active duty U.S. Navy EOD operators ($N = 64$; mean \pm SD age: 34 ± 6.0 years) self-collected saliva samples in a non-deployed, free-living setting on 2 consecutive weekdays at wake, wake + 30 min, wake + 60 min, 1600, and 2100 (10 samples total). Exclusion criteria included use of any anabolic supplements within the last 3 months. Coupling hypotheses (associations between CORT, DHEA, and TESTO summary parameters) were tested with Pearson product-moment correlation analyses. Established summary parameters were determined for each hormone: highest morning value, area under the curve (with respect to ground [morning values]), and averages of morning and evening values, respectively. **RESULTS:** DHEA was positively coupled with TESTO (r range: .28-.61, $p < .05$) and also with CORT (r range: .50-.57, $p < .05$) throughout the day. Positive coupling between CORT and TESTO was only observed in the evening ($r = .32$, $p = .014$). **CONCLUSION:** This study partially replicated our prior report in NSW personnel, which demonstrated that DHEA positively coupled with TESTO as well as CORT. The evening association of TESTO and CORT is also consistent with our previous findings and likely indicative of homeostatic processes. Unlike the previous study, however; the morning values of TESTO and CORT were not coupled in the present study. This inconsistency could potentially be explained by a warfighter's specific operational demands. For example, positive coupling may be adaptive for duties that include direct engagement with the enemy. In contrast, uncoupling may be more conducive to ensuring unit safety and security.

3268 Board #2 June 1 9:00 AM - 11:00 AM
Testosterone Status Following Short-term, Severe Negative Energy Balance Predicts Fat-free Mass Loss in U.S. Marines

Claire E. Berryman, John J. Sepowitz, Holly L. McClung, Stefan M. Pasiakos, FACSM. *US Army Research Institute of Environmental Medicine, Natick, MA.* (Sponsor: Stefan M. Pasiakos, FACSM)

(No relevant relationships reported)

Male US military personnel exposed to periods of severe negative energy balance often experience marked reductions in circulating total testosterone, and it is not uncommon for concentrations to fall below normal levels (< 300 ng/dL). However, testosterone fluctuations following severe negative energy balance are variable, and little is known about the metabolic and physiological differences between males who experience low testosterone (LT) and those who maintain normal testosterone (NT). **PURPOSE:** To determine metabolic and physiological differences between males with LT versus those with NT following 8 d of strenuous military training. **METHODS:** Male US Marines ($n = 68$) were dichotomized based on testosterone concentration ($< \text{or} \geq 300$ ng/dL) following 8 d of severe negative energy balance incurred during military training. Body composition (DEXA) and whole-body protein turnover (^{15}N alanine) were measured and blood and urine samples collected before (PRE) and after (POST) training. Linear mixed models were used to assess the effects of testosterone status, time, and their interaction on outcomes. **RESULTS:** Testosterone concentrations decreased PRE (505 ± 135 ng/dL) to POST (284 ± 115 ng/dL, $P < 0.01$). When volunteers were dichotomized by POST testosterone status (NT, $n = 24$; 407 ± 97 vs. LT, $n = 44$; 217 ± 52 ng/dL, $P < 0.01$), PRE BMI, total fat mass, and testosterone were greater in NT compared to LT ($P < 0.05$). LT lost more fat-free mass (FFM, -3.4 ± 1.3 kg) and less fat mass (-2.4 ± 1.2 kg) compared to NT (-2.4 ± 2.0 and -3.2 ± 1.6 kg, respectively; P -interaction < 0.03). Insulin ($+5.55 \pm 9.35$ $\mu\text{U/mL}$) and norepinephrine ($+0.23 \pm 0.29$ ng/mL) increased from PRE to POST in LT, whereas no changes occurred in NT ($+1.03 \pm 3.75$ $\mu\text{U/mL}$ and $+0.04 \pm 0.30$ ng/mL, respectively), resulting in significant differences between groups (P -interaction < 0.02). Independent of time, LT had greater whole-body protein synthesis, breakdown, and flux (P -status < 0.01), but not net balance (P -status = 0.2), compared to NT. **CONCLUSION:** Military personnel susceptible to operational stress-induced LT may be predisposed to greater FFM loss during periods of negative energy balance incurred during short-term, strenuous military training. Supported by US Army Medical Research and Materiel Command; authors' views not official US Army or DoD policy.

3269 Board #3 June 1 9:00 AM - 11:00 AM
Salivary Stress Biomarkers During the Lake Placid Ironman® Ultraendurance Event

Aidan P. Fiol, Deanna M. Dempsey, Douglas J. Casa, FACSM, Jun Hashiwaki, Rebecca L. Stearns, Robert A. Huggins, Amy L. McKenzie, Colleen X. Munoz, Elaine C. Lee. *University of Connecticut, Storrs, CT.*
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(No relevant relationships reported)

Biomarkers such as salivary IgA (sIgA) have been established as valid, reliable, and non-invasive stress markers. sIgA concentrations have been reported to decrease following periods of high physiological stress, such as that experienced during ultraendurance events. Heat shock protein 70 (HSP70), a molecular chaperone, has been assessed primarily as a plasma/serum stress biomarker. The role of HSP70 in saliva, how it responds to extremely stressful exercise events and its correlation to changes in sIgA remain unclear. **PURPOSE:** To test the hypothesis that salivary HSP70 can be used as a salivary stress biomarker correlated to sIgA during an ultraendurance event. **METHODS:** Thirty-three subjects competing in the Lake Placid Ironman triathlon participated (all data, mean \pm SD: 38 ± 8 yrs, 178.4 ± 8.9 cm, 76.3 ± 10.4 kg, $10.8 \pm 3.8\%$ body fat, finish time 708 ± 90 min). Environmental symptoms questionnaires (ESQ) were administered before (PRE) and 1 hour after the race (POST). Hydration status was assessed via urine specific gravity (USG). Saliva samples were collected PRE, POST, and 1 day post-race (AMPOST) and analyzed for IgA (Salimetrics) and HSP70 (Enzo Life Sciences) by ELISA according to manufacturer instructions. Significant differences among time points were analyzed by repeated measures ANOVA and LSD post hoc tests. **RESULTS:** Subjects experienced significant stress with completion of the race (708 ± 90 min finish time, ESQ 1hPOST (20 ± 8) vs. PRE (5 ± 3 , $p < 0.05$), POST RPE 18 ± 2). sIgA was decreased POST (41.71 ± 20.46 $\mu\text{g} \cdot \text{mL}^{-1}$) vs. PRE (48.88 ± 17.20 $\mu\text{g} \cdot \text{mL}^{-1}$, $p = 0.05$) and vs. AMPOST (37.76 ± 27.02 $\mu\text{g} \cdot \text{mL}^{-1}$, $p = 0.006$). Salivary HSP70 was increased POST (3.91 ± 3.29 ng $\cdot \text{mL}^{-1}$) vs. PRE (1.68 ± 1.93 ng $\cdot \text{mL}^{-1}$, $p = 0.0002$). **CONCLUSIONS:** Salivary HSP70 was detectable using a commercially available ultrasensitive HSP70 ELISA. Extracellular HSP70 in the oral cavity may be a non-invasive marker of stress during an ultraendurance event and is correlated with more common salivary stress marker sIgA.

- 3270** Board #4 June 1 9:00 AM - 11:00 AM
Daily Cortisol Patterns in Specialized Military Men: Replication and Refinement in a Novel Population
 Genie Leah A. Padilla¹, Lisa M. Hernández¹, Marcus K. Taylor, FACSM². ¹Leidos, San Diego, CA. ²Naval Health Research Center, San Diego, CA.
 (No relevant relationships reported)

Amassing evidence suggests that post awakening cortisol patterns are useful indicators of health status. Our lab established summary parameters of cortisol and reported excellent stability across 2 days of repeated sampling in 58 U.S. Navy SEALs. To confirm the generalizability of our original findings, there is a need to replicate procedures in another military population with unique operational demands. **PURPOSE:** To establish the summary parameters of daily cortisol patterns, the stability of repeated sampling, and the impact of salivary sampling compliance in U.S. Navy Explosive Ordnance Disposal (EOD) operators. **METHODS:** Seventy active duty, male EOD operators (mean \pm SD age = 34.9 ± 6.5 y) self-collected saliva samples in a nondeployed, free-living setting. Samples were collected on 2 consecutive weekdays at Wake, Wake + 30 min, Wake + 60 min, 1600, and 2100. Three measures of magnitude and three measures of pattern were computed. The stability of each parameter was evaluated via correlational analyses and Cronbach's alpha (α). Compliance was evaluated via actigraphy using two alternate compliance criteria. **RESULTS:** Average salivary cortisol concentrations increased at Wake + 30 min (mean \pm SE reactivity = $48.9 \pm 6.8\%$), followed by a swift recovery at Wake + 60 min. Approximately 17.4% ($n = 12$) were classified as negative-reactors (i.e., $<0\%$ change from Wake to Wake + 30 min). The three measures of magnitude demonstrated good stability across 2 days (r value range: 0.37-0.45, $p < 0.01$; α range: 0.54-0.62). Fifty-five percent of the sample was classified as compliant (defined as <15 min deviation from target sampling times) across both days; this decreased to 31% when compliance was refined to <5 min deviation. However, controlling for compliance did not convincingly influence any of the summary parameter estimations or their stability. **CONCLUSIONS:** These findings demonstrate a thorough replication and refinement of our prior report, implying that these results are generalizable across diverse military populations. The noninvasive salivary sampling protocol used in this study yields stable estimations of daily cortisol patterns in specialized military men. This sampling protocol is recommended for use as an operational health surveillance instrument for chronically stressed military members.

- 3271** Board #5 June 1 9:00 AM - 11:00 AM
Cortisol Responses During a Long Duration Incremental Exercise Protocol in the Heat while Wearing Personal Protective Equipment
 Thomas Service¹, Cory Coehoorn¹, Lynne Stuart-Hill¹, Olave Krigolson¹, Patrick Neary². ¹University of Victoria, Victoria, BC, Canada. ²University of Regina, Regina, SK, Canada.
 (No relevant relationships reported)

Individuals in occupations that wear personal protective equipment (PPE) are exposed to acute heat stress on a regular basis. There is no research evaluating the effects of rapid and uncompensable core temperature (T_c) acquisition, as which occurs when one is wearing PPE, on rate and magnitude of salivary cortisol appearance. **PURPOSE:** To determine the effects of rapid and uncompensable (T_c) acquisition on the rate and magnitude of salivary cortisol appearance. **METHODS:** Fourteen male subjects (33.6 ± 12.1 years) performed an incremental treadmill test to a termination point in a control session (CON) and an experimental session (PPE). Salivary samples were collected using an oral swab stimulated method. Saliva samples were processed and analyzed for salivary cortisol concentration using a highly sensitive enzyme immunoassay. Heart rate (HR), thermal comfort scale (TCS) and thermal sensation (TS) were also recorded at each 0.5°C increase in core temperature (T_c). **RESULTS:** There were significant differences in time to termination (TTT) (CON = 77.3 ± 12.6 min; PPE = 50.3 ± 6.9 min), pre-exercise HR (CON = 76.8 ± 4.8 bpm; PPE = 86.5 ± 5.1 bpm), post-exercise HR (CON = 161.1 ± 11.9 bpm; PPE = 179.6 ± 6.8 bpm), end-exercise T_c (CON = $38.57 \pm 0.3^\circ\text{C}$; PPE = $39.01 \pm 0.3^\circ\text{C}$), TCS (CON = 3.57 ± 0.6 ; PPE = 4.63 ± 0.3), and TS (CON = 7.57 ± 0.5 ; PPE = 8.67 ± 0.3). There was also a $0.04^\circ\text{C}/\text{min}$ increase in T_c during PPE and a $0.02^\circ\text{C}/\text{min}$ increase in T_c during CON. Significant cortisol results showed a difference in the rate of cortisol appearance (CON = $0.002 \mu\text{g dL}^{-1} \text{min}^{-1}$; PPE = $0.018 \mu\text{g dL}^{-1} \text{min}^{-1}$). There was a significant difference in mean cortisol values between start of exercise and the end of exercise ($p \leq 0.01$). There was also a significant difference ($p \leq 0.05$) between magnitude of salivary cortisol values at termination when comparing CON and PPE. **CONCLUSION:** Rapid and uncompensable T_c acquisition results in an elevated acute cortisol response. This will have implications for individuals who are employed in fields that are exposed to acute heat stress chronically. The acute effects of increased cortisol concentration are a decreased anabolic response, decreased cognitive performance, and decreased mood states. The chronic effects are many, but are mostly related to atherosclerosis development and subsequent cardiovascular disease.

- G-20** Thematic Poster - Exercise and Physical Activity in Cancer Survivors
 Saturday, June 1, 2019, 9:00 AM - 11:00 AM
 Room: CC-102B

- 3272** Chair: Kerri M. Winters, FACSM. Oregon Health & Science University, Portland, OR.
 (No relevant relationships reported)

- 3273** Board #1 June 1 9:00 AM - 11:00 AM
Objectively-Measured Physical Activity in Breast Cancer Patients Undergoing Chemotherapy
 Whitney A. Welch¹, Kara Gavin¹, Juned Siddique¹, Jason Fanning², Payton Solk¹, Cesar A. Santa Maria³, William Gradishar¹, Seema Khan¹, Swati Khulkarni¹, Siobhan Phillips¹. ¹Northwestern University Feinberg School of Medicine, Chicago, IL. ²Wake Forest School of Medicine, Winston-Salem, NC. ³Johns Hopkins Sidney Kimmel Comprehensive Cancer Center, Baltimore, MD. (Sponsor: Ann Swartz, FACSM)
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 (No relevant relationships reported)

PURPOSE: To determine the effect of demographic, health, and treatment factors on moderate to vigorous physical activity (MVPA) in breast cancer patients undergoing chemotherapy. **METHODS:** Breast cancer patients ($N=66$, $M_{age} = 48.3 \pm 10.0$ years) undergoing chemotherapy (CT) wore an accelerometer for 24-hours (worn on the hip during the day and wrist while sleeping) for ten consecutive days (3 days pre-, day of, and 6 days post-CT dose) during three treatment phases (beginning, middle and end of chemotherapy). Mixed models were used to assess the effect of demographic, health, and treatment factors on MVPA. We assessed the effect of time point (burst), treatment status (i.e. pre-CT dose v. day of/post-CT dose), burst x treatment status interaction, age, body mass index, education, total number of comorbidities, disease stage, cumulative treatment cycle number, self-reported pre-diagnosis minutes/day of MVPA, weekend v. weekdays, and self-reported health status on daily minutes of MVPA. **RESULTS:** On average, breast cancer patients engaged in 20.8 minutes/day (95%CI:17.4,24.1) of MVPA across all bursts. Results indicate a significant decrease of 5.0 minutes/day of MVPA (95%CI:-6.5,-3.5) as time point increases, a 4.2 minute/day decrease in MVPA (95%CI:-5.8,-3.2) on day of CT dose or post-CT days compared to pre-CT dose days, a 0.9 minute/day increase in MVPA (95%CI: 0.5,1.3) as treatment cycle number increases, and a 2.2 minute/day increase in MVPA (95%CI:1.1,3.2) on weekends. **CONCLUSIONS:** Results from the current analysis suggest treatment-related factors, such as treatment day, post-treatment days, and time undergoing chemotherapy, had the greatest effect on MVPA in breast cancer patients, significantly decreasing minutes per day spent in MVPA over time. These results show the importance of tailoring future physical activity interventions to specific treatment factors in order to reduce the decline in MVPA during chemotherapy.

- 3274** Board #2 June 1 9:00 AM - 11:00 AM
Overcoming Fitness, Symptom, And Behavior Barriers After A Physical Activity Intervention With Fitness Graded Motion Exergames (PAfitME) Among Head And Neck Cancer Patients
 Hsiao-Lan Wang¹, Harleah Buck¹, Tapan Padhya¹, Kristine Donovan², Laura Szalacha¹, Ellen Smith³, Srinivas Katkoori¹, Barbara Smith, FACSM¹. ¹University of South Florida, Tampa, FL. ²Moffitt Cancer Center, Tampa, FL. ³University of Michigan, Ann Arbor, MI. (Sponsor: Barbara Smith, Member# 126904, FACSM)
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 Reported Relationships: H. Wang: Receipt of Intellectual Property Rights/Patent Holder; Exergame Grading Scheme (Copyright: TXu1-996-913).

Purpose: Routinely engaging physical activity (PA) leads to better health outcomes in cancer survivors. Over 50% of head and neck cancer (HNC) survivors rarely engage in any type of PA because of the barriers of impaired fitness, severe symptoms, and poor self-efficacy (SE). A personalized telehealth Physical Activity intervention with fitness graded Motion Exergames (PAfitME) was designed to overcome these barriers. In our pilot study, we found the HNC patients fully adhered with the personalized exergame prescription in the 6-week PAFitME intervention. The purpose of this study was to examine changes in barriers: fitness (gait speed), symptoms, and SE among HNC patients participating in the PAFitME intervention.

Methods: A pre/post-test design was used to test the 6-week PAFitME intervention. Personalized exergame prescriptions were developed and progressed based on the social cognitive theory and exercise principal of adaptation. Fitness was measured by preferred gait speed (m/s). Symptom data were collected via the MD Anderson Symptom Inventory, Brief Pain Inventory, Pittsburgh Sleep Quality Index, General Anxiety Disorder scale, and Center for Epidemiologic Studies Depression Scale. SE was measured by the PA Self-Efficacy scale (0-100%). Descriptive statistics and paired t tests were applied.

Results: A total of 10 HNC participants were recruited. Two participants dropped out due to recurrence. The mean age was 58.2 years old (n=8). Seven (88%) were male. Three (38%) had oral cancer and 5 (63%) had laryngeal cancer. Three (38%) had a feeding tube and 2 (25%) had a tracheostomy. Four (50%) had stage III/IV cancer. Mean gait speed improvement was clinically significant (0.11m/s). There were positive improvements in 17 of 20 symptoms with significant decreases in pain ($t=2.34$, $p=0.05$), in fatigue ($t=3.64$, $p=0.008$) and in difficulty with voice/speech ($t=2.35$, $p=0.05$). Seven participants (88%) had 100% SE to do their personalized exergame prescription in the post test.

Conclusions: This study shows HNC participants overcame their PA barriers after the PAFitME intervention. It also supports the need for a larger randomized clinical trial for efficacy testing. The positive impact from PAFitME will shift PA interventions from a standardized protocol to a personalized, behavioral telehealth approach.

3275 Board #3 June 1 9:00 AM - 11:00 AM

Muscle Function And Cancer Related Fatigue In Prostate Cancer Survivors Receiving Different Treatment Regimens

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(No relevant relationships reported)

Prostate cancer is the most commonly neoplastic disease that affects men in the world. Androgen deprivation therapy (ADT) is the treatment regimen most used in advanced disease stages. Whereas the occurrence of late side effects induced by ADT seems well described, the long-term consequences of ADT in muscle function and fatigue have not been well documented.

PURPOSE: The purpose of this study was to assess fatigue, muscle strength, muscle thickness, and muscle quality in prostate cancer survivors undergoing to ADT.

METHODS: Ten prostate cancer patients on ADT (ADT group) (74.40 ± 5.76 years, 77.44 ± 14.75 kg and 1.63 ± 0.07 m), 8 patients not undergoing ADT (N-ADT) (69.75 ± 5.92 years, 82.25 ± 9.20 kg and 1.70 ± 0.07 m) and 18 healthy control subjects (CON) (72.17 ± 6.54 years, 77.94 ± 9.47 kg and 1.69 ± 0.07 m) participated in this study. Perceived fatigue was assessed through 20-item Multidimensional Fatigue Inventory. Muscle thickness and quality (e.g., echo intensity) were assessed through B-mode ultrasound. Muscle strength and work capacity were assessed using an isokinetic dynamometer. One-way ANOVAs with Bonferroni post-hoc were used for comparisons between groups adjustment.

RESULTS: Muscle thickness was lower in ADT than CON (21.32 ± 3.20 vs. 26.49 ± 5.10 respectively, $p = 0.021$). Peak torque was lower in ADT than CON (109.78 ± 30.36 vs. 154.67 ± 33.92 respectively, $p = 0.005$). Work capacity was lower in ADT than CON (1964.40 ± 571.71 vs. 2923.67 ± 604.39 respectively, $p < 0.001$). ADT showed greater echo intensity than CON (116.82 ± 15.98 vs. 101.23 ± 8.33 respectively, $p = 0.005$) and N-ADT (102.73 ± 11.72 , $p = 0.046$). There were no differences between N-ADT and CON on muscle thickness, peak torque, work capacity, and echo intensity ($p > 0.05$). General fatigue was greater on both ADT (11.10 ± 3.41 vs. 7.83 ± 2.60 , $p = 0.030$) and N-ADT (11.13 ± 3.48 vs. 7.83 ± 2.60 , $p = 0.047$) compared to CON. Physical fatigue was greater on ADT than CON (13.20 ± 4.02 vs. 8.72 ± 2.87 , $p = 0.006$).

CONCLUSIONS: Therefore, it appears that the nature of ADT treatment has a deeply negative effect on muscle function and fatigue when compared to patients not-undergoing ADT. Therefore, further research is needed to confirm these preliminary findings, in order to attenuate the decline of muscle function and fatigue in men undergoing ADT treatment.

3276 Board #4 June 1 9:00 AM - 11:00 AM

Inflammation Mediates The Effects Of Exercise On Fatigue In Patients With Breast Cancer Undergoing Chemotherapy

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(No relevant relationships reported)

PURPOSE: The randomized controlled OptiTrain trial showed beneficial effects on fatigue after a 16-week exercise program in patients with breast cancer undergoing adjuvant chemotherapy. Hypothesized underlying mechanisms include the involvement of inflammatory pathways. Here, we investigated the effects of exercise on inflammation markers and whether the positive effects on fatigue were mediated by changes in inflammation.

METHODS: 240 women scheduled for chemotherapy were randomized to 16-weeks of resistance and high-intensity interval training (RT-HIIT), moderate-intensity aerobic and high-intensity interval training (AT-HIIT) or usual care (UC). In the current mechanistic analyses, we included participants with >60% attendance and a random selection of controls (RT-HIIT = 30, AT-HIIT = 27, UC = 29). Ninety-two blood markers (e.g. IL-6, TNF α , soluble CD8A) were quantified at baseline and post-intervention. The Piper Fatigue Scale was used to assess general and physical fatigue. Mediation analyses were conducted to explore whether changes in inflammation markers mediated the effect of exercise on general and physical fatigue. ANCOVA, adjusted for menopausal status, chemotherapy treatment (taxanes/no taxanes) and baseline values of the inflammation marker and fatigue, was used to identify between-group differences in the outcome.

RESULTS: In general, chemotherapy led to an increase in inflammation. The increase in IL-6 (pleiotropic cytokine) and CD8A (T-cell surface glycoprotein) was, however, less pronounced following RT-HIIT compared to UC (-0.45 (95% CI -0.85 ; -0.05), $p=0.03$ and -0.28 (95% CI -0.57 ; 0.004), $p=0.05$, respectively). The changes in IL-6 and CD8A significantly mediated the effects of exercise on both general and physical fatigue by 32.0% and 27.7%, and by 31.2% and 26.4%, respectively. No significant between-group differences in inflammation markers at 16 weeks (post-intervention) were found between AT-HIIT and UC.

CONCLUSIONS: This study is the first showing that supervised RT-HIIT partially counteracted the increase in inflammation during chemotherapy, i.e. IL-6 and soluble CD8A, which resulted in lower fatigue levels post-intervention. Exercise might be put forward as an effective treatment to reduce chemotherapy-induced inflammation and subsequent fatigue.

3277 Board #5 June 1 9:00 AM - 11:00 AM
Differences by Activity Level in Barriers and Benefits of Exercise in Breast Cancer Survivors

Gwendolyn A. Thomas, Margaret F. Bedillion. Syracuse University, Syracuse, NY.

(No relevant relationships reported)

Physical activity is a critical component of treatment for breast cancer survivors that prevents additional cancer recurrence, comorbid chronic disease and body composition changes. However, recommended physical activity guidelines are rarely met.

PURPOSE: This study examined how barriers and benefits of exercise differ between breast cancer survivors who are not engaging in any moderate or vigorous physical activity, those doing physical activity but not meeting physical activity guidelines, and those meeting recommended physical activity guidelines. **METHODS:** 392 breast cancer survivors were recruited through the Susan Love/Army of Women, a national non-profit breast cancer organization, and completed the Exercise Barriers and Benefits Survey, the International Physical Activity Questionnaire and questions on resistance exercise activities. **RESULTS:** Multivariate ANOVAs examined whether exercise groups differed in types of exercise benefits and barriers they reported. 267 of the women (69.6%) did not meet recommended guidelines (150 minutes/week of aerobic activity and twice per week resistance exercise). The greatest perceived benefits were for physical performance and the lowest were for social interaction. There were significant differences between groups on benefits ($F=18.981$; $df=2, 16$; $p=.000$; $\eta^2=.090$). Exercise benefits were not significantly different between the some exercise and exercise guidelines groups. The greatest perceived barriers were for physical exertion and the lowest were for the exercise milieu. There were significant differences between groups on barriers ($F=54.807$; $df=2, 16$; $p=.000$; $\eta^2=.222$). The some exercise group had significantly higher barriers than the exercise guidelines group ($p=.047$).

CONCLUSIONS: Despite recommendations, the majority of breast cancer survivors do not meet physical activity guidelines. Understanding which barriers and benefits are relevant to different groups of exercisers is an important avenue to prescribing exercise in an at risk population. Personalized approaches may promote exercise initiation in those not currently exercising; while targeting different barriers may help those already exercising to meet recommended physical activity guidelines.

Supported by Robert E. Leet and Clara Guthrie Patterson Trust (PI: Thomas)

3278 Board #6 June 1 9:00 AM - 11:00 AM

Effects Of Exercise On QoL And Fatigue of Inactive Breast Cancer Survivors, A TwiCs study

Anne M. May¹, Roxanne Gal¹, Carla H. van Gils¹, Rolf HH Groenwold², Desirée HJG van den Bongard¹, Petra HM Peeters¹, Helena M. Verkooijen¹, Evelyn M. Monnikhof¹. ¹University Medical Center Utrecht, Utrecht, Netherlands. ²Leiden University Medical Center, Leiden, Netherlands.
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(No relevant relationships reported)

PURPOSE: Meta-analyses have shown beneficial effects of exercise on quality of life (QoL) and fatigue in breast cancer survivors. Methodological considerations, however, are drop out after randomization to control caused by disappointment and contamination (controls adopting the behavior of the intervention group), since blinding in exercise trials is not possible. TwiCs (Trials within Cohorts) is an alternative for conventional randomized clinical trials and might overcome these disadvantages. We studied the 6-month effectiveness of a 12-week exercise program on the QoL and fatigue in inactive breast cancer survivors using the innovative TwiCs design.

METHODS: The UMBRELLA Fit study is nested within the UMBRELLA cohort, including patients at the radiotherapy department of the UMC Utrecht. Patients were asked consent for prospective collection of medical data and patient reported outcomes, and to be randomized to future intervention studies. For UMBRELLA Fit, we randomized 260 eligible inactive (<150 min/wk moderate to vigorous leisure time and sports activities) breast cancer survivors, 12-18 months after cohort inclusion. Survivors randomized to the intervention group (n=130) were offered a twice weekly supervised moderate to high intensity aerobic and resistance exercise program. Survivors were also asked to be active for 30 min/day supported by an activity tracker. The control group (n=130) was not informed and received usual care (UC). To evaluate effects on QoL and fatigue by intention to treat ANCOVA regular cohort measurements (EORTC QLQ 30, MFI-20) were used.

RESULTS: Included breast cancer survivors aged 58±10 years and 52% (68/130) accepted the intervention. TwiCs accrual was efficient and no contamination was observed (median change in physical activity from baseline in controls was 0). At baseline, QoL was comparable to Dutch reference values and no significant between-group changes were observed. Physical fatigue was significantly lower following the exercise intervention (effect size 0.2, p<0.05) compared to UC.

CONCLUSIONS: Physical exercise has beneficial effects on physical fatigue of inactive breast cancer survivors. Future instrumental variable analysis will show influence of non-acceptance on the intervention effect. The TwiCs design seems feasible for pragmatic trials.

3279 Board #7 June 1 9:00 AM - 11:00 AM
Community-based Soccer Improves Hip BMD, Mental Health, And Reduces Hospital Admissions In Prostate Cancer Patients

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(No relevant relationships reported)

Physical exercise has been shown to improve quality of life, fitness, and physical function for men with prostate; however, research on effects of real-life interventions is warranted. **PURPOSE:** To evaluate the effects of one year of community-based soccer training on bone mineral density (BMD), body composition, mental health, and hospital admissions. **METHODS:** Design, Setting and Participants: In a pragmatic, multicentre, parallel randomised controlled trial, 214 men with prostate cancer were randomly assigned to either soccer delivered in local football clubs (FG, n=109) or usual care including referral to community-level rehabilitation (UG, n=105). Intervention: One hour of soccer twice weekly over one year or usual care. All participants received standardised advice in relation to physical activity guidelines. Outcome Measurements and Analysis: BMD, lean body mass, and fat mass were assessed with dual-energy X-ray absorptiometry. Mental health was assessed by Short Form-12 Mental Component Summary. Per-protocol population was defined as soccer participation ≥50% of training sessions over one year. **RESULTS:** Total hip BMD improved for both intention-to-treat (ITT) 0.007 g/cm² (95% CI 0.004 to 0.013, p = 0.037) and per-protocol population 0.007 g/cm² (95% CI 0.000 to 0.015, p = 0.046). The per-protocol population scored 2.9 points higher (95% CI 0.0 to 5.7, p = 0.048) on mental health, and reduced fat mass by 0.9 kg (95% CI -1.7 to -0.1, p = 0.029). No changes were observed in lean body mass. Hospital admissions were reduced in the ITT population with 20 in FG and 33 in UG (p = 0.016). In the per-protocol population odds ratio for hospital admission was 0.34 (p = 0.042) for FG compared to UG.

CONCLUSIONS: Community-based soccer improved hip BMD, and men who played regularly for one year improved mental health, lost fat mass and had fewer hospital admissions.

3280 Board #8 June 1 9:00 AM - 11:00 AM

Exercising Together® for Couples during Radiation Therapy for Prostate Cancer: A Pilot Feasibility Study

Mary E. Medysky, Jessica C. Sitemba, Kimi Daniel, Arthur Hung, Kerri M. Winters-Stone, FACSM. *Oregon Health & Science University, Portland, OR.* (Sponsor: Kerri Winters-Stone, FACSM)

(No relevant relationships reported)

We developed Exercising Together®, a partnered strength training program, as an exercise-based approach to improve patient, spouse and relationship health for couples coping with cancer. Exercising Together® may be most effective during cancer treatment, when couples experience the most stress, but the program has only been tested in couples post-treatment. **PURPOSE:** To determine the feasibility and acceptability of Exercising Together® during a course of radiation therapy for prostate cancer and the preliminary efficacy of the program on physical function, symptoms and dyadic coping in both the patient and spouse. **METHODS:** Couples were recruited from a radiation oncology clinic to participate in group classes of Exercising Together® 3x/week throughout his treatment. Classes consisted of moderate-intensity strength training performed by the couple who worked as training partners. The Physical Performance Battery (timed walk, stance and chair stand) and 400m walk time, and anxiety (SCL-90 ANX), depressive symptoms (CES-D), intimacy (Physical Intimacy Scale) and dyadic coping (active engagement and protective buffering) were assessed at baseline and at the end of radiation, with self-report measures assessed again 8 weeks after training stopped. Independent Wilcoxon-signed rank tests were used to assess change in each patients and spouses. **RESULTS:** 10 couples were enrolled within 3-months. Retention was 100% and average adherence to prescribed classes was 78%. No adverse events occurred. Patients showed significant increases in 4m walk speed (p=0.017), reductions in anxiety (p=0.027) and more active engagement based on the dyadic coping scale (p=0.039) at the end of training. Spouses had improvements in PPB scores (p=0.023) and chair stand time (p=0.024) post-training. At 8-week follow-up no further changes occurred in men, but spouses had significant reductions in depressive symptoms (p=0.016) and nearly significant reductions in anxiety (p=0.066). **CONCLUSION:** Exercising Together® is feasible, acceptable and improved physical, mental and relationship health over a course of radiation therapy. Comparisons to a control group may further identify benefits; however, based on these data a larger, multi-site trial of Exercising Together® in the radiation oncology setting is warranted.

G-21 Thematic Poster - Muscle Damage and Injury

Saturday, June 1, 2019, 9:00 AM - 11:00 AM
Room: CC-104B

3281 **Chair:** Panagiotis Koutakis. *Florida State University, Tallahassee, FL.*

(No relevant relationships reported)

3282 Board #1 June 1 9:00 AM - 11:00 AM

The Role of T Cells in Muscle Damage Protective Adaptation

Michael R. Deyhle¹, Meghan Carlisle², Chad Hancock², Robert Hyldahl². ¹University of Florida, Gainesville, FL. ²Brigham Young University, Provo, UT.
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(No relevant relationships reported)

Skeletal muscle rapidly adapts to contraction-induced damage such that it is subsequently resistant to damage. This phenomenon is called the repeated bout effect (RBE). Interestingly, following damaging contractions on one muscle group the contralateral analogous muscle group also acquires resistance to damage. This is known as the contralateral RBE (cRBE). The mechanisms that underlie the acquisition of the repeated bout effect are not yet fully understood, yet some studies have shown that muscle immune cell accumulation and inflammation after the initial muscle damage is necessary for the RBE to be realized. T-cells are capable of generating immunological memory, an attribute that is central to their role in adaptive immunity. Additionally, a growing body of literature highlights an important role of T-cells in muscle healing following injury. Therefore, we hypothesized that T-cells could

contribute to the RBE in a way reminiscent to their role in adaptive immunity. In this study, in vivo lengthening contractions (LC) were used to model the RBE and the cRBE. Flow cytometry was used to characterize intramuscular T-cells following single and repeated bouts of LC. Herein, we also test the hypothesis that T-cells contribute to the RBE by immunological memory. Rats that did two bouts of LC separated by 2 weeks sustained less damage after the second bout. Rats that did a repeated bout of LC on the opposite limb were not protected from damage. CD4+, CD8+ and regulatory T-cells increased in muscle muscles that sustained damage. In rats that were protected from damage a minimal increase in T-cells was observed. Adoptive transfer of T-cells from rats that had previously done muscle-damaging LC did not confer damage protection to recipient rats. In conclusion, the RBE, but not the cRBE was observed in rats, and T-cells infiltrate muscle damaged by LC, but they do not appear to contribute to the RBE in the same way that they drive adaptive immunity.

3283 Board #2 June 1 9:00 AM - 11:00 AM
Low-Dose Rapamycin Facilitates Recovery from Exercise-Induced Muscle Injury

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 (No relevant relationships reported)

Rapamycin has been shown to have a dose-dependent effect on multiple signaling proteins in skeletal muscle cells that influence protein synthesis and calcium handling. However, it has yet to be determined if a low-dose of rapamycin impacts skeletal muscle during recovery from an exercise-induced injury. **PURPOSE:** To determine if low-dose rapamycin affects the rate of isometric strength recovery, muscle ubiquitination levels and markers of autophagy compared to saline control 14 days after exercise induced injury. **METHODS:** Mice were injected with either saline (SAL; 0.9%) or low-dose rapamycin (RAP; 10 µg/kg body weight) every other day for 2 weeks before and after a single bout of 150 eccentric contractions of the left anterior crural muscles. The recovery of strength of the anterior crural muscles was measured in vivo immediately, 7 days, and 14 days after injury induction. The magnitude of expression of beclin-1, ubiquitin, and ubiquitinated protein in injured and contralateral control TA muscles (i.e., primary anterior crural muscle) were analyzed via Western blot at 14 days after injury. **RESULTS:** Isometric twitch torque values did not differ between groups at any time point. No group differences in peak isometric tetanic torque were observed pre-injury, post-injury or 7 days following injury. However at 14 days, RAP mice recovered to pre-injury peak isometric torque values (Pre= 2.30 ± .07 Nmm; 14d= 2.25 ± 0.08 Nmm) while SAL group was significantly lower than pre-injury. At 14 days, RAP mice generated 15.4% higher maximal torque than SAL group (p = 0.04). Beclin-1 and free ubiquitin expression in TA muscles were significantly increased in both SAL (1.4-fold and 2.3-fold, respectively) and RAP (2.2-fold and 8.0-fold, respectively) mice at 14 days after injury compared to the uninjured muscle. The increase in the free ubiquitin in the injured muscle was 3.3-fold greater in the RAP treatment compared to SAL (p = 0.001). There were no significant changes in the ubiquitination of proteins among the groups at 14 days post-injury. **CONCLUSION:** Chronic low-dose rapamycin treatment in mice enhances recovery of skeletal muscle from eccentric contraction-induced injury at the 14th day and accentuates the upregulation of free ubiquitin.

3284 Board #3 June 1 9:00 AM - 11:00 AM
Time Course of Change in Critical Torque following Exercise-Induced Muscle Damage

Robert E. Hight, Darshit S. Patel, Jessica A. Peterson, Cameron Lohman, Jason A. Campbell, Michael G. Bembien, FACSM, Christopher D. Black, FACSM. *University of Oklahoma, Norman, OK.* (Sponsor: Christopher D. Black, FACSM)
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 (No relevant relationships reported)

Exercise-induced muscle damage (EIMD) is a result of high-force eccentric contractions and can lead to significant alterations in the structure and function of skeletal muscles. Critical torque (CT) and the impulse above critical torque (IACT) have both been reported to decrease following EIMD. **PURPOSE:** The purposes of this study were to 1) observe the time course of change in CT and IACT up to 7-days following EIMD, and 2) to assess the extent to which central and peripheral fatigue contribute to changes in CT and IACT following EIMD. **METHODS:** Participants (males = 6, females = 4) completed 2 familiarizations and 5 experimental visits. Fatigue patterns were assessed, and CT and IACT were derived at the 1st experimental visit. The 2nd experimental visit included an EIMD protocol consisting of 100 back squats. The 3rd, 4th, and 5th experimental visits were identical to the 1st. CT and IACT were acquired through voluntary and stimulated conditions. **RESULTS:** The participant's ratings of muscle soreness were significantly elevated up to 4-days following EIMD (p<0.05). Dominant leg MVIC was reduced up to 2-days (p<0.05) while non-dominant leg MVIC was reduced up to 4-days (p<0.05) following EIMD. Mean CT was decreased up to 4-days following EIMD in the voluntary

condition (p<0.05) while decreases lasted up to 2-days in the stimulated condition (p<0.05). IACT was not significantly different following EIMD in either conditions (p>0.05). Voluntary activation was not significantly different following EIMD (p>0.05) and these results are the same for twitch torque (p>0.05). EMG RMS and twitch torque both showed a significant reduction during the voluntary CT test (p<0.05). There were no changes in low-frequency fatigue after the voluntary and stimulated conditions (p>0.05) or following EIMD (p>0.05).

CONCLUSIONS: Even though CT was lower following EIMD, IACT was not. Additionally, our results show no contribution of central or peripheral fatigue on torque production following EIMD. These findings suggest the loss in torque production following EIMD to be a factor of EIMD's effect on muscular function and not the central and peripheral mechanisms of fatigue.

3285 Board #4 June 1 9:00 AM - 11:00 AM
Short Wave Elastography Changes in the Biceps Brachii in Response to a Muscle Damage Protocol

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 (No relevant relationships reported)

PURPOSE: Standard ultrasound (US) imaging can help determine structural alterations within muscle and tendon; however, it offers limited information about the intrinsic mechanical properties of muscle. Because muscle is compressible, but transversely isotropic, the most accurate measure is the shear modulus, and SWE correlates well with Young's modulus. Shear wave changes should be useful for determination of muscle lesions or intrinsic changes. To date only a couple studies have observed SWE changes in an arm undergoing DOMS with varying results. Thus, the purpose of this study was to track the changes in biceps SWE changes in kilopascals (kPa), from baseline to 1 week post muscle damage protocol.

METHODS: Standard ultrasound (US) imaging can help determine structural alterations within muscle and tendon; however, it is limited in its ability to convey information about the intrinsic mechanical properties of muscle. Because muscle is compressible, but transversely isotropic, the most accurate measure is the shear modulus, and SWE correlates well with Young's modulus. Shear wave changes should be useful for determination of muscle lesions or intrinsic changes. To date only a couple studies have observed SWE changes using velocity as the variable of interest in muscle undergoing DOMS with varying results. Thus, the purpose of this study was to track the changes in bicep SWE changes (kPa), from baseline to 1 week post muscle damage protocol.

RESULTS: All data were analyzed using a RMANOVA with post-hoc comparisons to determine significance between data points. VAS and SWE were significantly increased for the DOM group at 24 and 48 hours post exercise (P<.0001) with no significant difference between 24 and 48 hours for SWE (p=0.825), while VAS scores increased significantly from 24-48 hours post (p=0.031). There was with no significant difference between baseline VAS (p=0.196) or SWE (p=0.087) at 1 week.

CONCLUSIONS: SWE values increased significantly from baseline to 24 hrs and stayed elevated at 48 hours, which is contrary to data from a published study showing a decrease after 24 hours in the brachialis. This could be due to muscle position. SWE measures of the bicep in an extended position appears to follow VAS and muscle damage progression better than SWE measurements reported from DOMS in a resting position.

3286 Board #5 June 1 9:00 AM - 11:00 AM
Vastus Lateralis Muscle Quality Deteriorates More So Than Muscle Size During Knee Joint Immobilization

Michael Sahebi, Rob J. MacLennan, Nathan Becker, Ethan Davis, David Ogilvie, John McDorman, Ernest Vargas, Matt S. Stock. *University of Central Florida, Orlando, FL.*
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 (No relevant relationships reported)

Disuse of a muscle group, such as what occurs during bedrest, limb immobilization, and spaceflight, results in atrophy. Investigators have yet to examine the extent to which short-term disuse alters the composition of muscle tissue, which can be quantified via measures of echogenicity. **PURPOSE:** The purpose of this study was to examine the effects of two weeks of knee joint immobilization on vastus lateralis echo intensity and cross-sectional area. **METHODS:** Twelve healthy females (mean ± SD age = 21 ± 2 years) with a body mass index ≤ 30 kg/m² voluntarily underwent two weeks of left knee joint immobilization via ambulating on crutches and use of a brace. The brace was worn at all times except during sleep, and compliance was confirmed via accelerometers secured around both ankles. Before (PRE) and after the two-week period (POST), B-mode ultrasonography was used to obtain panoramic images of the left (immobilized) and right (control) vastus lateralis in the transverse plane. Images were taken from 50% of femur length. The same investigator performed all imaging. Images were analyzed at the end of the study with ImageJ software to quantify vastus

lateralis echo intensity and cross-sectional area. Two-way (time \times limb) analyses of variance, effect size statistics, and linear regression were used to interpret the data. **RESULTS:** Echo intensity showed a significant time \times limb interaction ($F = 8.27$, $p = .015$, $\eta^2 = .429$). Follow-up analyses showed a large increase in echo intensity (i.e., decreased muscle quality) for only the immobilized limb ($p = .016$, Cohen's $d = 0.817$). Declines in muscle cross-sectional area for the immobilized limb were less consistent, as no time \times limb interaction was observed ($F = 2.90$, $p = .116$, $\eta^2 = .209$). There was, however, a significant association between the change in echo intensity and the change in cross-sectional area ($r^2 = .383$, $p = .032$). **CONCLUSION:** In healthy female participants, two weeks of knee joint immobilization resulted in considerable changes in vastus lateralis muscle quality, whereas the atrophic response was less dramatic.

3287 Board #6 June 1 9:00 AM - 11:00 AM
The Effects of Betalain Supplementation on Indices of Muscle Damage

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 (No relevant relationships reported)

Purpose: Immediately following eccentric exercise, a pro-inflammatory and pro-oxidative state ensues to initiate the remodeling phase and subsequent repair of damaged tissue. A continued pro-inflammatory and pro-oxidative state can lead to secondary muscle damage thereby prolonging the repair and regenerative process. Betalains are bioactive pigments that are reported to have anti-inflammatory and antioxidant properties. We therefore examined the effects of a betalain-rich concentrate (BRC) on indices of muscle damage following eccentric exercise in an effort to assess muscle recovery following supplementation. **Methods:** In this counterbalanced repeated measures design, a total of 11 recreationally active males consumed 50 mg of BRC, containing 12.5 mg of betalains, 3 times per day for 3 days (initial testing day, 24 and 48 hr post-exercise), or nothing at all (control). The exercise protocol consisted of 30 maximal eccentric contractions of the elbow flexors. Each condition was separated by 2 weeks and the contralateral arm was used for the second testing session. Maximal voluntary isometric contraction (MVIC), arm circumference (AC), muscle soreness (MS), and range of motion (ROM) were measured pre, post, 24, 48, and 72 hr following the eccentric exercise. Creatine kinase (CK) was measured pre, 24, 48, and 72 hr following the eccentric exercise. **Results:** No significant differences or interactions were observed for any of the variables ($p > .05$). There was, however, a p -value approaching significance with a corresponding large effect size for the main effect of MVIC ($p = .07$, $\eta_p^2 = 0.28$). **Conclusion:** Betalain supplementation did not enhance skeletal muscle recovery following eccentric damage. However, we feel the large effect size may provide practical significance. Therefore, future studies should expand upon ours to include larger samples of recreationally active individuals using a more intense damage protocol.

3288 Board #7 June 1 9:00 AM - 11:00 AM
Pilot Data Suggest Negative Change In Bone Mineral Content Is Related To Self-report Musculoskeletal Injury In Infantry Marines

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 (No relevant relationships reported)

Background: Prevalence of musculoskeletal injury (MSKI) is greatest in young Marines due to the high volume of vigorous exercise, especially in early training. Fitness and body composition are known to be related to injury risk; however, understanding changes in such factors over a training cycle and the risk of injury are not well understood.

Purpose: The purpose of this study was to measure changes in body composition and bone density over the 40-day infantry training and its relation to MSKI. **Methods:** Active duty, male, infantry students ($n = 50$) enrolled in the infantry training battalion located at School of Infantry-West (SOI-W) aboard Camp Pendleton were recruited to participate in this study. Pre- and post-SOI-W training (Day 1 and Day 40), Marines completed a whole body dual-energy x-ray absorptiometry (DXA); as well as, sleep, nutrition, and fitness questionnaires. Three months following graduation from SOI-W, a follow-up survey was sent regarding prevalence and type of MSKI. **Results:** Of the original Marines in the study ($n = 50$), six Marines (12%) reported sustaining an MSKI within three months of completing SOI-W. Those that were injured showed decreased bone mineral content (BMC) in both the dominant and non-dominant leg as compared to the group average whom had an increase in BMC (injured vs. non-injured right leg: $\Delta -5.5\%$ vs. $\Delta +3.3\%$; injured vs. non-injured left leg: $\Delta -3.8\%$ vs. $\Delta +1.2\%$). Additionally, of the injured Marines, 50% reported "poor" sleep quality on the Pittsburgh Sleep Quality Index and 67% reported "excessive sleepiness"

on the Epworth daytime sleepiness scale at the follow-up time point. No differences in fitness levels or dairy consumption (milk, cheese, yogurt, ice cream) were present between injured and non-injured Marines at any time point.

Conclusion: These pilot data suggest that MSKI may be related to negative changes in BMC; as well as sleep quality and daytime sleepiness. Further work is needed to determine the relationship between MSKI and BMC and sleep to elucidate mechanisms or impact on injury risk.

G-34 Free Communication/Poster - Body Composition

Saturday, June 1, 2019, 7:30 AM - 11:00 AM
 Room: CC-Hall WA2

3313 Board #1 June 1 8:00 AM - 9:30 AM
Accuracy of Body Fat Estimation Using Circumferences and Air Displacement Plethysmograph on Male Navy Sailors

Katherine M. Wilson, Rebecca S. Weller, Andrew J. Ordille, Douglas M. Jones, Melissa D. Laird, Jay H. Heaney. *Naval Health Research Center, San Diego, CA.*
 (No relevant relationships reported)

The Department of Defense maintains fitness and body composition standards for active duty service members to maintain safety and performance as well as promote health and disease prevention. Since height/weight tables do not reflect body fat percentage (BF%), the Navy needed a technique that was quick, portable, cost effective, and scalable to a large, diverse population. An equation to calculate BF% using circumference measurements was developed in 1984, using underwater weighing as the gold standard, and has remained in use by the Navy since its implementation.

PURPOSE: To assess the accuracy of BF% estimation on male U.S. Navy sailors obtained using circumference (Circ) and air displacement plethysmograph (ADP) techniques compared with BF% estimates using dual-energy X-ray absorptiometry (DXA) as the gold standard. **METHODS:** Same-day DXA, Circ, and ADP measurements were recorded for 45 male subjects (age: 33 ± 7 yr, height: 177.9 ± 7.8 cm, weight: 92.9 ± 15.1 kg). Circumferences were taken using a retractable tape measure placed on the skin by trained researchers. Three measurements were taken and averages were calculated and entered into the equation. Compression shorts and swim caps were worn for ADP measurements and lung volumes were predicted. DXA was completed per manufacturer specifications. **RESULTS:** Average BF% was 21.6 ± 4.8 , 21.9 ± 4.8 , and 26.2 ± 7.1 for DXA, Circ, and ADP, respectively. Differences between ADP and DXA were statistically significant ($p < .001$). Compared with DXA, BF% estimates were accurate within $\pm 1.0\%$ in 31.1% and 8.9% of subjects for Circ and ADP measurements, respectively. Circ overestimated BF% in 57.7% of subjects, while ADP overestimated BF% in 93.3% of subjects. **CONCLUSION:** When comparing the accuracy of Circ and ADP with DXA, Circ had a nearly identical average and SD, while the average was 4.6% higher for ADP with a larger SD (4.8 vs. 7.1). Circ was within $\pm 1\%$ of DXA in nearly 1 in 3 subjects, while ADP was as accurate in fewer than 1 in 10 subjects. ADP overestimated BF% in 42 of the 45 subjects. Furthermore, the highest BF% overestimation for any individual was 7.1% for Circ in contrast to 11.5% for ADP. The results of this study suggest that in a male Navy population, use of circumference measurements to estimate BF% is more accurate than ADP and in close agreement with DXA measurements.

3314 Board #2 June 1 8:00 AM - 9:30 AM
The Influence of Gender and Body Composition on Pool-Based Anaerobic Power and Capacity

Jacquelyn N. Zera¹, Emma Connell¹, Elizabeth Nagle, FACSM², Takashi Nagai³, Mita Lovalekar², John P. Abt, FACSM⁴, Scott M. Lephart, FACSM⁴, Bradley Nindl, FACSM². ¹John Carroll University, University Heights, OH. ²University of Pittsburgh, Pittsburgh, PA. ³Mayo Clinic, Rochester, MN. ⁴University of Kentucky, Lexington, KY. (Sponsor: Elizabeth Nagle, FACSM)
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Recent evidence has shown that a tethered 30-second maximal swim (TST) is a valid and reliable measure of anaerobic power and capacity in swimmers. Consistent differences between males and females exist in both land and water-based measurements of force production, with land-based differences heavily influenced by body weight and muscle mass. However, the influence of body size and composition has not been investigated for the TST. **Purpose:** To explore gender differences in anaerobic power (F_{peak}) and capacity (F_{mean}) during a TST, and to explore the influence of body total body mass (TBM), and body composition (percent body fat (%BF) and

fat free mass (FFM)) on gender differences. **Methods:** Thirteen males (Age = 22.54 ± 3.1 years; BMI = 24.63 ± 2.5 kg·m⁻²; %BF = 13.92 ± 5.1%) and fifteen females (Age = 20.67 ± 4.5 years; BMI = 23.36 ± 2.9 kg·m⁻²; %BF = 25.80 ± 7.9%) completed a TST, as previously described in the literature. Body composition was assessed via air displacement plethysmography. Independent t-tests were used to determine absolute differences between males and females for F_{peak} and F_{mean} . Additionally, the influence of TBM, %BF, and FFM on gender differences for F_{peak} and F_{mean} during a TST was determined using a backwards stepwise linear regression analysis. **Results:** Males produced significantly higher F_{peak} ($p < 0.001$) and F_{mean} ($p = 0.008$), compared to females. However, when adjusted for measures of body composition, FFM was significant for F_{peak} ($p = 0.002$) and F_{mean} ($p = 0.001$), and gender was not significant ($p = 0.694$ and $p = 0.136$, respectively). **Conclusions:** Although gender differences were observed for mean and peak force production, results of the present investigation revealed that fat free mass significantly contributed to force production, regardless of gender. Therefore, force production and sprint swimming performance may benefit from gains in muscle mass, although more research is needed in the form of training studies. Additional research should investigate the influence of the ratio of fat mass and fat free mass on buoyancy, body position, and the balance required to achieve optimal force production and sprint swimming performance.

3315 Board #3 June 1 8:00 AM - 9:30 AM

Fat-Free Mass Index in a Diverse Sample of Male Collegiate Athletes

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(No relevant relationships reported)

Fat-free mass index (FFMI) is a body composition metric that has been employed to assess relative muscularity, with a 28.1 kg/m² upper limit reported in male athletes. FFMI is calculated by dividing fat-free mass by squared height, though further height corrections via linear regression may be required to normalize FFMI in taller individuals. To date, only two investigations have reported height-adjusted FFMI (FFMI_{Adj}) in males. **PURPOSE:** The purpose of this study was to report height-adjusted FFMI data and natural upper limits of FFMI in male collegiate athletes. **METHODS:** The body composition of 209 male collegiate athletes from 10 sports (Mean ± SD; Age: 20.7 ± 1.9 years, Height: 182.9 ± 6.7 cm, Weight: 90.8 ± 16.8 kg, Percent Body Fat: 15.6 ± 5.3 %) was measured using dual-energy x-ray absorptiometry. The height adjustment was calculated by regressing unadjusted FFMI against height in all athletes above the median unadjusted FFMI. The slope of this line was used to adjust all FFMI values. The natural upper limit for FFMI_{Adj} in this sample was determined by calculating the 97.5th percentile of all values. FFMI_{Adj} data were assessed for normality using the Shapiro-Wilks test. One-way ANOVAs with Tukey *post-hoc* comparisons were used to determine between-sport differences. **RESULTS:** The slope of the line used in height adjustment was -0.014 ($p = 0.631$). A paired-samples t-test revealed a significant difference (0.041 kg/m², $p < 0.001$) between unadjusted and adjusted mean FFMI values. The overall mean FFMI_{Adj} was 22.8 ± 2.8 kg/m². FFMI_{Adj} was not normally distributed and was log transformed prior to analysis. Significant between-sport differences ($p < 0.001$) in FFMI_{Adj} were identified. Upper limits (97.5th percentile) for FFMI_{Adj} were found to be 28.32 kg/m² for the entire cohort while upper limits for rugby and baseball were found to be 29.1 kg/m² and 25.5 kg/m², respectively. **CONCLUSION:** This study reported FFMI_{Adj} values in a diverse cohort of male collegiate athletes, providing data for the first-time in several sports. These values can be used to guide nutritional and exercise interventions and provide coaches with standardized information regarding the potential for further fat-free mass accretion in male athletes.

3316 Board #4 June 1 8:00 AM - 9:30 AM

Gender and BMI Differences in Body Image Among College Freshmen

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(No relevant relationships reported)

Research in the area of body image has shown that females have more dissatisfaction with their bodies than males, but that males also have concerns with some aspects of body image. Instructors in wellness courses designed for college freshmen have the opportunity to address these challenges.

Purpose: to determine which components of body image display gender differences, and whether gender differences in certain aspects of body image are related to BMI. **Methods:** The Body Self-Image Questionnaire was administered to students in a freshman Wellness course as a part of their physical fitness assessment which included BMI (N=130 F, 50 M). Data were analyzed with a 2 x 2 factorial ANOVA to evaluate both effects of BMI and Gender and their interactions. All nine subscales of the BSIQ were included: Overall Appearance Evaluation (OAE), Fatness Evaluation

(FE), Health/Fitness Evaluation (HFE), Health/Fitness Influence (HFI), Attention to Grooming (AG), Social Dependence (SD), Height Dissatisfaction (HD), Negative Affect (NA), and Investment in Ideals (II). For the analysis, BMI values <25.0 kg/m² were classified as "normal" (NW); values ≥25 kg/m² were categorized as "overweight" (OW).

Results: In SD, there was a significant main effect for gender, with females scoring higher in the factor of social dependence ($p=.0138$). There was a main effect for gender in HD, with males being more dissatisfied with their height than females ($p=.0103$). An interaction existed between gender and BMI for height dissatisfaction, with a greater gender disparity in HD in normal weight students (M>F) than in OW students, where differences almost disappeared. The main effect for gender in FE indicated that females view themselves as fatter than males ($p=.0015$); not surprisingly, there was also a main effect in FE for BMI ($p<.0001$; OW>Nor). A main effect for BMI existed in OAE ($p<.0001$; Nor>OW); II ($p=.0373$; Nor>OW); HFE ($p<.0001$; Nor>OW); and NA ($p=.0003$, OW>Nor). A gender-BMI interaction existed in HFI ($p=.0098$) indicating that OW males felt that health and fitness influenced feelings about their bodies more so than OW females; in Nor students, gender differences were very small. **Conclusion:** The belief that females have more body image concerns than males is valid in some components of body image, and BMI attenuates some gender differences.

3317 Board #5 June 1 8:00 AM - 9:30 AM

Impact of Body Fat Percent on Heart Rate of Moderate-Intensity Aerobic Activity

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(No relevant relationships reported)

PURPOSE: To better understand the relationship between body fat percent (%BF) and aerobic capacity, this study examined how %BF would impact heart rate (HR), maximal HR% (%HRmax) and HR reserve% (%HRR) when walking at 3.0 mph among young adults.

METHODS: The three-site skinfold measure was administered to 176 university students (mean age: 20.82±1.49; 102 males and 74 females) in the US and converted to %BF using the conversion tables by Jackson et al. (1985). The ACSM satisfactory ranges of %BF (2014, 10%-22%BF for men and 20%-32%BF for women) were used to divide participants into three %BF groups: Normal, Lean, and Obese. HRmax was calculated with "220-age", resting HR (after lying on the floor for five minutes) was measured using HR monitors (Sigma PC26.14), and HRR was calculated with "HRmax-resting HR". Finally, HR at the end of a three-minute treadmill walking at 3.0 mph was measured, which was also used to compute %HRmax ($HR \div HRmax \times 100\%$) and %HRR [$(HR - \text{Resting HR}) \div HRR \times 100\%$] of the walking. One-way MANOVA was used to examine differences in HR, %HRmax, and %HRR of the three-minute walking among the three %BF groups.

RESULTS: There were 90 participants in Normal, 64 in Lean, and 22 in Obese group. No age difference ($p > .70$) was found among the three %BF groups (Normal 20.71±.90, Lean 20.94±2.79, Obese 20.95±1.50). However, significant differences (p values ranged from .000 to .003) were observed in HR, %HRmax, and %HRR for the three-minute walking at 3.0 mph among the three %BF groups. Specifically, significant differences were identified in HR in all the three pairwise comparisons: Lean (95.56±10.27) vs. Obese (112.14±9.82), Lean vs. Normal (104.58±11.24), and Normal vs. Obese; in %HRmax in all the three pairwise comparisons: Lean (48.03±5.29) vs. Obese (56.34±4.91), Lean vs. Normal (52.48±5.64), and Normal vs. Obese; and in %HRR between Lean (22.89±7.35) and Obese (30.22±6.07) and between Lean and Normal (26.85±6.99).

CONCLUSIONS: The %BF classified with ACSM %BF ranges has significant impact on HR among young adults when walking at 3.0 mph, a moderate-intensity (3.5-MET) activity. Specifically, when walking at 3.0 mph, lean individuals demonstrate significantly lower HR, %HRmax, and %HRR than normal and obese individuals; and normal individuals show significantly lower HR and %HRmax than obese individuals.

3318 Board #6 June 1 8:00 AM - 9:30 AM

Anthropometric Characteristics Of NCAA Division III Swimmers

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(No relevant relationships reported)

There is an assumption among competitive swimmers that certain body types are predisposed to perform better. This assumption may be in part due to research on young swimmers that suggests that greater standing (SH) and seated height (SH), arm span (AS), and the surface areas of the arm and foot increase swimming speed. However, literature on these variables in adult swimmers does not exist. Further, despite literature supporting the negative correlation between body fat percentage (BF) and performance in a variety of sports, the literature on swimmers suggests BF

is not a leading contributor to faster swimming speeds. There exists a need to explore the association between anthropometric characteristics and performance among adult competitive swimmers.

PURPOSE: To evaluate the association between anthropometric characteristics of National Collegiate Athletic Association Division III (DIII) male and female swimmers and performance determined by qualifying for NCAA national competition. **METHODS:** 54 Subjects (25 F) were evaluated preseason for StH and SH, arm circumference (AS) and upper arm length (AL), hand length (HL) and width (HW), foot length (FL) and width (FW), and weight (WT) and BF in accordance with standard methods. At midseason, BF and AS were repeated. Means (M) and standard deviations (SD) for all variables among male and female swimmers were reported. Logistic regression analyses were performed to determine the association between each anthropometric measure and qualification for Nationals competition controlling for gender. **RESULTS:** Nineteen (35.2%; 11 [37.9%] male and 8 [32.0%] female) qualified for Nationals. With the exception of seated height and left hand length ($p=0.05$), both of which showed a positive association, regression analyses revealed that there were no statistically significant differences between anthropometric characteristics and qualification for Nationals. **CONCLUSIONS:** Results suggest that greater SH and left HL have a positive effect on swimming performance, but there was no association between any other anthropometric variable and qualification for Nationals. These findings suggest that differences in swimming performance among DIII swimmers are likely due to other factors, such as biomechanical, intrinsic physiological and psychosocial attributes.

3319 Board #7 June 1 8:00 AM - 9:30 AM
Body Composition Changes Following NFL Combine Preparation Training
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 (No relevant relationships reported)

The NFL scouting combine and college pro-days implement a battery of anthropometric and performance tests to assess college football players attempting to play in the NFL. As such, athletes commonly undergo specific training and nutrition regimens to optimize combine performance to increase their chances of signing with an NFL team. **PURPOSE:** To observe body composition changes following a training program of different lengths designed to prepare athletes for NFL combine and pro-day performance. **METHODS:** Seventeen male collegiate football players (21.9 ± 0.43 y, 1.89 ± 0.06 m, 106.7 ± 15.3 kg) participated in a NFL combine preparation program. The combine preparation training consisted of 4 resistance training sessions per week and 6 days per week of position and combine test-specific training. Athletes participating in this program were also provided dietary counseling by a nutritionist to improve dietary habits. Pre- and Post- training, body mass (BM), body fat percentage (BF%), fat mass (FM), total body water (TBW), and lean body mass (LBM) were assessed via bioelectrical impedance analysis (BIA). Since all athletes did not join the program on the same date we divided athlete data into two groups: (1) those that completed 7-8 weeks of training ($n=10$) and, (2) those that completed 4-6 weeks of training ($n=7$). Data were analyzed by separate repeated measures analysis of variance (ANOVA) for each variable. **RESULTS:** Regardless of group, the combine preparation training program produced significant increases in body mass ($p=0.004$; $\Delta +1.14 \pm 1.36$ kg), TBW ($p=0.045$, $\Delta +1.24 \pm 2.31$ kg), and LBM ($p=0.041$, $\Delta +1.67 \pm 2.97$ kg). No significant ($p>0.05$) main effect of time was observed for BF% or FM. Additionally, there were no significant differences between groups for variable. Of the 17 participants, 3 players were drafted and were on active rosters for the 2018 NFL season, 1 participant was drafted and signed a practice squad contract, with 5 other participants signing undrafted free agent contracts with various NFL teams. **CONCLUSION:** Data suggests that significant changes in body mass, TBW, and LBM can be achieved as a result of NFL combine training even when the training program is of short duration. Furthermore, in these highly trained athletes, even 8 weeks of training may be too short to observe significant improvements in FM or BF%.

3320 Board #8 June 1 8:00 AM - 9:30 AM
Skinfold Thickness As A Predictor Of 3200m Performance For Trained, Male Runners
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Greater levels of adiposity have traditionally been linked to a decrease in distance running performance, as excess weight and body fat have been seen to increase energy expenditure and power output necessary to complete the task of efficient locomotion.

The researchers of the current study hypothesized runners with less appendicular fat would have a biomechanical advantage over runners predisposed to appendicular fat storage. **PURPOSE:** To determine the predictive power of traditional skinfold sites, including chest, midaxillary, triceps, subscapular, abdomen, suprailiac, thigh, calf, and biceps, on performance in a 3200m time trial for trained male distance runners.

METHODS: Participants were 22 members of a NCAA Division 3 men's cross country team. Skinfold measurements were recorded for each of the nine-sites on each of the athletes using a skin caliper. The athletes then completed a 3200m time trial. This data was then used to run a multiple-regression to determine the importance of each site to time trial performance. **RESULTS:** The subjects had an average body fat percentage of 12.8%, $\pm 4.5\%$, and an average 3200m time of $10:48 \pm 48$ s. The regression analysis revealed that 58.1% of the variance in 3200m time trial performance was predicted by the model using the nine sites (biceps, suprailiac, thigh, chest, subscapular, calf, midaxillary, abdomen, and triceps) as predictors ($p<0.05$). When co-varied out, chest, midaxillary, and abdomen were significant ($p<0.05$) predictors of 3200m performance. Increased chest and abdomen fat storage significantly predicted increased finish time ($p=0.037$, $B=0.206$ min) and ($p=0.023$, $B=0.117$ min). Increased midaxillary fat storage significantly predicted decreased finish time ($p=0.023$, $B=-0.166$ min). When co-varied out, triceps, calf, biceps, subscapular, suprailiac and thigh fat storage were not significant predictors ($p > .05$). **CONCLUSIONS:** Skinfold thickness in the chest, midaxillary, and abdomen were significant predictors of 3200m performance in trained college males, while skinfold thickness in the triceps, subscapular, suprailiac, thigh, calf, and biceps were not. Appendicular fat storage may not be as important to performance as hypothesized in homogeneous well trained male endurance runners.

3321 Board #9 June 1 8:00 AM - 9:30 AM
Bilateral Lean Mass and Dynamic Balance Asymmetry in Collegiate Athletes
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 (No relevant relationships reported)

Introduction: Laterality, or lateral dominance may lead to asymmetry in muscle mass and strength, which in turn could lead to differences in stability and balance. Muscular asymmetry and dynamic balance asymmetry have been independently linked with increased injury risk. For example, athletes with >4 cm anterior reach distance differences (Δ ARD) were found to be at significantly higher risk to incur injuries. However, it is unknown if there is an association between muscle mass asymmetry and dynamic balance. Nor is it known if these factors change throughout the sports' seasonal periods (i.e., off-, pre-, and post-season). The purpose of this preliminary analysis was to analyze differences between lower body lean mass and dynamic balance in collegiate athletes and to examine if associations exist between the two variables during different seasons. Methods: NCAA Division II student-athletes were recruited in their respective off- or pre-season. Lean mass was assessed via dual energy x-ray absorptiometry. Dynamic balance was assessed via lower quarter Y Balance Test and Δ ARD was calculated. Pearson correlation was used to examine associations. Results: 109 athletes (67W/42M) from six sports have been recruited (see table). There were no significant correlations ($p > 0.05$) between differences in lower body lean mass and Δ ARD in either off- or pre-season ($r^2=0.003$ and $r^2=0.001$, respectively). 51% of athletes in off-season and 48% in pre-season exhibited >4 cm Δ ARD. Conclusion: In this preliminary report, no correlation was found between lower body lean mass asymmetry and dynamic balance asymmetry. Concerning was our finding that about half of the athletes showed dynamic imbalances, indicating higher injury risk. Further data collection will determine the extent of the changes in muscle mass and dynamic balance asymmetry over one full competitive season.

Subject characteristics			
Sport	n	Height (cm)	Weight (kg)
Football	18	185.8 ± 5.7	106.8 ± 18.1
Softball	18	167.0 ± 5.3	76.5 ± 10.8
Basketball (W)	6	174.9 ± 9.1	69.5 ± 10.3
Basketball (M)	5	192.5 ± 8.3	88.3 ± 8.0
Track & Field (W)	20	168.2 ± 7.8	63.2 ± 9.8
Track & Field (M)	13	180.8 ± 7.6	81.0 ± 15.6
Volleyball (W)	15	173.8 ± 6.5	69.0 ± 8.1
Golf (W)	8	164.5 ± 8.2	61.1 ± 5.1
Golf (M)	6	177.8 ± 8.2	74.5 ± 9.2

- 3322** Board #10 June 1 8:00 AM - 9:30 AM
Effects Of Oral-contraceptive Use On Strength, Power And Body Composition In Trained Women
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 (No relevant relationships reported)

Oral contraceptives consumption has been identified as a usual strategy for birth control among athletes. Nevertheless, its impact on body composition and sports performance remains unknown due to the heterogeneity in the formulation of these products and individual factors such as the menstrual cycle, age or sports discipline. **PURPOSE:** The aim of this study was to evaluate the effect of oral-contraceptive use on strength and body composition changes in trained women undergoing regimented resistance training (RT). **METHODS:** Twenty-three resistance-trained women (age 27.4±3.4 years; height 162.7±6.1 cm; body weight 60.5±7.8 kg; BMI 22.9±2.7 kg·m⁻²) were randomized to either a non-oral contraceptive (n=11, NOC) or an oral contraceptive (n= 12, OC) group. After a 3-week familiarization period, all participants performed four sessions of RT per week over the course of an 8-week non-linear program. Dual X-ray absorptiometry was used to measure lean body mass and fat mass. Muscle power was measured by the countermovement jump (CMJ) test using a jump contact mat, and maximal strength was assessed by the one-repetition maximum (1RM) test in the back squat (SQ) and bench press (BP). **RESULTS:** OC significantly increased lean body mass [1.4±1.4(CI: 0.5, 2.3) kg; p= 0.007]; however, no changes were observed in the NOC group [0.7±1.1(-0.2, 1.5) kg; p= 0.0741]. No significant changes were seen in regard to fat mass in both OC [0.4±1.8(-0.7, 1.5) kg; p=0.437] and NOC [0.3±0.8(-0.2, 1.0) kg; p= 0.220]. Both OC and NOC increased upper-body 1RM [6.7±3.6(4.4, 8.9) kg; p<0.01] and [4.8±1.8(3.4, 6.1) kg; p<0.01], respectively; likewise, increased lower-body 1RM [11.9± 6.7 (7.7, 16.2) kg; p< 0.01] and [15.6±5.4 (11.7, 19.4) kg; p< 0.01], respectively. No significant changes were found in CMJ in both OC and NOC [0.7±1.1 (-0.1, 1.6) cm; p= 0.911] and [0.7±1.1(-0.1, 1.6) cm; p= 0.69], respectively. **CONCLUSIONS:** OC use in conjunction with RT produces similar increases in measures of strength and power compared to NOC in trained women and has potentially beneficial effects on lean body mass. Supported by University of Málaga (Campus of International Excellence Andalucía Tech).

- 3323** Board #11 June 1 8:00 AM - 9:30 AM
Relationships Of Waist Circumferences Measured At Different Anatomical Sites With Body Fat In Chinese Adults
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 (No relevant relationships reported)

In large-scale population surveys and public health screenings, the use of simple anthropometric indices has become popular for identifying individuals who are overweight and obesity. Waist circumference (WC) has been extensively investigated as an indicator of abdominal obesity and health risks among adults. However, standardized protocols for WC measurement have yet to be established. **PURPOSE:** This study aims to determine relationship between body fat and different WC sites in Chinese adults. **METHODS:** A total of 213 Chinese adults aged 18-35years old participated in the study. WC was measured at five sites: immediately above the iliac crest (WC1), immediately below the lowest rib (WC2), midpoint between the lowest rib and the iliac crest (WC3), 1 cm above the umbilicus (WC4), and at the narrowest waist (WC5). Body fat mass (FM), body fat percentage (%BF), abdominal fat mass (FM in abdominal) and abdominal percentage fat (%BF in abdominal) were determined through dual-energy X-ray absorptiometry. Pearson correlation was used to analyze the relationships of WCs with FM, %BF, FM in abdominal, and %BF in abdominal. Levels of significance were set at P < 0.05. **RESULTS:** For males, the measured WCs were strongly correlated with FM and FM in abdominal (p < 0.001), and significantly correlated with %BF and %BF in abdominal (p < 0.001). For females, the WCs were significantly correlated with FM, %BF, and %BF in abdominal (p < 0.001). **CONCLUSIONS:** The WCs were correlated significantly with FM, %BF, FM in abdominal, and %BF in abdominal both in Chinese males and in Chinese females.

- 3324** Board #12 June 1 8:00 AM - 9:30 AM
Association Between Body Composition and Bone Mineral Density in Elite Collegiate Athletes
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 (No relevant relationships reported)

Individuals, such as collegiate athletes, that engage in increased levels of strenuous exercise often possess a lower body fat percentage (BF%) and increased fat-free mass (FFM). Additionally, repetitive progressive resistance training and participation in high-impact sports has been demonstrated to increase bone mineral density (BMD). Because collegiate athletes experience a high amount of repetitive loading, it may be expected that BMD would yield a relation to body composition. **PURPOSE:** The purpose of this study was to examine the relationship between body composition and BMD in elite college athletes. **METHODS:** Male (n = 45) and female (n = 33) athletes (ages 18-21 years) from a range of sports, including baseball, football, softball, and volleyball, participated in the study. Total BMD and body composition (i.e., BF% and FFM) were measured using dual-energy x-ray absorptiometry. Pearson's product moment correlations were used to assess all relationships between BMD, BF%, and FFM. **RESULTS:** In terms of males, Pearson's product correlation demonstrated a significant moderate-to-strong positive association between FFM and BMD (r = 0.79, p < 0.01). BF% showed a significant positive low-to-moderate correlation with BMD (r = 0.35, p = 0.02). For females, FFM showed a moderately positive association with BMD (r = 0.58, p < 0.01), while BF% provided a non-significant inverse correlation with BMD (r = -0.21, p = 0.23). **CONCLUSION:** FFM in both male and female collegiate athletes was positively associated with BMD. However, males displayed a positive BMD and BF% relationship, while females a non-significant, inverse association. These findings may reflect the diversity of female athletes (i.e., various sports) that were included within the analysis. For instance, sports that require a greater body mass to enhance performance and those that require a leaner physique were both included within one group which may have affected the BMD and BF% relationship.

- 3325** Board #13 June 1 8:00 AM - 9:30 AM
Comparison of Air Displacement Plethysmography and Multi-Frequency Bioelectrical Impedance Analysis for Body Composition Assessment
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 (No relevant relationships reported)

Body composition is a crucial component of health-related fitness. Two methods that are frequently used in clinical settings are air displacement plethysmography (ADP) and multi-frequency bioelectrical impedance (MF-BIA). ADP has been thoroughly validated relative to other various criterion methods. MF-BIA is newer technique relative to ADP, and does not have a substantial amount of validation. **PURPOSE:** To determine the correlation between ADP and a new model of MF-BIA. **METHODS:** The current project was a part of The RISE study, which is aimed at determining the associations between dietary supplement intake and biological and psychosocial measures, including body composition, inflammatory markers, dietary intake, stress, anxiety, and sleep. The current project aims to validate a new model of MF-BIA as a means of estimating body composition when compared to the more established ADP in adults who participate in the RISE study. The current sample consisted of 50 healthy and active individuals, 21 males with mean age 24.3 and 29 females with mean age 24.4. Mean body mass index was 25.2 kg/m² for males and 23.3 kg/m² for females. Participants were asked to come in for one study visit to measure their body composition sequentially using both methods of body composition. **RESULTS:** Average body fat percentages measured by the ADP were 28.8% (females) and 16.6% (males). For MF-BIA the average body fat percentages were 27.8% (females) and 16.9% (males). Further, average fat free mass estimated by ADP was 18.2 kg (females) and 13.8 kg (males). For MF-BIA average fat free mass was 18.3 kg (females) and 14.0 kg (males). A high correlation (Pearson's correlation coefficient, r=0.87) between the two methods was established. **CONCLUSIONS:** These findings indicate that there is a strong correlation between the two methods and MF-BIA provides comparable measurements of body composition in relation to an established method in ADP.

3326 Board #14 June 1 8:00 AM - 9:30 AM
Comparing a 3-Compartment Model to Criterion Measures for Estimating Body Composition in Athletes

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(No relevant relationships reported)

Multi-compartment models are emerging as a criterion method of analyzing body composition, thereby reducing the error associated with standalone laboratory measures. **PURPOSE:** The purpose of this study was to compare a 3-compartment model (3-C) with two gold standard lab measures (i.e., air displacement plethysmography (ADP) and dual-energy x-ray absorptiometry (DEXA)). **METHODS:** Sixty-nine male and forty-eight female athletes completed three body composition measures (i.e., DEXA, ADP, and bioelectrical impedance spectroscopy (BIS)). Body fat percentage (BF%) was calculated using a 3-compartment (3C) model, consisting of total body water (via BIS), body volume (via ADP), and body weight. For statistical analysis, a repeated measures ANOVA was used to compare ADP and DEXA against a 3-C model for all within gender comparisons. **RESULTS:** For males, results showed a significant mean difference when comparing 3-C ($13.2 \pm 7.0\%$) and DXA ($16.5 \pm 9.5\%$; $p < 0.01$), but no difference between 3-C and ADP ($12.0 \pm 8.0\%$; $p = 0.09$). For females, a significant mean difference was seen with 3-C ($23.5 \pm 7.2\%$) and DXA ($28.5 \pm 6.6\%$; $p < 0.01$); however, there was no difference between 3-C and ADP ($22.2 \pm 7.1\%$; $p = 0.34$). **CONCLUSION:** DEXA may provide overestimates of BF% for both male and female athletes, while ADP provided no significant differences when compared to a multi-compartment model.

3327 Board #15 June 1 8:00 AM - 9:30 AM
Body Composition Comparisons Via Dual Energy X-Ray Absorptiometry and Air Displacement Plethysmography in College Athletes

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(No relevant relationships reported)

Body composition is a highly important metric in regards to overall physical activity as well as sports performance. Most body fat percentage (BF%) measurements are recorded using two-compartment models, such as skinfold analyses, bioelectrical impedance analysis, or more accurately, via hydrostatic weighing or air displacement plethysmography (ADP). However, research has suggested that three-compartment models, like dual energy x-ray absorptiometry (DEXA), may provide more accurate recordings of BF%. However, limited research exists in comparing BF% obtained via two- and three-compartment models in collegiate athletes. **PURPOSE:** To compare BF% recordings via DEXA and ADP in Division-I collegiate male and female athletes. **METHODS:** Seventy-eight athletes (Male: $n = 45$ [age = 18.4 ± 1.0 y, height = 161.9 ± 55.5 cm, weight = 77.3 ± 32.5 kg]; Female: $n = 33$ [age = 18.0 ± 0.7 y, height = 146.3 ± 56.9 cm, weight = 55.9 ± 23.8 kg]) from multiple sports underwent BF% testing via DEXA and ADP. Both tests were completed on the same visit under supervision by the same test administrator. Hydration status was measured before testing to ensure that all athletes were properly hydrated prior to the test. Athletes were instructed to dress in accordance to the recommended protocols for both tests. Individual paired sample t-tests were run for BF% comparisons for whole group, male athletes, and female athletes. **RESULTS:** A significant mean difference existed for all athletes between DEXA ($21.6 \pm 10.3\%$) and ADP ($16.4 \pm 9.2\%$) when comparing BF% ($p < 0.01$, ES = 0.53). When factored for gender, male BF% exhibited a significant mean difference between DEXA ($16.3 \pm 9.5\%$) and ADP ($11.8 \pm 8.0\%$) ($p < 0.01$, ES = 0.51). Additionally, a significant mean difference for BF% was found in the female athletes between DEXA ($28.5 \pm 6.6\%$) and ADP ($22.2 \pm 7.1\%$) ($p < 0.01$, ES = 0.92). **CONCLUSION:** These results, which are consistent with previous research, indicate significantly greater BF% values for DEXA when comparing athletic populations.

3328 Board #16 June 1 8:00 AM - 9:30 AM
Resting Energy Expenditure And Body Composition In Crossfit

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(No relevant relationships reported)

Crossfit is a training program created by Greg Glessman in 1995 and consists of performing high intensity functional movements. Some studies have already reported reduction of body fat and increase of metabolic rate. **PURPOSE:** To investigate differences in body composition and resting energy expenditure (REE) in CrossFit beginners and athletes using electrical bioimpedance (BIA) and indirect calorimetry (IC), respectively. **METHODS:** 28 individuals (14 male) aged 20-34 years were selected in CrossFit boxes and divided into two groups: CrossFit athletes (GA) and CrossFit beginners (GI). In baseline and after 4 weeks, participants were submitted to body composition and metabolic evaluation. Fat-free mass (FFM), fat mass (FM) and body fat percentage (BFP) were evaluated by BIA and REE and oxygen consumption (VO_2) were investigated using IC. Participants continued to perform their CrossFit training, usually in accordance with the spreadsheet prescribed by their coaches. Statistical analyses used: Kolmogorov-Smirnov and T of Student. **RESULTS:** There were no differences between groups in baseline. After 4 weeks, female GA showed higher REE (1656.0 ± 78.7 vs 1455.7 ± 157.8 , $P = 0.02$) and higher VO_2 (240.4 ± 11.6 vs 211.3 ± 22.9 , $P = 0.02$) when compared to female GI. Only female GA showed a significant increase in baseline energy expenditure (1415.0 ± 236.7 vs 1656.0 ± 78.7 , $P = 0.03$) and a significant decrease in baseline body fat percentage (26.4 ± 1.7 vs 25.2 ± 2.2 , $P = 0.05$) between baseline and 4 weeks. In female GI, a reduction in fat mass (15.8 ± 5.7 vs 14.3 ± 5.7 , $P = 0.05$) was observed, with no differences in others parameters. Among male groups, male GA showed higher REE (2275.0 ± 286.5 vs 1843.3 ± 336.8 , $P = 0.03$) and greater VO_2 (330.0 ± 41.2 vs 267.2 ± 48.6 , $P = 0.03$) when compared to male GI after 4 weeks. But there were no differences for body composition and metabolic characteristics in the same male group, comparing baseline and 4 weeks evaluation. **CONCLUSIONS:** This study showed that 4 weeks of CrossFit training positively influenced REE and BFP, especially in female athletes when compared to beginners. Body composition was improved in both female groups. Among men, there were no differences and, probably, four weeks represent a short period to observe changes in body composition and resting energy metabolism in male groups.

3329 Board #17 June 1 8:00 AM - 9:30 AM
An Examination Of Upper Body Power And Fat-free Mass In Division-I Cheerleaders

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(No relevant relationships reported)

The sport of cheerleading requires extended bouts of great physical strength and coordination, particularly at the collegiate level. Upper body power (UBP) is vital to cheerleading performance, as many stunts require athletes to lift and propel themselves or teammates into the air. Additionally, large proportions of fat-free mass (FFM) may provide the ability for cheerleaders to execute advanced movements during competition. **PURPOSE:** The purpose of this study was to examine the association between UB and FFM in Division-I cheerleaders. **METHODS:** Male ($n = 12$) and female ($n = 33$) collegiate cheerleaders were assessed for height (cm), weight (kg), UB, and FFM. UB was determined using the medicine ball put test in which participants sat on an exercise bench at a 45-degree recline and were instructed to throw a medicine ball from the chest for maximum distance. Females and males used 15-lb and 20-lb medicine balls, respectively and completed two trials with a one-minute rest in between. FFM was assessed on the same visit to the laboratory via air displacement plethysmography. Spearman's rho correlations were used to determine all associations with FFM and UB for the entire group and genders. **RESULTS:** Results indicated a significant, strong, positive correlation ($r_s = 0.79$, $p < 0.01$) between UB and FFM for the entire group. Separating the participants by gender produced a significantly, strong, positive correlation for the female population ($r_s = 0.71$, $p < 0.01$); while the males demonstrated a non-significant, moderate correlation ($r_s = 0.45$, $p < 0.45$). **CONCLUSION:** Results suggest that FFM and UB are positively correlated in collegiate cheerleaders, although this relationship was exhibited particularly among females. The demand of UB associated with the sport may require greater amounts of FFM in order to properly execute advanced movements during competition.

3330 Board #18 June 1 8:00 AM - 9:30 AM

Body Composition and Muscle Characteristics of Junior Track and Field AthletesJanel S. Bailey, Rachael Irving, Eon Campbell. *University of the West Indies, Mona, Kingston, Jamaica.* (Sponsor: Melanie Poudevigne, FACSM)

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(No relevant relationships reported)

PURPOSE: To characterize and evaluate the body composition and muscle characteristics profile of junior track and field athletes in the athletic preseason and postseason.

METHODS: The study included 55 junior athletes. Age, height and weight ranged from 12-19 yrs, 157-191 cm, and 42.88-100.88kg, respectively. Body composition and muscle characteristics were measured using ultrasound technology. The two-compartmental model which divides the body into fat mass (FM) and fat free mass (FFM) was used for the analysis of body composition. Muscle cross sectional area (mCSA), muscle thickness (MT) and echo intensity (EI) were used to analyze muscle characteristics. Performance (fP) was quantified using the IAAF scoring system, where each time/distance, was assigned a score and fP calculated. Athletes were categorized into two groups, based on fP: (Group A- increase in performance, Group B- decrease in performance in terms of time or distance).

RESULTS: Group B athletes had higher mean values for body %fat in the preseason. However, there was no significant change in %fat or regional fat thickness between preseason and postseason, irrespective of performance group. Though not significant, (p>0.05) %fat and waist circumference increased in group B athletes, but decreased in group A athletes. Significant correlations were found between change in muscle cross sectional area in the waist (p<0.05, r= 0.63) and thigh (p<0.05, r= 0.87), with performance in all athletes

CONCLUSIONS: Significant differences in body composition parameters between group A and group B athletes at preseason, highlights the importance of maintaining optimal body composition in the offseason. Changes in muscle characteristics in preseason and post-season may influence athletic performance more than changes in body composition over the same period.

3331 Board #19 June 1 8:00 AM - 9:30 AM

Seasonal Body Composition Changes in Division I Cross Country RunnersKatie R. Hirsch, Malia N.M. Blue, Gabrielle J. Brewer, Austin M. Peterjohn, Abbie E. Smith-Ryan, FACSM. *University of North Carolina at Chapel Hill, Chapel Hill, NC.* (Sponsor: Abbie Smith-Ryan, FACSM)

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Body composition can significantly impact performance and injury risk, particularly in cross country, where a small build and low percent body fat are typically desirable. Body composition goals for an athlete may vary year-to-year, depending on training goals, years of competitive training, and access to specialized training staff. Tracking body composition throughout a collegiate career is important for optimal health and performance. **PURPOSE:** To evaluate changes in body composition across a first, second, third, or fourth year of competition in Division I cross country runners.

METHODS: Pre and post season measures of body composition were evaluated in first season (N=25), second season (N=24), third season (N=13), and fourth season (N=10) Division I National Collegiate Athletic Association cross country runners (Total: N=46; male=25; female=21) between the years of 2014 to 2017. Total and regional body composition (fat mass [FM], percent body fat [%BF], lean mass [LM], bone mineral content [BMC], and armLM, legLM) was assessed using dual-energy x-ray absorptiometry. **RESULTS:** First year runners significantly increased weight (change [Δ] ± SD; 1.6 ± 2.2 kg; p=0.001), LM (1.6 ± 1.3 kg; p<0.001), BMC (0.03 ± 0.05 kg; p=0.008), and armLM (0.1 ± 0.3 kg; p=0.047). Second year runners significantly increased weight (1.1 ± 1.8 kg; p=0.005), LM (1.2 ± 1.2 kg; p<0.001), armLM (0.1 ± 0.3 kg; p=0.019), and had a small but significant decrease in BMC (-0.02 ± 0.03 kg; p=0.002). There were no significant changes in body composition in third or fourth year runners. **CONCLUSIONS:** First and second season Division I cross country runners experience significant changes in body composition, primarily increases in LM, while third and fourth year runners experience minimal changes. Changes are likely influenced by the addition of strength and conditioning and nutrition staff that are not available in high school. The first two seasons may be key times for developing body composition characteristics in runners that can maximize performance and minimize injury throughout their career.

3332 Board #20 June 1 8:00 AM - 9:30 AM

Multi-Frequency Bioimpedance Reliability and Validity for Assessing Total and Segmental Body Composition in College-Aged MalesSaori Braun¹, Alexa Hayes¹, Garrett Stadler¹, Tucker Goesch¹, Morgan Goldammer¹, Steven Fleck, FACSM². ¹*University of Wisconsin-Eau Claire, Eau Claire, WI.* ²*Andrews Research and Education Foundation, Gulf Breeze, FL.*

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Reported Relationships: S. Braun: Industry contracted research; InBody USA.

Bioimpedance analysis (BIA), which may be affected by hydration status, is frequently used to assess total and segmental body composition for research purposes. However, the reliability and validity of BIA in determining body composition in all populations including well hydrated college aged males has not been determined. **PURPOSE:**

To determine the reliability of direct segmental multi-frequency BIA and its validity against dual energy x-ray absorptiometry (DXA) in a population of normally hydrated college-aged males. **METHODS:** Body composition was measured in the early morning 3 times in the following order: 1) BIA, 2) DXA, and 3) BIA, all in the same session lasting < 30 minutes. Immediately prior to body composition measurement, a urine sample was collected and analyzed for urine specific gravity (USG). To ensure normal hydration, a USG of 1.022-1.028 encompassing slightly dehydrated, euhydrated, and well hydrated statuses was required for study participation.

RESULTS: A total of 102 males (mean age = 20.35 ± 1.38 years) were included in the analyses. Intra-class correlations between the two BIA determined fat free mass (FFM) of total body, right arm, left arm, trunk, right leg and left leg were .974, .961, .965, .963, .994, and .994, respectively. Two-tailed paired samples t-tests showed all comparisons of DXA FFM (bone mineral content [BMC] + lean mass) compared to the average of the two BIA FFM (comparable to DXA BMC + lean mass) to be significantly different (p < .001) except for the trunk (p = .242). Segmental BIA FFM underestimated segmental DXA FFM by ≤ 1.05kg, while total body BIA FFM overestimated total body DXA FFM by 2.2kg. **CONCLUSIONS:** Multi-frequency BIA is reliable in determining total and segmental FFM. The significant differences between DXA and BIA in determining segmental FFM may be due to body composition derived from DXA is based on attenuation of x-ray to determine BMC, lean tissue, and fat mass while; body composition derived from BIA is based on impedance of body water content.

3333 Board #21 June 1 8:00 AM - 9:30 AM

Test-retest Reliability Of Bioimpedance Spectroscopy For The Analysis Of Body Composition In Physically Active MalesTyler W.D. Muddle, Patrick M. Tomko, Ryan J. Colquhoun, Mitchel A. Magrini, Nile F. Banks, Nathaniel D.M. Jenkins. *Oklahoma State University, Stillwater, OK.*

(No relevant relationships reported)

No previous studies, to our knowledge, have examined the reliability of bioimpedance spectroscopy (BIS) for the evaluation of body composition. **PURPOSE:** To evaluate the test-retest reliability of BIS for the assessment of total body water (TBW), extracellular water (ECW), and intracellular water (ICW) content, as well as fat mass (FM), fat-free mass (FFM), and body fat percentage (BF%) in physically active males.

METHODS: Sixteen males (Mean ± SD, 25 ± 3 y, 90 ± 11 kg, 176 ± 6 cm) were assessed at two visits, separated by 2 – 7 days. During each visit, participants rested quietly for 3 – 5 min in a supine position with their arms abducted ≥ 30° away from their torso and legs separated prior to their assessment. Two single-tab electrodes were placed on the right side of the body 5 cm apart on both the dorsal surface of the wrist and dorsal surface of the ankle, respectively. The BIS device was used to estimate TBW, ECW, and ICW (liters; L) based on Cole modelling with Hanai mixture theory, which were then used to calculate FM (kg), FFM (kg), and BF%. Reliability was examined by calculating the intraclass correlation coefficient (ICC; model 2,1) and standard error of measurement (SEM). The coefficient of variation (CV) was calculated by expressing the SEM relative to the grand mean (%). The 95% confidence interval (CI) for each ICC was calculated and used to test the null hypothesis that each ICC was equal to zero. Systematic variability was assessed for each variable via a paired t-test. **RESULTS:** Reliability statistics are displayed in Table 1. None of the dependent variables displayed systematic variability (p > 0.05). 'Excellent' relative and absolute reliability was observed among all body water (ICC = 0.91 – 0.99; CVs = 1.08 – 3.50%) and body mass (ICC = 0.95 – 0.99; CVs = 1.10 – 6.99%) measurements. **CONCLUSION:** These results indicate that the BIS device used in this study allows for the reliable assessment of TBW, ECW, ICW, FM, FFM, and BF% in physically active men.

Table 1.

	Visit 1	Visit 2	p-value	ICC _{2,1}	SEM (MS _E)	CV (%)	95%CI
TBW (L)	52.0 ± 5.9	51.8 ± 6.0	0.34	0.99	0.56	1.08%	0.97 – 1.0
ECW (L)	20.6 ± 2.5	20.7 ± 2.4	0.72	0.99	0.25	1.20%	0.97 – 1.0
ICW (L)	31.4 ± 3.5	31.6 ± 4.1	0.62	0.91	1.10	3.50%	0.77 – 0.97
FM (kg)	18.2 ± 5.5	18.8 ± 6.3	0.26	0.95	1.29	6.99%	0.87 – 0.98
FFM (kg)	71.1 ± 8.1	70.8 ± 8.1	0.40	0.99	0.78	1.10%	0.97 – 1.0
BF%	20.2 ± 4.7	20.3 ± 4.9	0.52	0.97	0.80	3.98%	0.92 – 0.99

3334 Board #22 June 1 8:00 AM - 9:30 AM

Comparison of Bioelectric Impedance Analysis for Tracking Body Composition Changes Across a Basketball Season

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(No relevant relationships reported)

Body composition assessment has become an integral part of the year-round training schedule for athletes. This may be especially important in women athletes due to the potential for disordered eating. Development of low-cost bioelectric impedance analysis devices (BIA) make them attractive for determining changes in body composition components at different times in the training cycle. Question remains concerning the accuracy of these devices to track body composition changes over the yearly training and competitive cycle compared to a standard laboratory procedure.

PURPOSE: To compare the accuracy of selected BIA devices compared to dual-energy X-ray absorptiometry (DEXA) for tracking body composition across a college women's basketball season. **METHODS:** Twelve NCAA Division-II women basketball athletes (age = 20.1 ± 1.2 y, height = 175.0 ± 5.6 cm, weight = 70.2 ± 4.4 kg, %fat = 27.8 ± 2.8%) were measured prior to the season (T1), after pre-season conditioning (T2), at mid-season (T3), and at the end of the season (T4) using 7 single-frequency BIA devices and DEXA.

RESULTS: Repeated-measures ANOVA indicated that body mass (p = 0.19) and DEXA %fat (p = 0.08) did not change significantly over the course of the season. A method x trial factorial ANOVA of %fat and fat-free mass (FFM) with repeated measures over the second factor indicated that 2 BIA devices were not significantly different from corresponding DEXA values while all others significantly underestimated DEXA %fat. Lin's concordance correlation between BIA devices and DEXA were varied at each phase from low of $\rho_c = 0.17$ to high of $\rho_c = 0.84$, with no consistency across time. Rank-order correlations of BIA devices with DEXA were also inconsistent across time ranging from $r = 0.40$ to $r = 0.72$. **CONCLUSIONS:** Compared to the DEXA standard, single-frequency BIA devices may not provide adequate tracking of %fat or FFM in women across a basketball season.

3335 Board #23 June 1 8:00 AM - 9:30 AM

Using Skinfolts and Bioelectrical Impedance for Tracking Body Composition across a Soccer Season

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(No relevant relationships reported)

Assessment of body fat (%fat) is common across yearly training cycles for many athletes, although questions remain concerning the accuracy of assessment methods.

PURPOSE: To compare various methods for determining body composition in male soccer players across a yearly cycle. **METHODS:** Body composition was assessed in collegiate male soccer players (n = 13; age: 20.2 ± 1.2 yrs) prior to winter resistance training (Phase 1), following 8-weeks of resistance training (Phase 2), 8-weeks of spring skills training (Phase 3), and 14-weeks of a summer individualized training program (Phase 4). %Fat was determined at each phase using dual-energy X-ray absorptiometry (DEXA), 6 athletic SKF equations, and two bioelectrical impedance devices (arm: A-BIA; leg: L-BIA). SKF sites were measured by one experienced investigator throughout. **RESULTS:** A phase x method factorial ANOVA of %fat with repeated measures over the second factor indicated all prediction methods significantly, but consistently underestimated DEXA %fat (average difference =

11.8 ± 2.1%) despite moderate to high correlations with DEXA (r = 0.57 to 0.81). Of the SKF equations, a 7-SKF model, previously produced in our laboratory using DEXA as the criterion measure, had the closest %fat estimate (16.5 ± 3.0%) but a low correlation (r = 0.64) with actual %fat (DEXA: 18.0 ± 3.9%). Jackson-Pollock 3-, 4-, and 7-sites equations significantly underestimated %fat by 8.9% to 9.2% with the highest correlation resulting from the 4-site equation (r = 0.81). A-BIA (13.6 ± 4.9%) and L-BIA (13.4 ± 5.8%) comparably underestimated %fat (-4.8 ± 4.4%) with similar correlations against DEXA (r = 0.57 and 0.59, respectively). Significant negative correlations for differences between SKF predicted %fat and DEXA %fat (r = -0.66 to -0.94) indicated greater underestimation by SKF occurred at higher %fat and body mass values. A similar tendency was noted for differences between BIA %fat and DEXA %fat (r = -0.58 to -0.89).

CONCLUSIONS: All prediction techniques produced significantly lower estimates of %fat in male college soccer players across a year-long training cycle. Despite underestimation, each method provided consistent measure by phase and can be used to effectively track changes across a season. Prediction errors were typically greater at greater DEXA %fat and body mass values.

3336 Board #24 June 1 8:00 AM - 9:30 AM

A Matter Of Fat? Body Composition In Relation To Vo2max Improvements In Division II Female Athletes

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(No relevant relationships reported)

PURPOSE: Body composition is a significant factor in the determination of relative maximal oxygen consumption (VO2max) (Kenney, Wilmore, & Costill, 2015). Historically, O2 consumption reported in ml/kg/min considers O2 consumption related to fat free mass (FFM). A training program that facilitates an increase in FFM and/or a decrease in fat mass (FM) and body fat percentage (BF%) would inherently increase relative aerobic capacity and may optimize performance throughout the competitive season (Castagna, et al. 2013).

The purpose of the study was to determine the relative aerobic capacity response via Graded Exercise Testing (GXT) in relation to body composition changes in female Division II collegiate athletes following a preseason conditioning program.

METHODS: Nine female college athletes (age = 20 ± 1 yrs) participated in the study. Subjects performed a modified Balke GXT assessment on a treadmill to failure. Prior to performing the modified Balke GXT, subjects had their body composition assessed utilizing a Bod Pod (COSMED, Rome, Italy). All laboratory assessments were performed in the kinesiology lab at Concordia University - St. Paul, MN. Aerobic fitness and body composition were assessed before and after an 8-week preseason interval training program. Paired t-tests evaluated mean differences for pre- and post-training variables within body composition and GXT assessments.

RESULTS: The measured VO2max via GXT (43.7 vs. 44.0 ml/kg/min, P=0.57) was not significantly increased and body composition components (FFM: 51.3 vs. 51.8 kg, P=0.49; FM: 16.0 vs. 15.9 kg, P=0.93; BF%: 23.9 vs. 23.5%, P=0.78) were also not significantly affected over the 8-week preseason training period.

CONCLUSIONS: The 8-week preseason conditioning program showed improvements, although not significant, among VO2, FFM, FM, and BF%. Further studies with a greater number of participants could provide appropriate power to accurately determine the anthropometric and physiological changes experienced throughout the program.

3337 Board #25 June 1 8:00 AM - 9:30 AM

Comparison of Regional and Global Bone Mineral Densities in Male and Female College Athletes

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(No relevant relationships reported)

The advent of dual-energy X-ray absorptiometry (DEXA) has prompted an increase in research concerning the response of bone to exercise training. Previous investigations have focused mainly on female athletes and their susceptibility to stress fractures and low bone mineral density (BMD). Recent information suggests that male athletes may also suffer from relative energy deficiency in sports which could affect their bone health. However, direct comparisons of sport-specific differences and sex-differences in BMD within specific sports have not been fully explored. **PURPOSE:** To compare regional and total BMD between men and women athletes in comparable sports.

METHODS: NCAA Division-II men (n = 115) and women athletes (n = 95) in four sports [soccer (SOC), basketball (BB), cross-country (XC), swimming (SW), and baseball/softball (BS)] were measured for regional and total BMD and lean mass (LM) using (DEXA). Inactive men (n = 23) and women (n = 27) served as a control group (CON). **RESULTS:** Men were taller and heavier and had greater regional and

LM than women. A sex x sport multivariate ANOVA, with the influence of height and weight removed by covariance, revealed that men had significantly greater regional BMD ($p < 0.005$) than women in the arms, legs, pelvis, and total body. XC and SW had significantly lower BMD than CON which were lower than SOC, BS, and BB with no significant difference among the latter groups. The sex x sport interaction was not significant ($p = 0.15$), except for leg BMD where women swimmers (1.153 ± 0.081 g/cc) had a significantly lower value than other groups (1.405 ± 0.151 gm/cc). BMD had a nonsignificantly higher correlation with LM ($r = 0.61$) than with body mass ($r = 0.58$) when sex was held constant.

CONCLUSIONS: Regional BMD appears to be uniquely dependent on sport participation and sport-specific training, but the pattern of bone development appears independent of sex. Men and women athletes in sports that require more intense ground contact and perhaps more resistance training have greater regional and total BMD, suggesting varying levels of bone stress are associated with training for different sports. The degree of stress on bones of the arms does not seem sufficient to differentiate between these sports or inactive individuals.

3338 Board #26 June 1 8:00 AM - 9:30 AM
Comparison of Abdominal Fat among Positions and Ethnicities in College Football Players

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Body types in American football vary dramatically, but the underlying premise is one of achieving greater size within any position. In order to reach the theoretical size required for a given position, players may perform extensive resistance training and consume large quantities of food without much concern for body composition. Recent investigation has suggested that the accumulation of abdominal or visceral fat may have serious long-term health consequences. However, limited information is available on the extent of abdominal fat accumulation in collegiate football players. **PURPOSE:** To compare the level of android adiposity among Caucasian and African-American football players in different playing positions. **METHODS:** Backs (BA, $n = 57$) and linemen (LM, $n = 47$) were measured for body composition using by dual-energy x-ray absorptiometry (DEXA). Android fat (AF) was identified as the region from the iliac crest to a height 20% distance below the chin. Ethnicity was categorized as Caucasian (CAU, $n = 74$) and African-American (A-A, $n = 30$) based on self-report. **RESULTS:** There was a significant difference ($p < 0.001$) in %fat between linemen ($27.4 \pm 7.5\%$) and backs ($16.8 \pm 4.3\%$) but not between ethnicities (CAU = $22.1 \pm 8.1\%$ vs A-A = $20.4 \pm 7.7\%$), with no significant interaction ($p = 0.96$). The same pattern was evident in AF with a significant difference between positions (LM = 3.03 ± 1.56 kg vs BA = 1.37 ± 1.75 kg), a non-significant difference between ethnicities (CAU = 2.32 ± 1.98 vs A-A = 1.63 ± 1.42 kg), and a non-significant interaction ($p = 0.54$). When body mass was held constant by covariance, there was no significant difference between positions (LM = 1.75 ± 1.95 vs BA = 2.26 ± 1.804 kg), ethnicities (CAU = 2.23 ± 1.35 vs A-A = 1.79 ± 1.371 kg), or for interaction ($p < 0.14$). AF was more highly correlated with body mass in LM ($r = 0.90$) than in BA ($r = 0.26$) and more highly correlated with body mass in A-A ($r = 0.91$) than CAU ($r = 0.63$).

CONCLUSIONS: These findings suggest that the amount AF in college football players is largely related to body size. Accounting for difference in body size eliminates the difference between playing positions and ethnicities. Further research should compare athletes to nonathletes of different ethnicities and sizes to determine if similar patterns exist.

3339 Board #27 June 1 8:00 AM - 9:30 AM
Comparison of Various Body Composition Measures for Division-I Collegiate Male Athletes

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 (No relevant relationships reported)

Estimates of body composition are critical for athletic populations as variations in body fat percentage may impact performance, power, and general overall health. However, most laboratory and field-based devices estimate body composition using algorithms based upon and intended for general populations. Therefore, these algorithms may not be applicable to special populations, specifically male athletes. **PURPOSE:** The purpose of this investigation was to compare various field and laboratory measures of body composition in division-I male athletes against a criterion of air displacement plethysmography (ADP). **METHODS:** Sixty-nine Division-I collegiate male athletes, from various sports, performed five body composition measures (i.e., bioelectrical impedance spectroscopy (BIS), hand-to-foot bioelectrical impedance analysis (HF-BIA), foot-to-foot bioelectrical impedance analysis (FF-BIA), three site skinfold

(SF), and ADP). Each participant performed all measures on the same visit to the laboratory. A repeated measures ANOVA was used to determine differences between body composition measures against the criterion of ADP. **RESULTS:** When compared to ADP ($12.2 \pm 1.1\%$), results indicated a significant mean difference with BIS ($18.1 \pm 6.8\%$; $p < 0.01$) and HF-BIA ($18.5 \pm 6.0\%$; $p < 0.01$). There were no statistical differences between ADP and FF-BIA ($12.1 \pm 6.5\%$; $p = 1.0$) or ADP and SF ($13.2 \pm 8.6\%$; $p = 1.0$). **CONCLUSION:** Results indicate that field measures of body composition (i.e., FF-BIA and SF) may be applicable to athletic populations; whereas, laboratory measures (i.e., BIS and HF-BIA) may tend to overestimate body composition in male athletes. Therefore, new algorithms estimating body composition in athletes may be warranted for laboratory based devices.

3340 Board #28 June 1 8:00 AM - 9:30 AM
Utility of Anthropometric Indices to Estimate Changes in Adiposity in Response to an Exercise Intervention

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In cross-sectional analyses, anthropometric measures are generally well correlated with clinical measures of adiposity such as those from dual-energy X-ray absorptiometry (DXA). However, it is unclear whether anthropometric measures are sensitive enough to accurately quantify longitudinal changes in central and whole-body adiposity in response to short term exercise interventions with minimal weight change. **PURPOSE:** To examine the relative agreement between anthropometric and DXA measures of change in adiposity following a 6-week cycling exercise intervention. **METHODS:** Overweight/obese women ($n = 53$, 18-24 years old, 66% White, 17% Black, 17% Other) participated in the exercise intervention. Anthropometric measures included body mass index (BMI) and natural waist (NW) circumference. DXA measures included absolute trunk fat (TrkFat), whole body absolute fat (TotFat), and percent fat (%Fat). Baseline anthropometric and DXA measures were compared using Pearson correlations, as were changes (Δ) in each measure across the intervention. **RESULTS:** Mean \pm SD at baseline for each of the measures were: NW (88.7 ± 10.8 cm), BMI (30.5 ± 5.0 kg/m²), TrkFat (16923.3 ± 5991.3 g), TotFat (35826.4 ± 9813.2 g), %Fat ($44 \pm 5.8\%$). Δ for each of the measures were: NW (-0.8 ± 0.4 cm), BMI (-0.2 ± 1.0 kg/m²), TrkFat (-482 ± 1029.8 g), TotFat (-693.6 ± 1773.6 g), %Fat ($-0.8 \pm 1.3\%$). The association between baseline NW and TrkFat was much stronger at baseline ($r = .93$, $p \leq .001$) compared to the correlation between post-intervention Δ ($r = .57$, $p \leq .001$). Similarly, correlations between baseline BMI and DXA measures were stronger (TotFat: $r = .90$, $p \leq .001$; %Fat: $r = .68$, $p \leq .001$) than correlations between Δ measures (TotFat: $r = .68$, $p \leq .001$; %Fat: $r = .34$, $p = .013$). **CONCLUSION:** Anthropometric indices may not accurately reflect Δ in body composition during short duration lifestyle interventions. This may be due to factors such as cumulative intra-rater measurement errors when assessing waist circumference and the inability of BMI to differentiate changes in lean and fat mass over time. More direct measures (e.g., DXA) may be needed to accurately assess Δ in body composition, especially when these changes are of modest magnitude.

3341 Board #29 June 1 8:00 AM - 9:30 AM
Body Composition Characteristics and Knee Injury Prevalence of NCAA Division I Women's Soccer and Lacrosse

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Body composition is directly linked to athletic performance and may influence injury risk and recovery. Female Division I soccer and lacrosse players are at a high risk for lower limb injuries specific to the knee joint throughout their competitive careers. Return to play criterion vary; evaluation of body composition may be an important element of clearance. **PURPOSE:** The purpose of this study was to characterize pre-season body composition and injury prevalence among female Division I soccer and lacrosse players using dual-energy x-ray absorptiometry (DEXA). **METHODS:** Sixty Division I Women's Soccer ($n = 27$) and Lacrosse ($n = 33$) athletes (Mean \pm SD: age: 19.8 ± 1.4 yrs, height, 167.3 ± 6.2 cm, weight, 64.9 ± 8.0 kg.) completed a whole body DEXA scan to determine fat mass (FM), percent body fat (%fat), lean mass (LM), segmental lean mass [right leg lean mass (RLM); left leg lean mass (LLM)], and bone mineral content (BMC). History of lower extremity injury (ACL and other knee injuries) throughout a career was self-reported using a validated questionnaire. Measurements were taken pre-season (August 2018). **RESULTS:** Soccer and lacrosse

players combined ($n=60$) demonstrated the following body composition characteristics: total body FM (15.23 ± 4.8 kg), total body LM (46.96 ± 4.7 kg), and BMC (2.78 ± 0.3). There were significant differences between sports in %fat and segmental LM (LLM and RLM). Lacrosse athletes had higher %fat compared to soccer athletes: (mean difference [MD] \pm SD: $2.5 \pm 2.3\%$; $p=0.034$). Segmental leg LM (LLM, RLM) was higher in both legs of soccer athletes (LLM MD: 0.08 ± 0.54 kg; $p=0.004$, RLM MD: 0.89 ± 5.2 kg; $p=0.001$). In the full sample, there was no significant difference ($p=0.139$) between RLM and LLM. When evaluating injured vs. not injured athletes in the full sample, 45% of athletes reported a knee injury; %fat was significantly higher for athletes with no injury history (MD: $2.5 \pm 2.4\%$; $p=0.046$). **CONCLUSIONS:** These findings suggest that Division I soccer and lacrosse players who have returned to play following a lower extremity injury do not experience differences in segmental leg lean mass between the left and right leg. Based on the elite level of these teams, these data could portray optimal characteristics of successful athletes returned to play.

3342 Board #30 June 1 8:00 AM - 9:30 AM
Parental Socioeconomic Status and Skeletal Muscle Mass among Chinese College Students

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PURPOSE: The purpose of this study was to determine the association between parental socioeconomic status and skeletal muscle mass in college students.

METHODS: A cross-sectional study including 2194 college freshmen (537 males; 1657 females) was conducted in Shenyang, China. Data on body composition, health check-up, and self-reported questionnaire were available from all participants. Skeletal muscle mass assessment was performed by bioelectrical impedance analyzer (TANITA BC-420 MA). Information on parental socioeconomic status (educational levels, annual income, occupational status) was collected via questionnaires. Educational levels were divided into 4 categories: primary school, middle school, high school, and \geq college. Annual income was divided as <15000 , $15000-29999$, $30000-49999$, and ≥ 50000 CNY. Occupational status was classified into 4 groups: non-employment, self-employment, blue-collar workers, and white-collar workers. Analysis of covariance was used to adjust the confounding effect of sex, age, ethnicity, hometown location, smoking status, alcohol use, sleep duration, and body mass index.

RESULTS: Mean (standard deviation) body muscle mass was 54.9 (7.8) kg in male students and 39.2 (4.3) kg in female students. Multivariate analysis showed that college freshmen with higher paternal (mean [95% confidence interval]: primary school, 42.2 [$41.7, 42.7$]; middle school, 42.9 [$42.6, 43.2$]; high school, 43.6 [$43.2, 43.9$]; \geq college, 43.2 [$42.8, 43.5$], P for trend < 0.001) and maternal (primary school, 42.2 [$41.7, 42.7$]; middle school, 42.9 [$42.6, 43.2$]; high school, 43.5 [$43.1, 43.8$]; \geq college, 43.4 [$43.1, 43.8$], P for trend < 0.001) educational level tended to have higher skeletal muscle mass after adjustment for potential confounding factors. On the other hand, skeletal muscle mass was not associated with parental annual income and occupational status in this study.

CONCLUSIONS: Our study found a positive association between parental educational level and body muscle mass in Chinese college students. Further longitudinal studies on association of parental socioeconomic status with youth' muscular mass and function are needed.

3343 Board #31 June 1 8:00 AM - 9:30 AM
Diagnostic Accuracy of Adipose Evaluation Indexes to Identify Obesity and Predict Osteoporosis in Chinese Adults

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 (No relevant relationships reported)

Objective: To develop more appropriate indicators and cutoffs for different sexes and ages in Chinese adults for earlier prevention of obesity and osteoporosis.

Design: Obesity detection difference was analyzed by chi-square test. Correlation analysis was used between adiposity evaluation indexes and body fat percentage (BF%)

and bone mineral density (BMD). Receiver operating characteristic curves detected BF%-defined obesity and BMD-defined osteoporosis. Diagnostic accuracy was assessed. Optimal cutoffs by sex and age group were determined by area under the curve, Youden index, and sensitivity.

Setting: Physical examination sites in Chinese urban areas.

Subjects: Representative samples from Han adults (702 men and 915 women) aged 20-59.

Results: Obesity prevalence increases from 7.73% (body mass index, BMI) to 26.16%

(BF%). BMI, waist-to-hip ratio (WHR), obesity degree (OBD), and BF% were correlated in all subjects ($r=0.7$, $P<0.01$). OBD thresholds of 20.5% and 14.65% for both sexes, respectively, are most applicable to 20-39-year-olds. BMI and WHR thresholds of 26.45 kg/m² and 0.9 , respectively, are most applicable to 40-59-year-olds. WHR threshold of 0.9 is most applicable to 40-59-year-old women. The correlation was satisfactory between weight, BMI, OBD, and BMD in men. BMI and weight thresholds of 23.3 kg/m² and 70.55 kg are respectively most applicable to 20-39 and 40-59-year-old men.

Conclusions: BMI, OBD, and WHR are valuable for obesity diagnosis in young people and women. Traditional cutoffs should be revised by sex and age. The most applicable index differed by sex and age. Weight, BMI, and OBD are valuable for men in osteoporosis screening.

3344 Board #32 June 1 8:00 AM - 9:30 AM
The Relationship Between Body Composition with Peak Force and Anaerobic Power in Collegiate Baseball Players

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While total lean body mass accretion (TLBM) has been shown to have a positive association with performance in professional baseball players (Hoffman et al., 2009), there is a paucity of data demonstrating the relationship between body composition with power performance in collegiate athletes. **PURPOSE:** To investigate the relationship between multiple body composition parameters with peak force and anaerobic power in division II collegiate baseball players. **METHODS:** This was a retrospective study in which four years of body composition data was analyzed to determine its association with peak force and anaerobic power performance for 95 collegiate baseball players (age: 21.1 ± 1.0 yrs.; height: 1.84 ± 0.05 m; body mass: 87.9 ± 11.1 kg). Each subject performed a DEXA scan as well as a performance test of either a countermovement vertical jump (CMJ) ($n=66$) and/or a Wingate test (WIN) ($n=43$). Pearson's correlation coefficient was used to analyze the association between body composition parameters (i.e., TLBM, lower body lean mass [LBLM], body fat percentage [BF] and body mineral component [BMC]) with vertical jump peak force (CMJPF) and anaerobic power (i.e., absolute peak power [PP] and absolute average power [AP] on the Wingate test. **RESULTS:** TLBM was strongly correlated to WIN (PP: $r=0.777$; $p<0.0001$, AP: $r=0.808$; $p<0.0001$), but only moderately correlated to CMJ (CMJPF: $r=0.488$; $p<0.001$). LBLM was also strongly correlated to WIN (PP: $r=0.660$; $p<0.0001$, AP: $r=0.738$; $p<0.0001$) but only moderately correlated to CMJ (CMJPF: $r=0.467$; $p=0.002$). BF had a weak correlation with WIN (PP: $r=0.244$; $p=0.049$, AP: $r=0.295$; $p=0.042$) and no significant correlation with CMJ (CMJPF: $r=0.026$; $p=0.869$). BMC was strongly correlated to WIN (PP: $r=0.713$; $p<0.0001$, AP: $r=0.776$; $p<0.0001$) and moderately correlated to CMJ (CMJPF: $r=0.519$; $p<0.0001$). **CONCLUSION:** Our data suggests a strong positive relationship between lean body mass, including bone, with anaerobic power but only a moderate relationship with peak force. Moreover, BMC was strongly correlated to performance probably because athletes with more TLBM had greater BMC. Surprisingly, there was no association between body fat percentage and performance.

3345 Board #33 June 1 8:00 AM - 9:30 AM
Weight Change and Hydration Status in Elite Puerto Rican Wrestlers in Preparation for the National Championship

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 (No relevant relationships reported)

Rapid weight loss is a very common strategy used in weight class sports, such as wrestling. Risky weight loss methods like fasting, fluid restriction and increased sweating are very common practices used to attain competitive weight. Acute weight gain, as a recovery strategy, after the weigh-in day has also been observed. **PURPOSE:** To determine weight change and hydration status of elite Puerto Rican wrestlers in preparation for the 2015 National Wrestling Competition. **METHODS:** Wrestlers of the national adult pre-selection (15 males, 9 females, ages 17-34 years) were evaluated. Body weight (BW) and hydration status based on urine specific gravity (USG) were determined one week before, the day of the official weigh-in and one hour before on the day of the competition. Questionnaires were administered to evaluate methods used to "make weight". Repeated measures ANOVA (post-Hoc Bonferroni) was used to identify changes in BW and USG between the measurement times. Independent sample t-test was used to detect differences between sex. **RESULTS:** Body weight decreased from 68.9 ± 14.0 to 66.95 ± 13.5 kgs from the week

before the competition to the day of the weigh-in, and then increased to 68.2 ± 13.8 kgs from weigh-in to the day of the competition ($F = 27.33$, $p < .001$). USG increased significantly from 1 week before to the weigh-in (1.024 ± 0.006 vs. 1.028 ± 0.007 g/ml) and decreased on the competition day (1.025 ± 0.0073) ($F = 4.32$, $P = .019$). No differences were found between sex in relative weight change (%) and USG. More than 80% of the athletes were classified as significantly dehydrated (USG > 1.020) during the evaluations. Fasting, exercise with plastic suits and fluid restriction, were among the most common weight loss methods reported. **CONCLUSION:** These results indicate that wrestlers of the national adult pre-selection of Puerto Rico did not accomplish adequate hydration status on the day of the competition, even though partial weight gain was achieved. Education programs for adequate weight and hydration management is highly recommended.

3346 Board #36 June 1 8:00 AM - 9:30 AM
Predicting Percent Body Fat from Waist-to-Height Ratio Using a Regression Model

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(No relevant relationships reported)

Relative body fat (%BF) is a predictor of health status. Waist-to-height ratio (WHtR) better indicates disease outcome and adiposity-related disorders than does BMI or waist circumference (WC). **PURPOSE:** Develop a %BF prediction equation from WHtR, weight (wt), age and sex. **METHODS:** White, black, and Hispanic adults (70 men, 71 women; 30 ± 10 yr; 79.6 ± 20.5 kg; 171 ± 12 cm) volunteered for the IRB-approved study. Participants gave written consent and followed pre-test guidelines. Duplicate measurements of WC (narrowest portion of torso), barefoot height (cm) and wt (kg) were averaged. Dry land residual volume (RV) was assessed via helium dilution; the average of 2 values ± 0.1 L were used to correct body volume (Vb) from hydrostatic weighing (HW). Tare weight, water density, the average of the 3 heaviest underwater weights within 0.1kg, and RV were included in the Vb calculation. Body density (dry weight/Vb) was converted to %BF using the Siri (1961) formula. A multiple regression analysis was performed to establish a prediction equation from WHtR, wt, age and sex. Statistical analyses were conducted using R; $p < .05$ indicated significance. **RESULTS:** WHtR, wt, age and sex were significant predictors of %BF ($p < .005$). For each sex, %BF increased with each unit increase in WHtR, kg body wt, and yr of age. Wt and WHtR were negatively correlated with sex ($r = -.145$ men; $r = -.434$ women, $p < .05$); %BF and WHtR were positively correlated with age ($r = .461$ men; $r = .389$ women, $p < .05$). For the sample, $\%BF = 19.415 + 0.544 * WHtR + 0.130 * wt + 13.650 * sex$ (men = 0; women = 1) + $0.259 * age$. For the women, %BF was higher at all ages ($b = 13.65$, $SE_b = 1.356$, $p < .001$). Weight has a stronger effect ($p < .001$) and WHtR has a lower effect ($p < .01$) on %BF in women than men and all participants combined. The resulting sex-specific equation for women is: $\%BF = 31.65 + 0.42 * WHtR + 0.23 * wt + 0.25 * age$. For the men, wt is a lower and age a stronger predictor of %BF than in women. The resulting sex-specific equation for men is: $\%BF = 20.85 + 0.55 * WHtR + 0.08 * wt + 0.27 * age$. **CONCLUSION:** Sex-specific %BF prediction equations for men and women have been established from WHtR, weight, age and sex. These equations await validation with an independent sample. Regardless, %BF can be easily predicted from simple anthropometric data collected in most any setting by technicians needing minimal training.

3347 Board #35 June 1 8:00 AM - 9:30 AM
The Relationship Between BMI, Lean Mass, and Body Fat Percentage with Balance in Collegiate Archers

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(No relevant relationships reported)

For shooting sports, static balance and stability can have a dramatic impact on successful athletic performance and may be a key contributing factor in determining the difference between an elite vs an intermediate archer. More specifically, archers need to have a firm foundation and adequate balance during practice and competition. Prior studies, using various types of athletes, have evaluated the relationship between body composition and flexibility, coordination, etc. However, there appears to be no prior studies that compared BMI, body fat percentage (BF%), leg lean mass (LLM), and trunk lean mass (TLM) with balance in archers. **PURPOSE:** To investigate the potential relationship between BMI, BF%, LLM, and TLM on balance in collegiate archers in order to determine if archers should consider incorporating training to improve body mass or segment lean mass. **METHODS:** After having height (170.73 ± 7.48 cm), weight (71.02 ± 13.31 kg), and age (20 ± 1.55 yrs) recorded, 11 (7 males, 4 females) collegiate archers had their body composition (ie. BF%, LLM, TLM, and BMI) assessed. Then, after the completion of a general dynamic warm-up and a series of flexibility tests (ie. sit and reach, back scratch test, and trunk extension), subjects had their balance, with a balance system, evaluated via an athletic single leg assessment feature. During that assessment, the individual performed a single leg

stance on a platform that decreased the amount of friction underneath the platform over 30 seconds and scoring was determined by how much movement occurred with the center of pressure. **RESULTS:** There was no relationship between balance and BF% ($p = .790$ $r = -.091$) and a low correlation occurred with balance and BMI ($p = .387$ $r = .290$). However, there was a moderately high correlation between balance and TLM ($p = .028$ $r = .656$) and a high correlation between balance and LLM ($p = .003$ $r = .801$). **CONCLUSIONS:** BF% appears to have no relationship with balance, while BMI has very little impact. Yet, LLM and TLM may influence static balance. Future research may be required to evaluate LLM and TLM with balance using a larger population in order to further explore this potential relationship and perhaps further understand the factors that affect balance.

3348 Board #36 June 1 8:00 AM - 9:30 AM
Relationship Between Physical Activity Level With Body Composition And Physical Fitness Of Students From Ilhabela, Brazil

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(No relevant relationships reported)

Low level of physical activity in children and adolescents has several negative implications for health, such as overweight and decreased physical fitness. **PURPOSE:** Describe and compare the body composition and physical fitness of schoolchildren according to the recommendation of physical activity, measured by accelerometry. **METHODS:** The sample consisted of 73 schoolchildren, 37 boys and 36 girls, from 9 to 11 years of age, participating in the Mixed-Longitudinal Project of Growth, Development and Physical Fitness from Ilhabela. The variables analyzed were: body weight (kg), height (cm), BMI (kg/m^2), skinfolds (mm), circumference (cm), agility (shuttle run/ sec), flexibility (sit and reach), speed (50 meters/ sec) and upper (hand grip/ kg), lower limb (vertical jump/ cm) strength, and abdominal strength (rep). The measures followed the CELAFISCS standardization. Physical activity was measured objectively by means of an accelerometer (ActiGraph, GT3X). Schoolchildren were divided into two groups: a- reached the PA recommendation (≥ 60 min/ day), b- not reached the PA recommendation (< 60 min/ day). To verify data normality, Shapiro Wilk test was used. Comparison of the schoolchildren who did or did not reach the physical activity recommendation was made by t-test and Mann-Whitney U test. The level of significance was set at $p < .05$. **RESULTS:** Schoolchildren who reached the recommendation had significantly lower values compared to those who did not meet, respectively for adiposity (sum of 7 skinfolds) 66.1 cm vs 100.4 cm; body weight 34.3 kg vs. 40.5 kg; height 141.1 cm vs. 144.1 cm; speed 10.1 secs. vs. 10.4 secs. and agility 12.6 secs. vs. 13.5 secs. No significant difference was found in upper and lower limb strength and abdominal strength. **CONCLUSION:** Children who fulfilled the recommendation of physical activity presented a better body composition, speed, and agility than the children who were insufficiently active.

Table 1. Comparison of the mean values of body composition and physical capacity of schoolchildren, according to compliance with the recommendation of physical activity. Mixed-Longitudinal Project of Growth, Development and Physical Fitness from Ilhabela, 2015-2018, SP, Brazil.

	(≥ 60 min/day)		(<60 min/day)		$\Delta\%$
	\bar{x}	σ	\bar{x}	σ	
Weight (kg)	34.3	6.2	40.5	11.1	18.1 *
Height (cm)	141.1	7.5	144.1	11.3	2.1 *
BMI (kg/m^2)	17.1	2.1	19.1	3.4	11.7 *
Sum of 7 skinfolds (mm)	66.1	35.2	100.4	50.4	51.9 *
Lower limb strength (cm)	26.4	5.6	26.6	6.7	0.8
Upper limb strength (kg)	16.8	4.1	18.7	5.8	11.3
Flexibility (cm)	24.2	5.5	26.3	6.7	8.7
Agility (sec)	12.6	1.2	13.5	1.7	7.1 *
Speed (sec)	10.1	1.2	10.8	1.4	6.9 *
Abdominal strength (rep)	28	7.5	24.7	10.1	-12

* significant difference between the means by the t-Student or U Mann-Whitney test; $p < .05$.

3349 Board #37 June 1 8:00 AM - 9:30 AM

Anthropometry Among Non-sedentary Elderly Tendency Analysis Of Adiposity Over Three Decades

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(No relevant relationships reported)

Purpose: To analyze the adiposity tendency of non-sedentary elderly women over three decades. **Methods:** The study is part of the Mixed Longitudinal Project of Physical Fitness and Aging of SCS. Sample comprised female subjects, 50 years-old and older, involved in a PA program totalizing 6367 individuals. It was measured subscapular, tricipital and suprailliac skinfold. To analyze the trend, the sample was divided into age groups: 50 to 59 years, 60 to 69 years and 70 years and over. **Statistical analysis:** Polynomial regression models were estimated. In the modeling process, the mean of each one of the anthropometric variables was considered as dependent variable (Y) and the years of evaluation as independent variable (X). For each anthropometric variable, the model that presented the highest statistical significance (p) and the best accuracy measure (r^2) was selected. The trend was considered significant when the estimated model obtained $p < 0.05$. **Results:** Triceps skinfold presented a negative trend over the three decades analyzed. In the age group of 50 to 59 years, the mean triceps skinfold decreased .01 mm every year. In the age group of 60 to 69 years, there was a decrease of .09 mm every year. In the age group of 70 years and over, the mean decreased of .16 mm. Subscapular and suprailliac and 3 skinfolds mean increased .01 mm every year in the three age groups analyzed. In the age group of 60 to 69 years, the mean of 3 skinfolds increased .01 mm. In the age group of 70 years and over, the subscapular mean increased of .16 mm in each year; while suprailliac presented an increase of .01 mm every year; and the 3 skinfold mean increased of .01 mm every year. **Conclusion:** Elderly women of all age groups showed a tendency to increase central adiposity and decrease the peripheral region, suggesting that a centripetal fat redistribution occurs with aging.

Table. Trend analysis of skinfolds among non-sedentary elderly according to age group

	50 to 59 years			60 to 69 years			70 years and over		
	Model	r ²	p	Model	r ²	p	Model	r ²	p
Triceps skinfold (mm)	y = 23.16 - 0.01x	0.49	0.0012	y = 21.85 - 0.09x	0.24	0.0090	y = 20.45 - 0.16x	0.32	0.0007
Subscapular skinfold (mm)	y = 24.32 + 0.01x	0.93	0.0000	y = 21.65 + 0.28x	0.86	0.0000	y = 19.91 + 0.16x	0.66	0.0000
Suprailliac skinfold (mm)	y = 23.36 + 0.49x	0.77	0.0000	y = 20.72 + 0.01x	0.73	0.0000	y = 19.29 + 0.01x	0.81	0.0000
Mean of 3 skinfolds (mm)	y = 23.54 + 0.01x	0.90	0.0000	y = 21.32 + 0.01x	0.79	0.0000	y = 19.84 + 0.01x	0.29	0.0017

a. first-order regression model; b. second-order regression model; c. third-order regression model

3350 Board #38 June 1 8:00 AM - 9:30 AM

VO_{2max} and Dual Energy X-Ray Absorptiometry Results in NCAA Division I Tennis Players

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(Sponsor: Stephen F. Crouse, FACSM)

(No relevant relationships reported)

Purpose: Describe VO_{2max} and body compositions using dual x-ray absorptiometry (DXA) in NCAA Division I male tennis players.

Methods: Nine (9) male NCAA Division I tennis players (age 19.6 ± 1 yr, height 183.6 ± 5.9 cm, weight 75.6 ± 5.3 kg) who were in pre-season were tested as part of their athletic training program. Each subject underwent a DXA scan two weeks prior to their VO_{2max} test. VO_{2max} tests were conducted using the Bruce protocol (mL/kg/min). On the day of the test, athletes were instructed to consume their normal free-living breakfast and not engage in strenuous activity including team workouts prior to the test. Subjects ran to volitional exhaustion and peak exercise times and VO_{2max} numbers were recorded. Blood pressures were monitored according to the ACSM guidelines before, during, and after the exercise. After the completion of the test, data were analyzed to determine VO_{2max}, max heart rate (HR) which was recorded using a 12-lead ECG, and ventilatory threshold during exercise.

Results: Results shown in Table 1.

Conclusion: With respect to published norms for men that are matched to age, the players' measured VO_{2max} average would be ranked in the 90th percentile and deemed excellent for VO_{2max} based on the ACSM guidelines. The highest recorded VO_{2max} from the study is ranked in the 95th percentile and deemed superior. Based off the ACSM guidelines, the average for the body fat percentage falls in the 55th percentile and is deemed fair. The leanest player of the group is in the 80th percentile and deemed excellent.

Player	Age (kg)	Height (cm)	Weight (kg)	% Body Fat	Lean Body Mass (lb)	Fat Mass (lb)	Measured VO2max from Metabolic Cart (ml/kg/min)	Measured Max HR (BPM)	Ventilatory Threshold Heart Rate (BPM)
1	20.1	182.9	73.9	9.6	62.9	6.7	64.3	200	174
2	19.2	175.3	68.0	21.9	52.2	14.6	54.3	188	158
3	21.9	175.3	68.0	20.3	57.3	9.3	53.2	190	159
4	19.3	188.0	83.0	14.5	67.3	11.4	64.4	183	167
5	18.9	180.3	73.5	13.4	59.7	9.3	71.5	191	186
6	19.2	185.4	77.1	14.4	62.8	10.5	69.4	183	161
7	19.5	186.7	78.5	17.6	63.8	13.7	70.1	188	167
8	20.0	193.0	81.7	13.4	66.9	10.4	54.2	200	175
9	18.5	185.4	76.7	12.5	63.6	9.1	67.3	188	169
mean ± sd	19.6 ± 1.0	183.6 ± 5.9	75.6 ± 5.3	15.3 ± 3.9	61.8 ± 4.8	10.5 ± 2.4	63.2 ± 7.4	190.1 ± 6.2	168 ± 8.9

3351 Board #39 June 1 8:00 AM - 9:30 AM

Effect of Moderate Intensity Physical Activity and Modality on Measures of Body Composition in Males

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(No relevant relationships reported)

Exercise prior to body composition measures using air displacement plethysmography (ADP) and bioelectrical impedance (BIA) is generally contraindicated. Blood flow redistribution varies when using modalities such as treadmill walking (TW), leg cycling (LC) and arm cycling (AC) that may contribute to inaccuracies. Understanding the effect of physical activity using modalities on the accuracy of these devices have practical benefits. **Purpose:** To determine the effect of moderate intensity physical activity using different exercise modalities on body fat percent (BF%) measured by ADP, whole body bioelectrical impedance (WBIA), upper body bioelectrical impedance (UBIA), and lower body bioelectrical impedance (LBIA). **Methods:** Seventeen male participants (33.1 ± 9.3 y; 23.0% - 49.0% body fat) were included in the study. Participants exercised using TW, LC, and AC (45% - 55% heart rate reserve) for 30 minutes on different days including a control condition. BF% was measured pre exercise (PreE), immediately post-exercise (PE0), 15 minutes post-exercise (PE15), 30 minutes post-exercise (PE30), 45 minutes post-exercise (PE45), and 60 minutes post-exercise (PE60) using ADP, WBIA, UBIA and LBIA at each time point. **Results:** No differences were found during the control for PreE BF% for ADP (18.2 ± 9.9%), WBIA (17.8 ± 7.6%), UBIA (17.8 ± 6.5%), and LBIA (15.6 ± 8.0%). There was no effect of time during the control on BF% except when using UBIA (p=0.03). Using ADP, BF% at PE0 was significantly less than all other time points following TW and LC (p<0.05). Following AC, PE0 was significantly different from PE15-PE60, but not PreE (p=0.06). Using LBIA, after TW only BF% measured at PE15 and PE45 was significantly less than PreE (p<0.05). **Conclusion:** BF% measured by ADP after exercise decreases with all modalities, but generally returns to PreE measures within PE15. WBIA and UBIA BF% are not affected by exercise modality over time. However, LBIA BF% tends to decrease following TM but returns to PreE measures within 60 minutes.

3352 Board #40 June 1 8:00 AM - 9:30 AM

Comparison of Different Methods Used to Assess Body Composition in College Aged Athletes

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With the prevalence of obesity increasing to almost 40% as of 2016 and the vast amount of health complications known to be associated with being overweight or obese, knowing one's body composition is increasingly important. The American College of Sports Medicine has recommended values for % body fat that places individuals into different categories (from very lean to very poor), based on sex and age. However, these categories of % body fat are based on the use of Skinfold Thickness measurements. There are now numerous ways in which to assess body composition and we don't know the variability that may exist between these methods. **PURPOSE:** The purpose of this study was to compare the most common methods of measuring body composition that are currently being used today in order to determine- 1) how much of a difference exists between the different techniques, and 2) the relationship of the different methods of measuring body composition. **METHODS:** Thirty-nine healthy males (age=20±2 y; body weight=97.38±21.26 kg; height=1.79±0.06m) had their body composition assessed five different ways. Prior to each testing day subjects completed a 10-12 hour fast, did not exercise, and had a Urine Specific Gravity of <1.02. Body composition assessments included skinfold (SF) thickness (Lange Skinfold Caliper), Dual Energy X-Ray Absorptiometry (DXA;

GE Advanced Prodigy DXA Encore V17 Software), Ultrasound Thickness (US; BodyMetrix), Bioelectric Impedance (BIA; Tanita Body Composition Analyzer, BF-350), and Underwater Weighing (UWW; Exertech Floatweight System). **RESULTS:** Body fat % for US was $17.62 \pm 6.82\%$, SF $17.69 \pm 7.59\%$, UWW $21.94 \pm 8.97\%$, BIA, $23.64 \pm 7.74\%$, and DXA $24.98 \pm 8.63\%$. In comparison to DXA, % fat was significantly greater than US, SF, and UWW ($p < 0.001$). In respect to the relationship to DXA, correlations ranged from .873 (DXA vs. BIA $p = 0.001$) to .957 (DXA vs SF $p = 0.001$). **CONCLUSIONS:** These results suggest that a difference in body fat up to 7.36% can be observed between the different methods assessed. However, the relationship between the different methods is fairly strong. Due to the large variability observed in the different body composition methods assessed, it would suggest the need for developing recommended standard ranges based on the body composition assessment utilized.

3353 Board #41 June 1 8:00 AM - 9:30 AM
Agreement Between Two Bioimpedance Spectroscopy Devices and DXA for Body Composition

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Bioimpedance spectroscopy (BIS) has been used as an alternative to the more expensive and invasive dual-energy x-ray absorptiometry (DXA) to estimate body composition. **PURPOSE:** To determine the agreement between two BIS devices in comparison to DXA for measuring body fat percentage (%Fat), fat-free-mass (FFM), and fat-mass (FM). **METHODS:** Ninety-five subjects ($m = 35$, $f = 60$; 30 ± 15 years; 170 ± 8.0 cm; 72.6 ± 14.8 kg) participated in the study. Both devices utilized whole body right side measurements, one device (BIS₁) in supine and the other (BIS₂) in standing position. Measurements were taken during a single visit following an 8-12 hour fast. **RESULTS:** Bland-Altman analysis revealed BIS₁ significantly underpredicted values for %Fat (mean differences $\pm 95\%$ limits of agreement: $3.09 \pm 4.97\%$) and FM (2.85 ± 5.99 kg) and significantly overpredicted FFM (1.15 ± 4.98 kg) in comparison to DXA. When compared to DXA, BIS₂ significantly underpredicted values for %Fat ($1.69 \pm 5.16\%$) and FM (1.81 ± 6.25 kg). No significant difference existed between BIS₂ and DXA for FFM (0.08 ± 5.32 kg). Correlations between both BIS₁ and BIS₂ and DXA for FM, FFM, and %Fat were very strong ($r \geq 0.92$). **CONCLUSIONS:** While BIS₁ and BIS₂ indicated some bias when calculating FM, FFM, and/or %Fat, the limits of agreement were fairly narrow, indicating both to be acceptable alternatives to DXA for clinical practice in males and females aged 18-82 years with BMIs 18-39.5 kg/m². This study was funded by Impedimed, Inc

3354 Board #42 June 1 8:00 AM - 9:30 AM
The Effect of Acute Exercise-Induced Fluid Loss and Fluid Consumption on Percent Body Fat
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Acute exercise fluid loss, as well as fluid consumption, have been shown to impact body composition assessment using multiple methods of assessment. However, to our knowledge no study to date has examined percent body fat (%BF) using skinfold measurements (SF), air displacement plethysmography (ADP), dual energy x-ray absorptiometry (DXA), and type-A ultrasound (US) under exercise conditions while also controlling for exercise-induced fluid loss. **PURPOSE:** To determine the effect of acute exercise-induced fluid loss and fluid consumption on %BF determined by SF, ADP, DXA, and US before exercise, after exercise, and after fluid consumption. **METHODS:** Thirty-two college-aged men (20.8 ± 1.1 yrs) participated in this study and were randomly assigned to one of three groups: one group consumed water during exercise and after exercise (with water; $n = 11$), a second group consumed water only after exercise (without water; $n = 11$), and a third group served as the control group ($n = 10$). Participants reported in a euhydrated state ($U_{\text{sg}} < 1.020$). %BF was determined using SF, ADP, DXA, and US. Participants then performed 30 min. of exercise at 70% heart rate reserve (HRR) on a cycle ergometer in a room at $28.3\text{--}29.4^\circ\text{C}$. Twenty-thirty min. after exercise %BF was determined a second time. Water equal to the BM lost during exercise was consumed and %BF was measured a third time 60 min. later. **RESULTS:** Body mass (BM) was significantly reduced post-exercise in the without water group (79.7 ± 9.4 ; 78.8 ± 9.5 kg; $p < 0.001$) but not in the group exercising with water (82.5 ± 7.4 ; 82.3 ± 7.3 kg; $p = 0.210$). %BF was significantly less post-exercise compared to pre-exercise in the without water group (14.3 ± 4.4 ; 12.6 ± 4.9 %; $p = 0.017$) when using ADP. In both the with water (16.8 ± 4.5 ; 18.8 ± 4.2 %; $p = 0.001$) and without water (12.6 ± 4.9 ; 14.7 ± 5.0 %; $p = 0.011$) groups, %BF significantly increased after fluid consumption when using ADP. No significant effects were observed for DXA, US, or

SF determined %BF after exercise and fluid consumption. **CONCLUSION:** Acute exercise and fluid consumption impacted ADP determined %BF, but did not have a significant effect on %BF determined by DXA, US, and SF.

3355 Board #43 June 1 8:00 AM - 9:30 AM
Decline In Aerobic Capacity Or Increase In BMI?

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PURPOSE: Aerobic capacities, specifically $\text{VO}_{2\text{max}}$, of children and youth, have been found declining over the second half of 20th century according to the secular trend analyses (see e.g., Tomkinson et al., 2007). Since body mass index (BMI) is often a part of $\text{VO}_{2\text{max}}$ prediction, this study was to examine the impact of changed BMI on the declined $\text{VO}_{2\text{max}}$.

METHODS: First, 50th percentiles of 8-11 yr. boys and girls' BMI and 1-mile-Run-Walk (1MRW) performance in 1987 National Children and Youth Fitness Study (NCYFS II) were used to estimate their $\text{VO}_{2\text{max}}$ using the equation of Cureton et al. (1995): $\text{VO}_{2\text{max}} (\text{ml/kg/min}) = (-8.41 * \text{Time}) + (0.34 * \text{Time}^2) + (0.21 * \text{Age} * \text{Sex}) - (0.84 * \text{BMI}) + 108.94$. Second, BMIs in the prediction were replaced by the BMI 50th percentiles of 8-11 yr. boys and girls in 2015-2016 NHANES. Finally, the difference between 1987 and 2015-16 estimated $\text{VO}_{2\text{max}}$ were computed and compared.

RESULTS: Impact of BMI changes on the estimated $\text{VO}_{2\text{max}}$ by age and sex was summarized below:

CONCLUSIONS: Even when running performances stay the same, the changes in BMI between 1987 and 2015-16 could lead 1-7% decline in estimated $\text{VO}_{2\text{max}}$ of 8-11 children and youth, indicating that weight management should be a part of fitness and health promotion in children and youth.

Age in Yr., Sex	BMI-1987 (kg/m ²)	BMI-2015-16 (kg/m ²)	1987-1MRW Time (min)	1987- $\text{VO}_{2\text{max}}$ (ml/kg/min)	2015-16- $\text{VO}_{2\text{max}}$ (ml/kg/min)	Change (ml/kg/min)	% Change
8, Male	16.38	16.95	10.65	45.86	45.38	-0.48	-1%
9, Male	16.88	18.10	10.17	46.29	45.27	-1.02	-2%
10, Male	17.03	19.00	9.87	46.86	45.20	-1.66	-4%
11, Male	16.03	20.10	9.05	49.52	46.10	-3.42	-7%
8, Female	16.27	17.85	11.53	43.50	42.18	-1.32	-3%
9, Female	16.88	17.30	11.22	43.21	42.85	-0.36	-1%
10, Female	17.03	19.40	11.23	43.07	41.08	-1.99	-5%
11, Female	16.83	20.00	11.25	43.22	40.56	-2.66	-6%

3356 Board #44 June 1 8:00 AM - 9:30 AM
Regional Differences In Bone Mineral Density Vary With Whole Body Z-scores In College Track Athletes

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Track and field athletes are susceptible to musculoskeletal injuries due to a combination of insufficient recovery and excessive training. Stress fractures in these athletes are common, especially in distance runners, and are associated with decreased regional and whole body bone mineral density (BMD). **PURPOSE:** To determine if college track and field athletes with low BMD experience loss of BMD in the ribs (RIB) to compensate for musculoskeletal loading of the lower extremity. **METHODS:** 110 NCAA Division 1 track and field athletes (57 males, 53 females) underwent whole body and bilateral hip dual energy x-ray absorptiometry (DXA) scans. Whole body Z-scores and BMD for standard sub-regions, including RIB, were automatically computed by DXA software. Proximal, middle, and distal regions of the femur (F_{PROX} , F_{MID} , F_{DIST}) and tibia (T_{PROX} , T_{MID} , T_{DIST}) were objectively identified and BMD for each sub-region was computed. In the hip scans, femoral neck (F_{NECK}), Ward's triangle

(F_{WARD}), and total hip BMD were computed. The mean BMD of both sides was computed for each sub-region, and a ratio between BMD of each respective sub-region and the ribs was computed. Participants were then divided into quintiles by whole body Z-score. A linear mixed effect model was used to determine whether the sub-regional BMD parameters and ratios differed between quintile groups. Pairwise comparisons were used to determine differences between quintile groups if a main effect was significant ($p < 0.05$). **RESULTS:** There were significant main effects for BMD to differ by each sub-region ($p < 0.001$ for all), with the lowest quintile group always having significantly lower BMD than that of each of the upper three quintiles. However, the only significant ratios were that of $F_{\text{MID}}:\text{RIB}$ ($p = 0.019$) and $F_{\text{DIST}}:\text{RIB}$ ($p = 0.019$). Pairwise comparisons revealed the upper quintile group had significantly lower ratios for these two parameters than all other quintile groups. **CONCLUSION:** Decreased BMD in RIB and all sub-regions of the legs, combined with elevated $F_{\text{MID}}:\text{RIB}$ and $F_{\text{DIST}}:\text{RIB}$ ratios, suggest that BMD is lost from the ribs at a greater rate than it from specific regions of the legs in athletes with the lowest whole body Z-scores. Future research should explore the clinical implications of this finding for stress fracture risk and long-term bone health in athletes.

3357 Board #45 June 1 8:00 AM - 9:30 AM

The Prevalence of Body Composition Criterion Methods for Validation Studies in Humans

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PURPOSE: To determine the recent prevalence of body composition criterion methods in validation studies of total body percent fat or fat free mass.

METHODS: A literature search was performed to identify studies between 2013 - 2018 using the following key words: four component model, validation, body composition, and fat using Medline. Only human studies published in English were included. One person (L. Milliken) screened all articles and coded the results to identify the criterion and comparison methods used. For all studies where multi component models were used, a further note was made regarding what methods comprised those models. All methods were summarized to capture the prevalence of methods used in the literature for body composition validation studies.

RESULTS: A total of 176 articles were identified; 128 measured total body composition or body volume articles and were included. Some studies used more than one criterion method. 10.9% of studies used a 2 component (2C) model, 67.2% used a 3C model and 10.9% used a 4C model as a criterion method. The most common 2C, 3C, and 4C models respectively were air displacement plethysmography (ADP) (9.3%), dual-energy x-ray absorptiometry (DXA) (62.5%) and ADP/DXA/total body water (TBW) (7.8%). 3.9% of studies used an inappropriate 3C or 4C model by using bioimpedance spectroscopy (BIS) in place of TBW by isotope dilution. The criterion methods used in order of prevalence were DXA (62.5%), 4C (10.9%), ADP (9.4%), isotope dilution (7.0%), magnetic resonance imaging (4.7%), 3C not including DXA (4.7%), bioelectrical impedance analysis (3.9%), and underwater weighing (1.6%).

CONCLUSIONS: Body composition validation studies are dominated by DXA as a criterion method which may not be appropriate in all situations. Also, researchers are incorrectly using field methods rather than laboratory methods (most commonly using BIS for TBW) as part of the 4C model in validation studies. The gold standard for body composition validation studies remains the 4C model with TBW determined by isotope dilution.

3358 Board #46 June 1 8:00 AM - 9:30 AM

Body Composition in Lean Athletes: Which Ultrasound Sites Best Predict Fatness Measured by DXA?

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PURPOSE: Ultrasound (US) has been used for over 50 years as a way of measuring fat thickness comparable to skin folds in predicting body fat. Recent advances in US (Müller et al, 2016) have increased objectivity and accuracy in measuring fat thickness. This study was designed to compare the new US approach with DXA %fat as the criterion method in male and female athletes.

METHODS: Three centers (Perth, Colorado, Lisbon) performed whole body DXA method on 16 competitive athletes ($n = 48$; age: 23.5 ± 4.2 years, weight: 69.2 ± 11.1 kg, height: 174.4 ± 8.6 cm, BMI: 22.6 ± 2.4 kg/m²). Three ISAK Level 1 and US trained observers at each center measured 8 standardized US sites, as described by Müller et al (2016), on each athlete capturing 3 sets of measurements per subject. Observer 1 data were combined from each center for both female and male athletes to create Observer 1 sample ($n = 48$); two other sets of data were collated by combining Observer 2 and 3 data, each $n = 48$. Step down regression and correlational analyses were examined for relationships between DXA %Fat and all 8 US sites.

RESULTS: Significant correlations between DXA %fat and all 8 US sites ($r = .52 - .87$, $p \leq 0.01$) were found. Using step down multiple regression analyses all 8 sites were entered into the analyses to predict DXA %fat. Three sites for females (lower abdomen (LA), medial calf (MC), distal triceps (DT); $p \leq 0.001$, $SEE = 2.4-2.6\%$); and two sets of three sites for males: LA, MC, and erector spinae (ES) ($p \leq 0.01$; $SEE = 1.8-2.2\%$), and upper abdomen (UA), MC, ES ($p \leq 0.01$; $SEE = 1.9\%$) were found to be the best predictors.

CONCLUSIONS: These findings show that US can predict DXA %fat with low SEE's in both male and female athletes.

3359 Board #47 June 1 8:00 AM - 9:30 AM

Body Fat Assessed With Electrical Impedance Myography Compared With DXA In Professional Athletes

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(No relevant relationships reported)

Electrical impedance myography (EIM) has been compared with DXA in physically active subjects, but its accuracy in professional athletes has not been explored.

PURPOSE: To compare the body fat estimated with a commercial EIM mobile device with body fat measured with DXA.

METHODS: We evaluated the body fat percentage (BF%) of 28 professional male soccer players (19 - 34 years old, BF% 14.95 ± 2.43) with a whole body DXA scan (Hologic®) and a mobile EIM device (Skulpt® Chisel). The EIM was assessed at ten anatomical sites (abdomen, biceps, calves, chest, forearms, hamstrings, lower back, quadriceps, shoulders, and triceps). The BF% was estimated for each anatomical point and for the sum of all according to the manufacturer's instructions. We calculated mean differences in BF% (DXA - EIM) and their 95% limits of agreement. DXA and EIM BF% were analyzed for correlation with intra-class correlation coefficient and compared with ANOVA and Dunnett post hoc test.

RESULTS: There were strong correlations between DXA BF% and EIM BF% assessed at abdomen, chest, lower back, quadriceps, hamstrings, and all sites. Moderate to low correlations were observed for shoulders and triceps. Biceps, calves, and forearms showed no significant correlation. Similarly, DXA BF% was different to EIM BF% at calves and forearms only ($p < 0.05$). From the other anatomical sites, the lowest mean difference was observed at hamstrings and the biggest at biceps. However, the narrowest limits of agreement were observed at quadriceps and the widest at chest. BF% estimated using all sites showed similar results as obtained evaluating BF% at quadriceps (Table).

CONCLUSIONS: The EIM mobile device was useful to accurately estimate BF%, even evaluating a single anatomical site when compared with DXA in professional soccer players. This device may be helpful for body composition assessment on the field. However, its accuracy in other athletic populations and its applicability for follow-up warrants further research.

Table. Body fat percentage analysis from DXA and electrical impedance myography.					
Anatomical site	Mean	-2SD	+2SD	ICC	Range LA
All sites	1.95	-2.65	6.55	0.64	9.2
Quadriceps	-1.97	-6.07	2.14	0.61	8.21
Triceps	-0.50	-5.30	4.29	0.48	9.59
Biceps	-2.34	-7.30	2.61	0.13	9.91
Shoulders	-0.63	-6.46	5.21	0.50	11.67
Hamstrings	-0.29	-6.24	5.66	0.61	11.9
Abdomen	2.16	-4.24	8.57	0.75	12.81
Lower back	1.33	-5.23	7.89	0.62	13.12
Chest	0.62	-6.71	7.96	0.67	14.67
Forearms	-3.19*	-8.34	1.95	0.04	10.29
Calves	-5.31*	-10.88	0.25	0.005	11.13
ICC: Intraclass correlation coefficient; Range LA: Absolute range on limits of agreement (95%); SD: Standard deviation. * Significant differences with DXA ($p < 0.05$).					

3360 Board #48 June 1 8:00 AM - 9:30 AM

Influence of Circumference Measurements and Body Composition on Estimating Resting Metabolic Rate in Healthy Adults

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(No relevant relationships reported)

Measurement of resting metabolic rate (RMR) is an important factor for weight management. Previous research has reported several variables to estimate RMR such as body size, percent fat (%BF), age, and sex; however, little is known regarding the effect of circumference measures in estimating RMR. **PURPOSE:** The purpose of this study was to develop a model to estimate RMR using waist circumference (WC), an easily obtainable measure, and cross-validate it to previously published models. **METHODS:** Subjects were 140 adult men and women, ages 18-65 years. RMR was measured through indirect calorimetry, %BF was measured through air displacement plethysmography, and fat mass and fat-free mass were determined from %BF and weight. Other variables collected were: weight, height, age, sex, ethnicity, body mass index, WC, hip circumference, waist-to-hip ratio, waist-to-height ratio, and %BF estimated from bioelectrical impedance analysis. Subjects were randomly divided into derivation and cross-validation samples. A multiple regression model was developed to determine the most accurate estimation of RMR in the derivation sample. The cross-validation sample was used to confirm the accuracy of the model and to compare the accuracy to published models. **RESULTS:** The best predictors for estimating RMR were body weight, $r = 0.70$, $p = 0.031$, age, $r = -0.30$, $p = 0.012$, and sex, $r = 0.51$, $p = 0.018$. Other factors failed to account for significant variation in the model. The derived equation for estimating RMR is: $\text{RMR (kcal/day)} = 843.11 + 8.77(\text{weight}) - 4.23(\text{age}) + 228.54(\text{sex}, M = 1, F = 0)$, $R^2 = 0.68$, $\text{SEE} = 173 \text{ kcal/day}$. Cross-validation statistics were: $R^2 = 0.54$, $p \leq 0.05$, $\text{SEE} = 199 \text{ kcal/day}$, and total error = 198 kcal/day . In published models, R^2 ranged from 0.47 to 0.57, SEE ranged from 192 to 213 kcal/day, and total error ranged from 212 to 1311 kcal/day. **CONCLUSIONS:** Cross-validation to published models for estimating RMR were similar to those of the derived model; however, the total error in the derived equation was lower than any of the previously published models. Several published models considerably overestimate RMR compared to the current model. The results of this study suggest that RMR can be reasonably estimated with easily obtainable measures which allow for estimation and implementation of RMR for weight management in clinical practice.

G-35 Free Communication/Poster - Fitness Assessment

Saturday, June 1, 2019, 7:30 AM - 11:00 AM

Room: CC-Hall WA2

3361 Board #49 June 1 9:30 AM - 11:00 AM

Health and Fitness Differences Between Urban and Rural Costa Rican Older Adults

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Costa Rica has one of the highest life expectancies in America, even higher than the United States. Studies addressing health and fitness in Latin American urban and rural older adults are scarce. **PURPOSE:** The purpose of the study was to test the hypothesis that older adults from rural areas present fewer negative health conditions and higher fitness than older adults from urban zones. **METHODS:** 298 participants aged 60 to 85 (Urban n = 188, Rural n = 110) completed a 29-item chronic diseases questionnaire and performed the Senior Fitness Test: a) 6-min walking test (6-MWT), b) 30-s Chair to-Stand Test, c) 30-s Arm Curl Test, d) timed up- and go test (TUG), balance time, and handgrip strength (HGS). Categorical variables were analyzed with non-parametric Chi² and continuous variables with 2 x 2 ANOVA (residency zone x gender). **RESULTS:** Urban women reported more chest pain ($\chi^2 = 6.05$, $p = 0.014$), more pacemakers ($\chi^2 = 4.70$, $p = 0.030$), diabetes ($\chi^2 = 3.98$, $p = 0.046$), and osteoarthritis ($\chi^2 = 5.08$, $p = 0.024$) than rural women. Urban men reported more chronic low back pain ($\chi^2 = 5.65$, $p = 0.017$) and depression ($\chi^2 = 3.90$, $p = 0.048$) than rural men. A higher diastolic blood pressure was observed in urban compared to rural older adults (Urban = $76.2 \pm 0.9 \text{ mmHg}$ kg vs. Rural = $70.2 \pm 1.3 \text{ mmHg}$; $p \leq 0.001$). Urban older adults showed better balance time than rural older adults (Urban

= $22.8 \pm 0.8 \text{ s}$ vs. Rural = $18.4 \pm 1.2 \text{ s}$; $p = 0.003$). Performance was similar between urban and rural older adults on the 6-MWT, 30-s Chair to-Stand, 30-s Arm Curl, TUG, and HGS tests ($p > 0.05$). **CONCLUSION:** In spite of having similar physical fitness performance, Costa Rican urban men and women showed an overall negative health profile compared to rural older adults. Balance was the only functional variable positively observed in urban older adults.

3362 Board #50 June 1 9:30 AM - 11:00 AM

A Comparison of Back Squat & Safety Squat Bar on Measures of Strength, Speed, and Power in NCAA Division I Baseball Players

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(No relevant relationships reported)

Squat exercise variations are considered a cornerstone of resistance training (RT) programs. Understanding the effectiveness of differing squat exercise variations is important for coaches and athletes in order to optimizing the effectiveness of a RT program. **PURPOSE:** The current investigation examined a comparison of the standard Olympic barbell loaded back squat (BS) with a squat performed with the safety squat bar (SSB). **METHODS:** Twenty eight Division I male baseball players (19.2 ± 1.1 years, $182.5 \pm 5.6 \text{ cm}$, $87.6 \pm 5.1 \text{ kg}$) participated in a RT program comprised of two workout sessions a week for nine weeks, performing either a BS or SSB utilizing an autoregulatory progressive resistance periodization protocol, concurrent with their existing, season-specific, RT program. Pitchers (n=14) utilized the SSB bar with the goal of minimizing stress on the shoulder and elbow joints during the execution of the squat. The non-pitchers (n=14) performed the Olympic barbell BS. Lower body strength (estimated 1RM squat: kgs), sprint speed (54.86 m sprint: secs), and vertical jump (VJ: cms) were assessed prior to and following the RT training period. **RESULTS:** The VJ had a significant positive improvement from pre to post RT for both the BS (pre: 74.6 ± 8.1 , post: 76.5 ± 8.0) and SSB (pre: 72.4 ± 7.6 , post: 75.3 ± 8.3) groups ($p < 0.05$). The estimated squat 1RMs had a significant positive improvement from pre to post RT for both the BS (pre: 136.2 ± 11.0 , post: 166.1 ± 23.7) and SSB groups (pre: 112.3 ± 14.9 , post: 152.6 ± 22.0) ($p < 0.05$). The 54.86 m sprint did not improve significantly from pre to post RT for either the BS (pre: 7.12 ± 0.33 , post: 7.05 ± 0.26) or SSB groups (pre: 7.27 ± 0.17 , post: 7.19 ± 0.20) ($p > 0.05$). When comparing gain scores between each group there were no significant difference between the BS and SSB groups for either 54.86 m sprint or VJ ($p > 0.05$). However, the estimated squat 1RM gain score for the SSB was significantly greater than the BS group ($p < 0.05$) noting that the effect size of change from pre to post RT was 2.69 and 2.71 standard deviations for the BS and SSB groups respectively. **CONCLUSION:** Given that both squat modalities yielded approximately equal improvements in VJ and lower body strength, coaches and athletes can consider the SSB variation of the squat as a viable option for developing lower body strength and power.

3363 Board #51 June 1 9:30 AM - 11:00 AM

Assessment of Bilateral Glenohumeral Posterior Capsule Tightness in Recreational Golfers

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Comparison of Glenohumeral Posterior Capsule Tightness between Golfers and Non-Golfers

Abstract

The primary movement of the golf swing is habitually unidirectional. Consistently the leading side, (left side of a right handed golfer) and the trail side, (right side of a right handed golfer) are asked to perform remarkably different tasks with an overall shoulder injury prevalence of between 8-16%.

Purpose. The current study examined glenohumeral posterior capsule mobility of the leading shoulder compared to the trail shoulder in recreational golfers and non-golfers. **Methods.** Participants were twenty-two recreational golfers (15 males, 7 females) mean age 38.8 years (SD= 18.85) with at least two years of prior experience golfing and thirteen non-golfers (7 males, 6 females) with a mean age of 33.1 years (SD=12.35). All participants had bilateral glenohumeral posterior capsule mobility measured as medial epicondyle distance from exam table in inches via side lying horizontal adduction of the non weight bearing upper extremity with scapula manually stabilized. **Results.** Golfers exhibited a statistically significant ($P < .001$) asymmetry of glenohumeral posterior capsule mobility in their leading shoulder compared to the trail shoulder. The non-golfing participants demonstrated no statistically significant difference in right to left glenohumeral posterior capsule mobility exhibiting relatively equal measurements bilaterally. **Conclusions.** The sample of golfers demonstrated an asymmetry in glenohumeral posterior capsule mobility in leading to trail shoulders

that was not seen in the non-golfing population. Clinical consideration should be given to this asymmetry in training and care of the golfing athlete especially as it relates to limitations in shoulder mobility and motion.

3364 Board #52 June 1 9:30 AM - 11:00 AM
Adjusted Muscle Strength Evaluation Using Directional and Continuous Jump Motion Test by 3D Motion Analysis

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PURPOSE: To study adjusted muscle strength evaluation methods using directional and continuous jump motion tests (vertical, forward, backward), this study compares basketball players with general students and examines differences between the groups and directional differences.

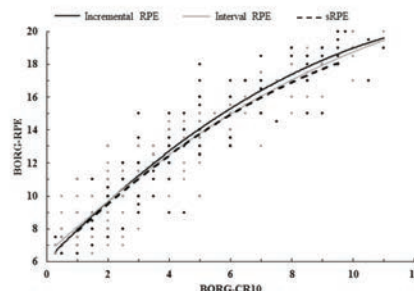
METHODS: Subjects were two groups; General Students (14 male students) and Basketball Students (10 male students). Vertical, forward and backward jumps were each measured twice for maximum exertion (100%) and adjusted exertion (50%). The first vertical jump with full strength and then immediately after landing, adjusted exertion in each direction (50% exertion) (vertical, forward, backward) were measured using 3D motion analysis (Kinect2 (Microsoft)). Difference in average value in single jump measurement (50%) and continuous measurement (50%) using absolute values (cm) was verified and two factor ANOVA was conducted for differences between the groups (basketball vs. general) using relative values (%) and for differences among each direction (vertical, forward, backward). For the multiple comparison test, the Bonferroni method was used. The level of significance was set at 5%.

RESULTS: In single jump and continuous measurements, the general student group showed close to 50% exertion in the order of forward, vertical, and backward jumps. The basketball group showed 50% exertion in the order of forward, backward, and vertical jumps. The order of superiority tended to be different between the two groups. Additionally, compared to the single jump measurement, continuous measurement showed that both the general student and basketball groups demonstrated close to 50% exertion and particularly in the continuous measurement, differences between the two groups tended to become more noticeable in the backward jump.

CONCLUSIONS: For two groups, there are different directions in which adjusted exertion are likely to occur. By continuous jump measurement with initial movement maximum exertion, it is possible to evaluate accurate adjustment abilities and competitive qualities.

3365 Board #53 June 1 9:30 AM - 11:00 AM
Comparison Of RPE Rating Scales For Session RPE
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Purpose: The Session RPE (sRPE) is an accepted method of monitoring training in athletes in many different sports. It is based on the Category-Ratio (0-10) RPE scale (BORG-CR10) developed by Borg. There is no evidence how substitution of the Borg 6-20 RPE scale (BORG-RPE) might influence the sRPE. **Methods:** Systematically training, recreational level athletes from different sport disciplines performed six, randomly ordered, 30-minute interval training sessions, at intensities based on peak power output (PPO), designed to be easy (50%PPO), moderate (75%PPO) or hard (85%PPO). sRPE was obtained 30-min post-exercise using the BORG-CR10 or BORG-RPE and compared for matched conditions. **Results:** The average percent of heart rate reserve (%HRR) was well-correlated with sRPE from both BORG-CR10 ($r = 0.76$) and BORG-RPE ($r = 0.69$). The sRPE from BORG-CR10 and BORG-RPE were very strongly correlated ($r = .90$) at matched times. **Conclusions:** Although producing different absolute numbers, sRPE derived from either BORG-CR10 or BORG-RPE provide substitutable estimates of perceived exercise training intensity.



3366 Board #54 June 1 9:30 AM - 11:00 AM
Reliability and Validity of Hip Rotation Strength Tests: Systematic Error Due to Tester Hand Dominance

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PURPOSE: Manual muscle testing using hand held dynamometry (HHD) is commonly utilized and for a more objective measure. Deficits in hip rotation strength have been linked to lower extremity pathology, but measurement reliability is unknown. The purpose of this study was to assess the reliability and validity of hip internal (IR) and external (ER) rotation strength in three positions. **METHODS:** Right and Left Hip IR and ER strength was measured using HHD in 20 patients, (30 ± 12 years, 9 women, 11 men), using 3 tests (seated, supine, side-lying), at two different time points (Test 1, Test 2), by two different testers (A and B). Strength was reported as torque (Nm/kg). Intratester and intertester relative reliability were assessed using intraclass correlation coefficients (ICC). Absolute reliability was assessed using 95% limits of agreement (LOA). **RESULTS:** Torque was highest for the seated tests, followed by the supine (13% lower than seated), and side-lying (25% lower than seated). There was a systematic difference between left and right legs for the seated and side-lying tests: the left side was stronger than right side for IR (Seated: 7% $p=0.044$, Side-lying: 9% $p=0.04$); right side 7% stronger than left side side-lying ER ($p=0.008$). Inter- and intratester ICCs are reported in Table 1. **CONCLUSIONS:** Hip ER and IR strength testing had poor intra- and intertester reliability. The right/left difference in seated and side-lying tests, suggest indicate tester hand dominance may be a confounding factor. These data highlight the need for more reliable hip rotation strength testing.

Table 1.

Intertester ICC							
Supine		Seated		Side-Lying			
Test 1	Test 2	Test 1	Test 2	Test 1	Test 2		
IR R	0.67	0.47	IR R	0.88	0.67	IR R	0.50
IR L	0.48	0.30	IR L	0.71	0.41	IR L	0.70
ER R	0.63	0.75	ER R	0.84	0.79	ER R	0.15
ER L	0.35	0.60	ER L	0.77	0.74	ER L	0.56
Intratester ICC							
Supine		Seated		Side-Lying			
A	B	A	B	A	B		
IR R	0.83	0.39	IR R	0.84	0.54	IR R	0.71
IR L	0.66	0.37	IR L	0.61	0.58	IR L	0.75
ER R	0.75	0.79	ER R	0.89	0.70	ER R	0.42
ER L	0.70	0.51	ER L	0.92	0.51	ER L	0.88

3367 Abstract Withdrawn

3368 Board #56 June 1 9:30 AM - 11:00 AM
Handgrip Fatigue and Forearm Girth in Intermediate Sport Rock Climbers

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Rock climbing has been increasing in popularity both recreationally and competitively. Indoor sport rock climbing is a type of climbing where the climber ascends a wall using artificial rocks (hand and foot holds) and is attached to a safety rope. Despite this increase in popularity of the sport, the physiological responses to sport climbing as an exercise to specific muscle groups are not well defined in literature. **PURPOSE:** The purpose of this study was to quantify the change in handgrip strength over a 30-minute bout of continuous climbing, specifically in intermediate sport climbers. An additional aim of this study was to quantify any change in forearm girth over a bout of climbing and compare it to the change in strength and to identify if there is a relationship between the two. **METHODS:** Ten intermediate rock climbers [Age: 26.7±6.7 years; Height: 174.5±6.12 cm; Mass: 68.14±8.21 kg; Body Fat %: 15.75±.63 %; Years Climbing: 7.3±4.69 years;] consented to participate and completed baseline handgrip strength (via handgrip dynamometer) and forearm girth (via tape measure). A climbing questionnaire indicated each participant's rock climbing ability and defined them as intermediate climbers. Each participant ascended one of two 5.9 YDS (Yosemite Decimal System) routes as many times as possible within 30 minutes. After each ascent, heart rate, handgrip strength and forearm girth was measured. Data were analyzed using repeated measures ANOVA and correlation with significance accepted at the p≤.05 level. **RESULTS:** Dominant handgrip strength decreased by 22% (p=0.009) and non-dominant handgrip strength decreased by 23% (p=0.002) compared to pre-climb. Dominant and non-dominant forearm girth increased by 4.4% (p=0.001, p=0.001). The average heart rate while climbing was 71±4.2 % of age-predicted HRmax. The rest times in between ascents were 1:22±33 sec. **CONCLUSIONS:** These results show that over a 30 minute bout of climbing, intermediate climbers' handgrip strength decreases and forearm girth increases. It is possible that with longer rest times, handgrip strength would not decrease as substantially. These results contribute to the existing literature and increase understanding of the physiological demands of indoor sport rock climbing.

3369 Board #57 June 1 9:30 AM - 11:00 AM
Biomechanical Comparison of Court Shoes for Indoor Sports Performance

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(No relevant relationships reported)

PURPOSE: To compare biomechanical factors between court shoes for indoor sports performance. **METHODS:** The Mizuno Wave Lightning Z (M_{WL}), ASICS Blade 5 (A_{B5}), Rocket 7 (A_{R7}), and Blast 6 (A_{B6}) court shoes were compared. 12 male Singapore handball players (age: 23.7 ± 5.8 years; height: 1.78 ± 0.056 m; weight: 69.6 ± 9.5 kg; shoe size 10.1 ± 1.0) participated in the randomized, counter-balanced study. Participants performed the vertical jump and Illinois Agility Run Test during each session, for four test sessions. Rate of perceived exertion (RPE), comfort, and fit variables were measured before and after both physical tests. **RESULTS:** No significant differences were found in maximum jump height (M_{WL}: 46.083 ± 3.059 cm, A_{B5}: 46.333 ± 2.774 cm, A_{R7}: 45.083 ± 3.777 cm, A_{B6}: 46.083 ± 3.965 cm; p = 0.341), maximum jump force (M_{WL}: 1.304 ± 0.116 N, A_{B5}: 1.283 ± 0.074 N, A_{R7}: 1.300 ± 0.088 N, A_{B6}: 1.304 ± 0.066 N; p = 0.831), and maximum landing jump force (M_{WL}: 3.212 ± 1.312 N, A_{B5}: 2.836 ± 0.850 N, A_{R7}: 2.986 ± 0.979 N, A_{B6}: 3.164 ± 1.628 N; p = 0.730) during the vertical jump. Significant differences were found between all shoes in the total time taken during the agility run (p = 0.020). A_{B5} resulted in better total time (A_{B5}: 17.493 ± 0.453 s, M_{WL}: 18.052 ± 0.432 s; p = 0.002), Straight run 4th quarter (A_{B5}: 1.575 ± 0.065 s, A_{B6}: 1.619 ± 0.062 s; p = 0.043), and Weave run 1st half (A_{B5}: 1.819 ± 0.096 s, A_{R7}: 1.873 ± 0.039 s; p = 0.019) timings. No significant difference was found in RPE values after vertical jump (M_{WL}: 1.917 ± 1.782, A_{B5}: 1.917 ± 1.443, A_{R7}: 1.833 ± 1.642, A_{B6}: 1.667 ± 1.435; p = 0.769) and agility run (M_{WL}: 6.250 ± 1.658, A_{B5}: 5.917 ± 1.929, A_{R7}: 6.000 ± 1.595, A_{B6}: 6.333 ± 1.826; p = 0.727). No significant differences were found in comfort and fit variables, even though A_{B6} had the highest overall comfort (A_{B6}: 11.867 ± 2.225, M_{WL}: 10.233 ± 2.814, A_{R7}: 11.850 ± 2.650, A_{B5}: 10.525 ± 2.650; p = 0.050) and most consistent fit variables (Shoe length: 4.08 ± 0.5, Heel region: 4.08 ± 0.515, Forefoot width: 3.75 ± 0.753, Collar: 4.08 ± 0.669; p = 0.341). **CONCLUSION:** Participants performed fastest during the agility run when

wearing ASICS Blade 5, although participants found that the ASICS Blast 6 was more comfortable and had the most consistent fit. Future research should focus on improving both shoes to enhance comfort and at the same time improve capacity in sports performance.

3370 Board #58 June 1 9:30 AM - 11:00 AM
Characterization Of The Fitness In The Military Personnel Of The Colombian Army Training Schools.

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Military personnel must assume demanding physical activities during both tactical and physical training in military installations or theaters of operations. In military operations, high levels of aerobic capacity and muscular strength are required, that is why adequate fitness (aerobic endurance, muscular endurance, strength, flexibility, body composition) is an important factor in the performance and survival. **PURPOSE:** To determine the fitness of the military personnel in training of the different schools of the Colombian Army. **METHODOLOGY:** Cross-sectional study with an analytical component, where morphological and physiological variables were measured in 120 senior Military students in the three military training schools (ESMIC-Officers, EMSUB-NCOs and ESPRO-soldiers). The body composition was evaluated by electrical bioimpedance after checking the pre-test protocol conditions. The explosive strength of the upper and lower limbs was assessed in a jump platform, with the Push-Up and Squat Jump tests without load. The flexibility was assessed by the "Sit and Reach" test, the maximum consumption of VO₂ with the "Léger" test and the prehensile force was evaluated by dynamometry. The comparisons were made using one-way analysis of variances (ANOVA) and post hoc tests. **RESULTS:** The comparison between the fitness of the students of the schools, showed differences in the consumption of VO₂ (49.8 vs 48.3 vs 53.5 ml / min / kg, p = 0.001), flexibility (4.5 vs. 3.2 vs 10 cm, p = 0.001), prehensile strength (44.4 vs 37.1 vs 48.3 kilograms, p = 0.001), flight time in the Squat Jump test (481.6 vs 451.1 vs 482.4 milliseconds, p = 0.001), flight time in the Push Up test (404.6 vs 316.7 vs 375.5 milliseconds, p = 0.001), body mass index (23.5 vs 23.7 vs 22.4 weight / height², p = 0.027) and an absolute value of fat-free mass (56.4 vs 52 vs 56 kg, p = 0.009). **CONCLUSIONS:** Although the training plan of the Colombian Army is standardized, it was found that there are differences in the fitness of personnel in military training, which could be due to the differences in intensity, volume, duration, density and frequency of training. Supported by internal Grant 001-2017 / Technological Support Command, Ejército de Colombia.

3371 Board #59 June 1 9:30 AM - 11:00 AM
A Comparison Of Physiological And Anthropometric Characteristics Among Senior And Young Elite Endurance Athletes

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(No relevant relationships reported)

Aging is a multi-factorial process. The relative contributions of decreases in maximal heart rate, stroke volume, and oxygen extraction rates as well as changes in body weight and composition to the age-related decline in maximal oxygen uptake (VO₂max) are unclear. **PURPOSE:** The purpose of this study is to compare the differences in body size and cardiorespiratory fitness among young and senior elite endurance athletes. **METHODS:** This study measured anthropometric and physiological data on 29 elite endurance athletes (mountain and road bikers, cross-country runners) made up of 12 young athletes (YA), ages 24±5.9 yrs. and 17 senior athletes (SA) ages 52±3.6 yrs. The Research Ethics Committee of ELTE University approved the study. Laboratory measurement of metabolic parameters was performed using a 2-min progressive treadmill protocol of 8 km×h⁻¹ at 3% grade, 8 km×h⁻¹ at 6% grade, 9 km×h⁻¹ at 6% grade, 10 km×h⁻¹ at 8% grade, 10 km×h⁻¹ at 10% grade, 11 km×h⁻¹ at 12% grade with additional 3% increase in grade per 2-min stage until volitional exhaustion. Anaerobic threshold (AT) was determined using ventilatory equivalents from the Vmax C29 Sensesmics (Yorba Linda, CA, USA) software. **RESULTS:** No significant differences were found between the groups' mean height (YA 178.7 ± 7.3 vs SA 174.5 ± 6.2 cm) and body mass (YA 72.8 ± 7.5 vs SA 75.8 ± 7.7 kg). Young athletes (YA) spent nearly twice as much time on the treadmill (YATST: 895 ± 114 sec.) as their senior counterparts (SATST: 529 ± 170 sec.) and their mean VO₂max was significantly higher (57.62±7.55 vs. 40.46±8.59 mL x kg⁻¹ x min⁻¹). However, only 11% of the YA total power was spent under anaerobic conditions, as compared to 43% for the SA group. The ratio of time spent in the aerobic zone during complete load calculated from the means of the values of ventilation (VE), breathing

rate (BF) and absolute aerobic capacity ($\text{VO}_{2\text{max}}$) at the AT and peak load (PE) was 80% for senior athletes (SA) and reached a value of 90% ($p < 0.05$) in the young athletes (YA). **CONCLUSIONS:** The difference between the performances of the two groups is not surprising. However, remarkable is the asymmetry of the metabolic performance of the senior athletes (SA), which may carry other pathological hazards. It is therefore important to pay great attention to the physiological characteristics of the age related performance sport.

3372 Board #60 June 1 9:30 AM - 11:00 AM

A Longitudinal Study of Muscular Fitness in Korean National Firefighters

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Firefighting is a physically demanding profession that requires optimal muscular fitness levels. Until now, there have been no studies investigating longitudinal changes and characteristics of the muscular fitness of firefighters. **PURPOSE:** To investigate the changes in the results of Korean firefighters' muscular fitness test over 6 years for each gender. **METHODS:** Muscular fitness test data was received from the National Fire Service Academy and represented firefighters working in Seoul from 2011 to 2016. We analyzed the muscular fitness from a total of 30,933 people over a 6-year period. The data was made using ANOVA and multiple regression analysis. **RESULTS:** Grip strength shows statistically significant differences between genders (Fmale = 256.808, Ffemale = 10.856, both $p < .001$) every year. Records show that grip strength decreased as age increased ($B = -.345$); records also show that grip strength improved in later years ($B = .717$). The results show that males' grip strength was higher than that of females ($B = 22.295$). Back strength increased each year showing statistically significant improvement for each gender (Fmale = 1061.565, Ffemale = 44.921, both $p < .001$). Records show that back strength decreased as age increased ($B = -1.173$); records also show improvements from year to year ($B = 6.114$). As the years went on, male firefighters saw a bigger improvement than female firefighters ($B = 80.276$). Sit-up records each year show statistically significant differences between genders (Fmale = 515.581, Ffemale = 23.336, both $p < .001$). Sit-up results decreased as firefighters aged ($B = -.395$); sit-ups increased each year ($B = 1.252$). Results among males were higher than among females ($B = 10.948$). **CONCLUSIONS:** This study provided basic data on firefighter muscular fitness tests and practical information that can be used to training programs. The characteristics of firefighter's tasks show that female firefighters need to perform their duties under the same conditions as male firefighters. However, results show that female firefighters are not testing as well in those three categories. Female firefighters should be required to carry out some tasks in emergency situations. Supported by the Field-oriented Support of Fire Fighting Technology Research and Development Program funded by NFA (MPSS- Fire safety-2017-87)

3373 Board #61 June 1 9:30 AM - 11:00 AM

Convergent Validity and Relative Reliability of Hexoskin during a Maximal Field Test

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PURPOSE: The aim of the study was to determine the convergent validity and relative reliability of a wearable metric Hexoskin "the smart shirt" during a maximal field test in measuring Heart Rate (HR) variables: resting HR and peak HR. **METHODS:** Variables were recorded simultaneously by the Hexoskin and Polar Team Pro 3. Fourteen professional male Handball players (age 21.8 ± 2.4 years) participated in the study voluntarily completed two trials of 400 m shuttle run test (10 shuttles), separated by 48h to 72h. **RESULTS:** Nearly perfect ($r=0.93$) and trivial ($r=0.009$) correlations have been shown in resting HR and peak HR, respectively, between Hexoskin and Polar Team Pro 3 results. Good ($\text{ICC}=0.715$) and low ($\text{ICC}=0.081$) intraclass correlation coefficient measured by Hexoskin. **CONCLUSIONS:** The findings indicate that Hexoskin has high validity and relatively good reliability in measuring resting heart rate and it can be used in slow activities/motions. However, it seems that quick movements affect the cardiac sensor and leads to an abnormal recording using Hexoskin.

3374 Board #62 June 1 9:30 AM - 11:00 AM

Cardiovascular Fitness In Recreational Athletes Prior To And After Anterior Cruciate Ligament Reconstruction

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(No relevant relationships reported)

Emphasis of most rehabilitation programs following anterior cruciate ligament reconstruction surgery (ACLR) is on range of motion and strength, with little, if any, focus on the recovery of cardiovascular fitness. **PURPOSE:** To evaluate cardiovascular fitness of recreational athletes from injury to 12-months post ACLR. **METHODS:** This was a prospective case series. Patients were recruited from a sports medicine clinic with an ACL rupture confirmed on MRI. Participants must have been involved in aerobic sport at least twice a week based on self-report. Study time points were baseline (as soon after injury as possible; T1), 6 (T2)- and 12-months (T3) post-ACLR. The primary outcome measure was relative $\text{VO}_{2\text{peak}}$ as measured during a graded aerobic exercise test (GXT) on a bike ergometer (Monark, Ergonomic 894E) using a metabolic measurement system (Oxycon Mobile, Carefusion). Secondary outcomes were absolute $\text{VO}_{2\text{peak}}$, Tegner activity score, and ACL-Quality of Life. Repeated measures ANOVA was performed to compare within groups between time points. **RESULTS:** Nineteen patients (13 male /6 female) consented at mean age of 22.9 ± 4.8 years. Baseline testing and surgery were performed 78 ± 48 and 152 ± 81 days post injury, respectively. Preoperative relative $\text{VO}_{2\text{peak}}$ was $33.7 \pm 6.3 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, at T2 was $32.7 \pm 8.9 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ and at T3 was $32.7 \pm 9.3 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ ($p > 0.05$). Based on ACSM cardiorespiratory fitness classifications by age and gender, there was no change in distribution from T1 to T3 ($p=0.88$). Tegner scores decreased from pre-injury to T1 (7.6 ± 1.5 vs. 3.2 ± 1.9 ; $p < 0.001$), and improved by T3 (5.1 ± 2.1 ; $p=0.003$), but did not recover to pre-injury levels ($p < 0.001$). ACL-QOL increased from T1 (32.9 ± 15.5) to T2 (53.5 ± 13.4 ; $p < 0.001$) and to T3 (70.3 ± 18.7 ; $p=0.008$). Relative $\text{VO}_{2\text{peak}}$ and Tegner score were not correlated at T1 but were at T3 ($r = 0.735$, $p=0.001$). **Conclusion:** Recreational athletes were aerobically deconditioned at two months post-ACLR rupture and did not improve with 12-months of rehabilitation following ACLR. Pre-injury aerobic fitness level could not be determined, but participants may have become deconditioned waiting for surgery. Without a conscious effort to promote aerobic fitness, recreational athletes may return to play at a suboptimal performance level with increased risk of injury.

3375 Board #63 June 1 9:30 AM - 11:00 AM

Effects of a Psyching Up Technique on Maximum Deadlift Ability: A Pilot Study

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PURPOSE: Psyching-up techniques for maximal lifting efforts are common practice among recreational and professional athletes. The use of psyching-up techniques have shown positive effects on bench press and handgrip performance, and on more complex actions such as the standing broad jump and sprinting. This has not been examined on the deadlift. The purpose of this study was to investigate the influence of a self-selected psyching up technique on maximum performance deadlift. **METHODS:** Five resistance trained men (mean \pm SD: 22.60 \pm 1.67 year, 98.76 \pm 6.94 kg, 4.7 \pm 1.64 years training experience, 2.15 \pm 0.42 deadlift strength to weight ratio) consented to participate in the study. The men had a self-reported one repetition maximum deadlift of at least one and a half times their body weight and had training experience using power lifts (power clean, deadlift, squat, or other main power lifts). Subjects were familiarized with the deadlift test protocol and observed for proper form. A cross-over study design was used in which each participant was randomly assigned to either a distraction technique or a self-selected psyching up technique prior to a maximum deadlift effort. The two trials were separated by a minimum of 72 hours. The distraction technique involved the participant having to count backwards from 100 for 100 seconds prior to exerting a maximal deadlift effort. The psyching up technique involved the participant using the self-selected psyching-up technique that they routinely used during their training for 100 seconds prior to exerting a maximal deadlift effort. A dependent t-test was used to analyze the psyching up technique on maximal weight deadlifted. **RESULTS:** There was no significant difference ($t(4) = -.512$, $p > .05$) between the self-selected psych-up technique (204.93 \pm 48.75 kg) and the distraction technique (205.75 \pm 48.92 kg) on maximal deadlift performance.

CONCLUSION: Within the limitations of this study, a self-selected psyching up technique provided no significant advantage on maximal weight lifted in the deadlift exercise compared to a distraction technique in experienced male lifters. Further investigation is recommended using a large sample size.

3376 Board #64 June 1 9:30 AM - 11:00 AM
Effect of Treadmill Protocol on Attainment of $\dot{V}O_{2\max}$ Criteria in Collegiate Women Athletes

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When performing the same test protocol, athletes from sports of differing metabolic demands may vary in the achievement of physiological criteria that are indicative of attaining maximal oxygen consumption ($\dot{V}O_{2\max}$).
PURPOSE: To examine whether the attainment of $\dot{V}O_{2\max}$ criteria differs in two sports with differing metabolic demands as a result of the graded exercise treadmill test (GXT) protocol used.
METHODS: Twenty-nine National Collegiate Athletic Association Division 1 women athletes (basketball (WBB): n=11; lacrosse (WLAX): n=18) completed a continuous GXT to volitional fatigue. Speed increased following each 1-minute stage with a 1% constant grade. $\dot{V}O_{2\text{peak}}$ indicated the highest $\dot{V}O_2$ value reached during a single test, while $\dot{V}O_{2\max}$ indicated the subject's functional limit was reached. The criteria to attain $\dot{V}O_{2\max}$ were: $\dot{V}O_2$ plateau of <0.15 L/min with an increase in the last two workloads; maximum heart rate (HR_{\max}) within 10 bpm of age-predicted heart rate max; respiratory exchange ratio (RER) ≥ 1.10 ; rating of perceived exertion (RPE, 1-10 scale) > 8 ; blood lactate (LAC) collected 5-min post-test ≥ 8 mmol/L. The attainment ≥ 3 of 5 criteria was required for $\dot{V}O_{2\max}$. Independent t-tests were used for comparison of values between teams, and chi-squared test was used for comparison of criteria attainment. Alpha level was set at $p < 0.05$.
RESULTS: Relative $\dot{V}O_{2\text{peak}}$ values did not differ between teams (WBB: 55.3 ± 8.1 ; WLAX: 53.8 ± 5.4 mL·kg⁻¹·min⁻¹). The percent of athletes that met each of the five criteria were: plateau (WBB: 55%, WLAX: 56%), HR_{\max} (WBB: 27%, WLAX: 39%), RER (WBB: 0%, WLAX: 17%), RPE (WBB: 55%, WLAX: 44%), LAC (WBB: 100%, WLAX: 83%). More WLAX attained $\dot{V}O_{2\text{peak}}$ than $\dot{V}O_{2\max}$ (55% vs. 45%). WBB was evenly distributed between $\dot{V}O_{2\text{peak}}$ (50%) and $\dot{V}O_{2\max}$ (50%). There was no statistical difference between WBB and WLAX in $\dot{V}O_{2\max}$ or the number of athletes from each team who met each individual criterion. Significant differences between teams were observed for LAC (WBB 13.3 ± 1.7 , WLAX 10.3 ± 2.3 mmol/L; $p = 0.001$) and RER (WBB 0.96 ± 0.05 , WLAX 1.04 ± 0.09 ; $p = 0.002$).
CONCLUSION: These findings suggest physiological responses to a fixed $\dot{V}O_{2\max}$ protocol may vary between sport teams of different metabolic demands. Consideration should be given to such variations when selecting test protocols and interpreting results.

3377 Board #65 June 1 9:30 AM - 11:00 AM
Evolution Of Exercise-related Dyspnea In Response To Anxiety-provoking Or Relaxing Situations In Healthy Subjects

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(No relevant relationships reported)

Exertional dyspnea, characterized as a symptom of discomfort or difficulty in breathing, is a common complaint in healthy individuals and in many pathologies. Previous studies have shown that emotions including anxiety and stress influenced the perceived unpleasantness of dyspnea. **PURPOSE:** The aim of this study was to investigate the effects of relaxing and anxiety-provoking situations on exercise-related dyspnea, heart and respiratory rates, blood pressure, mood state, anxiety and depression in healthy subjects. **METHODS:** Twenty-two healthy adults were included in this randomized cross-over study. Each participant performed three submaximal cycling exercise for 30 minutes on three separate days in a randomized order: a neutral condition (NC) with no particular effect, a relaxing condition (RC) where each subject listened to relaxing music and an anxiety-provoking condition (APC) where a horror movie was broadcast. Heart and respiratory rates, blood pressure, dyspnea using the Multidimensional Dyspnea Profile (MDP) and modified Borg scales, mood state using the Profile of Mood States (POMS), anxiety and depression using the Hospital Anxiety and Depression scale (HADS) were evaluated before and 5 minutes after each intervention. In addition, heart and dyspnea rates were measured throughout the intervention. **RESULTS:** Dyspnea and heart rates increased more with APC than NC (1.68 ± 0.15 vs 1.32 ± 0.12 RPE, $p < 0.01$ and 138 ± 2 vs 119 ± 1 bpm, $p < 0.001$). In addition, submaximal exercise with APC showed a higher increase than NC in the subscales "breathing discomfort" (2.50 ± 0.18 vs 1.86 ± 0.11 , $p = 0.02$) and "emotional response domain" (6.82 ± 1.55 vs 0.95 ± 0.34 , $p < 0.001$) of MDP, global POMS score (11.73 ± 3.58

vs -4.64 ± 2.3 , $p < 0.001$) and HADS-Anxiety subscale (8.59 ± 1.27 vs 3.27 ± 0.61 , $p < 0.001$) and the dyspnea rates (0.64 ± 0.12 vs 0.14 ± 0.07 RPE, $p < 0.001$). No significant difference were observed between NC and RC. **CONCLUSION:** Exercise-related dyspnea and anxiety increased with APC in healthy subjects. In contrast, results did not show difference in any parameters with RC. Many activities and daily life situations can lead the patient with a chronic disease to experience dyspnea. Future studies should investigate strategies to reduce dyspnea in chronic diseases and in fine, improve quality of life of these patients.

3378 Board #66 June 1 9:30 AM - 11:00 AM
Oro-nasal Mask Versus Two-way Non-rebreathing Valves For Maximal Aerobic Capacity Testing In Astronauts

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INTRODUCTION: Astronauts complete maximal aerobic capacity ($\dot{V}O_{2\max}$) testing as part of their annual fitness assessment (AFA) as well as several times once assigned to an International Space Station mission. Historically, the 2-Way T-Shape Non-Rebreathing valve with a mouthpiece and nose clip (mouthpiece) has been used in these tests. The testing procedure was updated to use the oro-nasal mask (mask) for the AFA starting in June 2017. Astronauts who used the mask during their AFA requested it be certified to be used for all mission associated tests. Considering the criticality of the data and the schedule constraints of astronauts, it is imperative that the requested hardware change provide data with equivalent reliability and repeatability as provided by the mouthpiece. **PURPOSE:** To assess the reliability of mask vs. mouthpiece by comparing submaximal and $\dot{V}O_{2\text{pk}}$ data within subjects (approximately 1 year apart). **METHODS:** Each of 17 active astronauts completed a $\dot{V}O_{2\text{pk}}$ test with the mouthpiece (first) and the mask (second) for their AFA. The $\dot{V}O_{2\text{pk}}$ test was conducted on a cycle ergometer with a metabolic cart. The nominal protocol started with a 3 minute warm-up at 50 Watts (W) and increased 25W every minute until volitional fatigue (Light: 45W start; 15W increase). The $\dot{V}O_{2\text{pk}}$ were compared between tests and the expected day-to-day variation ($\pm 5\%$) was used as the threshold for determining agreement between tests. Submaximal values were plotted and evaluated visually for deviations between mask and mouthpiece. **RESULTS:** $\dot{V}O_{2\text{pk}}$ values were more than 5% different, despite similar test times, between mouthpiece and mask in 6 of 17 comparisons, 3 of which were higher with the mask ($9.0 \pm 5.9\%$) while 3 were lower ($-10.8 \pm 2.0\%$) with the mask. The submaximal data did not indicate a leak in either apparatus during these tests. An Astronaut Strength & Conditioning Rehabilitation specialist confirmed that the measured differences in $\dot{V}O_{2\text{pk}}$ of these 6 astronauts was consistent with observed changes in exercise habits during the year that separated the two tests. **CONCLUSION:** After being presented with the results of this data mining effort the mask was accepted for use in all tests, accepting that, if a leak is detected without resolve, the test will be repeated (if schedule allows) and remaining tests will be completed with the mouthpiece.

3379 Board #67 June 1 9:30 AM - 11:00 AM
What Type Of Exercise Is Appropriate For An Optimistic Affective Mind-set?

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PURPOSE: "Affective mind-set" is a mental frame or lens that selectively organizes. Previous reports proved that activation of the left anterior brain region is linked with the optimistic affective mind-set. Aerobic exercise such as moderate-intensity interval training (MIT) and moderate continuous training (MCT) activates the frontal area of the left hemisphere, which gives euphoric feelings. However, whether interval training is appropriate for stimulating an optimistic affective mind-set is unknown. We hypothesized that interval, rather than continuous, training activates the left brain. This study aimed to evaluate which exercise can activate the left brain more by using three different kinds of bicycle exercise. **METHODS:** The participants were six healthy male volunteers. The three bicycle exercises used were MCT, MIT, and high-intensity interval training (HIT). Exercise intensity was considered in the assessment of the peak heart rate (PHR) induced by the cardiopulmonary exercise test. A 70% PHR was defined as moderate intensity; and 90% PHR, as high intensity. The MCT protocol included 3 min of warm-up (WU) and 40 min of moderate-intensity (70% PHR) continuous exercise, 3 min of cooldown (CD), and 10 min of rest. The MIT protocol was composed of a 3-minute WU, 4 term of moderate-intensity (70% PHR) exercise, active rest (45% PHR), 5-min CD, and 10-min rest. The HIT protocol was composed of

a 3-min WU, 4 term of high-intensity (90% PHR) exercise with active rest (70% PHR), 3-min CD, and 10-min rest. Brain activity was measured using electroencephalography (EEG; NegPos, Neuro Sky). EEG was performed during each session. Data were the mean values obtained at WU, CD, and 5-min rest. Δ CD-WU and Δ Rest 5-min WU were calculated. The three groups were compared via one-way analysis of variance, with the Bonferroni test for post hoc comparison. **RESULTS** A slight difference was observed among the three groups in Δ Rest 5-min WU (MIT: 42.0 ± 42.6 , HIT: -19.5 ± 48.6 , MCT: -3.8 ± 14.8 , $p < 0.057$). Δ CD-WU was not significantly different among the groups (MCT: -2.7 ± 15.8 , MIT: 39.1 ± 43.7 , HIT: -16.2 ± 51.1 , $p < 0.11$). WU and CD showed no significance differences among the three groups (WU: $p < 0.25$, CD: $p < 0.51$). **CONCLUSION** MIT is the most appropriate exercise for an optimistic affective mind-set. I have no financial relationships to disclose.

3380 Board #68 June 1 9:30 AM - 11:00 AM

Test-retest Reliability Of An Isokinetic Fatigue Test

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(No relevant relationships reported)

By performing muscular testing, such as an isokinetic fatigue test, it is possible to assess anaerobic capacity and measure how muscles perform when isolated. This might also identify weak points and which movements might be related to compensation. However, test-retest reliability is key to obtaining consistent results of muscular function. **PURPOSE:** To establish isokinetic fatigue test-retest reliability when testing without familiarization. **METHODS:** 22 masters (53 \pm 5 years), competitive female cyclists completed 2 separate 50-repetition knee extension tests (T1 and T2) on a Biodex isokinetic dynamometer, separated by one-week with no familiarization. **RESULTS:** Test-retest reliability (intra-class correlation coefficients; ICC), were calculated between T1&T2 scores for fatigue index (T1 $38.8 \pm 9.5\%$; T2 $43.7 \pm 6.9\%$), time to peak torque (T1 280.5 ± 59.8 ms; T2 284.1 ± 69 ms) average power (T1 99.0 ± 19.4 W; T2 100.5 ± 20.6 W), and average peak torque (T1 36.6 ± 6.3 N·m; T2 37.5 ± 7.1 N·m). ICCs between trials exhibited excellent reliability (.93-.97) for all variables except time to peak torque (ICC=.35) and fatigue index (ICC=.65). **CONCLUSION:** There was strong test-retest reliability for strength and power measurements in masters female cyclists during an isokinetic knee extension fatigue test. However, the test was unreliable for its purpose in determining rate of fatigue. Practitioners should seek other forms of knee extension fatigue measurement.

3381 Board #69 June 1 9:30 AM - 11:00 AM

Forearm Circumference as a Sarcopenic Indicator in Older Mexican Population. A Preliminary Study

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The 10.5% of the total Mexican population is 60 years and older, and it is expected that by the year 2050, the older adult population reaches 28.7 million inhabitants. The "fragility phenotype in the older adult", characterized by sarcopenia or loss of skeletal muscle mass and dynapenia or loss of muscle strength, affect functional capacity by impairing neuromuscular functions. **PURPOSE:** To determine the association between handgrip muscle strength and anthropometric variables associated with muscle mass in a sample of female Mexican older adults. **METHODS:** Volunteers were 40 healthy women (Age = 61.15 ± 6.1 yr.; Body Mass Index [BMI] = 27.9 ± 7.4 kg/m²) residing in Ensenada, Baja California, Mexico. A hand dynamometer (BioRadio, Great Lakes NeuroTechnologies, Cleveland, OH), was used to measure handgrip strength on the dominant hand. The maximal circumference of the dominant forearm was measured following the protocol by the International Society for the Advancement of Kinanthropometry. Bioelectrical impedance analysis (InBody 770; Cerritos, CA) was used to measure body composition. Appendicular skeletal muscle (ASM) relative to BMI and skeletal muscle index (SMI) relative to height (m²) were analyzed as anthropometric sarcopenic indicators. **RESULTS:** The older adult's mean handgrip strength and forearm circumference were 17.0 ± 3.3 kg and 25.5 ± 2.3 cm, respectively. The ASM relative to BMI was 0.6 ± 0.1 and the SMI relative to height was 6.7 ± 0.8 . Handgrip strength was related to arm circumference ($r = 0.56$, $p = 0.0001$, 95% CI = 0.31, 0.75, $R^2 = 0.32$), and SMI relative to height ($r = 0.37$, $p = 0.01$, 95% CI = 0.08, 0.62, $R^2 = 0.14$). The ASM relative to height was unrelated to handgrip strength ($r = 0.12$, $p = 0.45$, 95% CI = -0.20, -0.42, $R^2 = 0.01$). **CONCLUSIONS:** Reduced handgrip strength and SMI were observed in the female participants

compared to international norms. Forearm circumference and SMI relative to height might be considered appropriate assessment measures to explore sarcopenic condition in female Mexican older adults.

3382 Board #70 June 1 9:30 AM - 11:00 AM

Aerobic Fitness And Body Composition Of Individuals With Anterior Cruciate Ligament Reconstruction

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Anterior cruciate ligament reconstruction (ACLR) requires 6 to 9 months of rehabilitation, often resulting in long periods of sedentary behavior. Following rehabilitation, only 45% of patients fully return to pre-injury level of sport participation, placing them at elevated risk of developing a physically inactive lifestyle. It is unknown whether ACLR negatively impacts aerobic fitness and body composition in the months following surgery. **PURPOSE:** To compare body composition and aerobic fitness between women with ACLR and healthy controls. **METHODS:** Nine women with ACLR (<5 yrs post-ACLR, age = 21.2 ± 3.9 yrs) and seven healthy women (age = 22.4 ± 3.7 yrs) with no injury history completed the Tegner Activity Scale to assess current physical activity level. Body fat percentage (%BF) was estimated using air displacement plethysmography. A graded exercise test using a cycle ergometer was performed by all participants to evaluate aerobic fitness ($\dot{V}O_{2peak}$), defined as the highest 20 sec $\dot{V}O_2$ attained during the test. Maximal heart rate (HR_{max}) and time to exhaustion (mins) were measured. Variables were compared between groups using Mann-Whitney U tests due to limited sample size. **RESULTS:** Individuals with a history of ACLR had significantly higher %BF than controls (ACLR = $33.5 \pm 6.5\%$, healthy = $24.4 \pm 5.2\%$) ($p = 0.008$) and significantly lower relative $\dot{V}O_{2peak}$ (ACLR = 32.1 ± 5.0 ml/kg/min, healthy = 40.6 ± 4.4 ml/kg/min) ($p = 0.008$). No differences were observed in absolute $\dot{V}O_{2peak}$ (ACLR = 2.4 ± 0.3 L/min, healthy = 2.5 ± 0.3 L/min) ($p = 0.61$) or time to exhaustion (ACLR = 13.0 ± 1.8 mins, healthy = 14.2 ± 2.3 mins) ($p = 0.25$) on the cycle. **CONCLUSION:** Women with a history of ACLR may have greater %BF than women who have not experienced a significant lower extremity injury. No significant difference was found in aerobic fitness between the groups as absolute $\dot{V}O_{2peak}$ is typically evaluated in cycle protocols. Although individuals with ACLR displayed lower relative $\dot{V}O_{2peak}$, this was most likely due to differences in body weight between groups rather than fitness. Excessive %BF and low aerobic fitness are risk factors for chronic disease and premature mortality; therefore, it is concerning that these young women returning to activity post-ACLR have poorer body composition profiles than healthy women in this pilot study.

3383 Board #71 June 1 9:30 AM - 11:00 AM

Achievement of Healthy Fitness Zone by Academic Major in College Students from Puerto Rico

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Healthy fitness components such as body composition, cardiorespiratory endurance, and muscle strength are associated with disease risk and premature mortality. Factors influencing health related fitness in college-aged students are unclear, and academic major has not been yet considered. **PURPOSE:** To assess and compare the achievement of healthy fitness zone (HFZ) by academic major in college students from Puerto Rico. **METHODS:** College students (331 females, 258 males, 18-25 years of age) enrolled in elective courses at the Physical Education Department of the University of Puerto Rico (PR), completed the Fitnessgram® assessment protocol. Achievement of HFZ was determined for each component: strength-endurance fitness (SEF) with push-up, curl-up, and trunk lift; flexibility fitness (FLF) with back-saver sit and reach, and shoulder stretch; body composition fitness (BCF) with BMI, and %fat; and cardiorespiratory fitness (CRF) with the 20-m PACER test. Students were also classified according to their academic major: teacher education (TE), physical education (PE), natural sciences (NS), business administration (BA), and others (OP) including social sciences, humanities, communication, and general studies. Frequencies and percentages of students achieving the HFZ in each component were determined, and Chi-squares used to detect differences by academic major and sex. **RESULTS:** HFZ for the SEF component was achieved by 68% of participants, FLF by 52%, BCF by 61%, and CRF by 26%. More males than females were in the HFZ for SEF (75 vs. 57%, $P = 0.001$), and CRF (41 vs. 12%, $P < 0.001$); while more females than males were in the HFZ for BCF (65 vs. 52%, $P = 0.001$). More PE majors were in the HFZ in SEF (82% vs 68, 59, 66 and 54% for TE, NS, BA and OP majors, respectively; $P < 0.01$) and CRF (48% vs 27, 14, 34 and 19% for TE, NS, BA and OP

major, respectively, $P < 0.001$). No differences were observed by academic major for FLF and BCF. **CONCLUSION:** Although a relatively high proportion of students achieved HFZ criterion in SEF, BCF and FLF; the low proportions achieving CRF, particularly females, is of concern. Results also suggest that academic major must be considered when developing strategies to promote the achievement of HFZ in critical health components such as CRF and SEF among college students in PR. Supported by FIPI/DEGI/UPRRP.

3384 Board #72 June 1 9:30 AM - 11:00 AM

Fitness Fights Fires: Examining the Relationship between Physical Fitness and Firefighting Ability

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(No relevant relationships reported)

The physical demands of firefighting are evident, and a high level of physical fitness is required to perform the job safely. Despite the clear need for adequate physical fitness, the majority of firefighters (FF) remain unfit for duty. Regular exercise is an effective strategy to prevent/attenuate multiple health risks, as well as improve health and job performance. **PURPOSE:** To investigate the relationship between physical fitness (i.e., cardiovascular endurance and muscular endurance) and performance on the Academy FF Challenge (AFC). **METHODS:** During the first (week 1) and last (week 7) weeks of the FF academy, FF recruits' ($n=54$; 26.76 ± 4.16 yrs; 100% male) physical fitness and FF ability were assessed. Physical fitness was assessed via cardiovascular endurance (estimated $\dot{V}O_{2max}$ via 1.5-mile run time) and muscular endurance (60-second sit-ups and push-ups and Young Men's Christian Association (YMCA) bench press), while FF ability was assessed via total completion time on the AFC (Keiser Sled, Self-Contained Breathing Apparatus maze, victim drag, hose advance, equipment carry, and ladder set-up). **RESULTS:** Physical fitness predicted significant variance in FF ability at Week 1 ($R^2=0.48$; $P<0.001$) and Week 7 ($R^2=0.47$; $P<0.001$) after accounting for age and BMI. Specifically, cardiovascular endurance accounted for 28.9% ($FA(3, 50) = 22.83$) and 36.4% ($FA(3, 50) = 28.70$) unique variance, while muscular endurance accounted for 11.4% ($FA(6, 47) = 3.45$) and 10.2% ($FA(6, 47) = 3.02$) unique variance on FF ability at week 1 and 7, respectively. **CONCLUSIONS:** Firefighting is a challenging occupation that requires these individuals to be in peak physical condition. Targeting FFs early in their careers and highlighting the importance of fitness is extremely vital to developing healthy, safe, and efficient FFs. By better understanding the relationship between physical fitness and firefighting ability, exercise specialists, researchers, and physicians may be able to better prescribe exercise in this population.

3385 Board #73 June 1 9:30 AM - 11:00 AM

Developing Criterion-Referenced Standards for Cardiorespiratory Fitness Among Canadian Adults Aged 18-69 Years

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(No relevant relationships reported)

PURPOSE: Cardiorespiratory fitness levels among adults are an important indication of general health. The aim of this project was to develop criterion-referenced standards for estimates of cardiorespiratory fitness in Canadian adults aged 18-69 years using a nationally representative sample, and body mass index (BMI) as the criterion measure. **METHODS:** Cross-sectional data were obtained from cycles 1 (2007-09) and 2 (2009-11) of the Canadian Health Measures Survey. The modified Canadian Aerobic Fitness Test (mCAFT) was used to predict cardiorespiratory fitness (as $\dot{V}O_{2max}$). Measured height and weight were used to calculate BMI. Obesity was classified as having a BMI greater than $30 \text{ kg} \cdot \text{m}^{-2}$. Receiver operating characteristic curves were used to identify cardiorespiratory fitness standards that optimized both sensitivity and 1-specificity (Youden's J) for males and females, separately, across five age groups (i.e., 18-29, 30-39, 40-49, 50-59, and 60-69 years).

RESULTS: A total of 4,967 participants (53% female, $M_{age} = 41.0 \pm 13.8$ years) were retained for the present analyses. The area under the curve ranged from 0.79-0.86 in males, and 0.85-0.92 in females. The optimal standards for cardiorespiratory fitness using BMI as the criterion measure ranged from $13.1\text{-}31.7 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ for males, and $16.9\text{-}32.6 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ for females. The cardiorespiratory fitness standards were slightly higher for females in comparison with males when matched for age.

CONCLUSIONS: These cardiorespiratory fitness standards may be useful in public health settings, particularly in Canada. Future research should further investigate other criterion measures, and research should validate these cut-points to see if they adequately discriminate individuals with chronic diseases.

3386 Board #74 June 1 9:30 AM - 11:00 AM

Relationship Between Maximal Respiratory Muscle Pressure and Strength and Anthropometric Variables in Healthy Young Adults

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Traditionally, evaluation and training of respiratory muscle strength (RMSt) have been planned and performed independently of gender. RMSt, measured as maximal inspiratory and expiratory pressures (MIP and MEP, respectively), has been related to musculoskeletal characteristics, such as muscle mass and strength, which might be aspects that influence RMSt development. These musculoskeletal features usually differ among genders, and therefore, it seems plausible that their relationships with RMSt would be different as well, for women and men. This might be an important issue, as assessment and training of RMSt maybe should be planned in accordance of the patient's gender.

PURPOSE: to determine the correlations between RMSt and musculoskeletal characteristics, for women and men.

METHODS: After obtaining informed consent from each participant, 71 young adults (41 men, 30 women, age 21.6 ± 3.5 and 21.7 ± 1.4 years, respectively) with normal BMI, were assessed in RMSt with MIP and MEP, general muscle strength (GMSt) with a back and leg dynamometer, and chest, arm, thigh and leg corrected perimeters (CP), according to the ISAK protocol. Normal distribution of data was confirmed with D'Agostino and Pearson test and Pearson's r coefficient was used to determine correlations between RMSt and GMSt and anthropometric variables. A p value < 0.05 was considered of statistical significance.

RESULTS: In women, the only correlation found was a direct and moderate correlation between PEM and GMSt ($r=0.46$; $p=0.01$). As for men, PIM had direct and moderate correlations with GMSt ($r=0.53$; $p<0.01$), arm CP ($r=0.44$; $p<0.01$), thigh CP ($r=0.40$; $p<0.01$) and chest CP ($r=0.47$; $p<0.01$), and a direct and weak correlation with leg CP ($r=0.36$; $p<0.05$); PEM had a direct and moderate correlation with GMSt ($r=0.40$; $p<0.01$).

CONCLUSIONS: According to these findings, gender would be an important aspect to be considered when planning RMSt assessment and training, as musculoskeletal mass and strength in women and men would be related to RMSt in a different manner, and therefore, having different implications in RMSt development.

3387 Board #75 June 1 9:30 AM - 11:00 AM

Health Related Fitness Comparison between 1st Year and 4th-6th Year College Students in Puerto Rico

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First year of college is a critical transition period when young adults begin to make lifestyle choices influencing long-term behaviors and health. Cardiorespiratory fitness (CRF) and body fat (BF) are two health-related fitness (HRF) components known to increase disease risk and premature mortality. These components are also known to negatively change during 1st year in college; however, little is known about changes in all health-related fitness components through college years. **PURPOSE:** To evaluate and compare HRF between 1st year and 4th-6th year college students in Puerto Rico.

METHODS: College students taking elective courses at the Physical Education Department of the University of Puerto Rico, were divided in two groups based on academic year: 1st year (28 females, 48 males; 18.5 ± 1.1 years of age) and 4th-6th year (184 females, 114 males; 21.8 ± 1.0 years of age). HRF was assessed using the Fitnessgram® protocol including measures of height, weight, skinfolds (triceps, calf, and abdomen), push-ups, curl-ups, trunk lift, back saver sit and reach, shoulder stretch, and PACER. Non-parametric Wilcoxon-Rank tests were used to detect differences between groups and between sex, and Chi-square analysis to detect differences by healthy fitness zone (HFZ) classification. **RESULTS:** Compared with 1st year, 4th-6th year students had higher BF (19.6 ± 6.6 vs. $23.5 \pm 6.8\%$, $P<0.001$), and lower number of curl-ups (45.3 ± 22.8 vs. 32.4 ± 20.9 , $P<0.001$), push-ups (21.8 ± 11.8 vs. 15.8 ± 12.3 , $P<0.001$), and $\dot{V}O_{2max}$ estimated from PACER (42.4 ± 8.6 vs. $32.3 \pm 7.5 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$, $P<0.001$). No group differences were observed for BMI, trunk lift, and flexibility. A higher proportion of 1st year students classified in the HFZ compared to 4th-6th year in curl-ups (90 vs. 71%, $P=0.002$) and PACER (49 vs. 16%, $P<0.001$). A higher proportion of males classified in the HFZ compared with females in push-ups (79 vs. 64%, $P=0.003$), sit and reach (91 vs. 71%, $P<0.001$), and PACER (40 vs. 10%, $P<0.001$); while more females classified in the HFZ in shoulder stretch (84 vs. 65%, $P<0.001$) and BMI (69 vs. 57%, $P=0.03$). **CONCLUSION:** Important declines in HRF

components associated with cardiorespiratory and muscle health between 1st and 4th-6th year college students highlights a critical need for interventions promoting healthier lifestyles in this young age group.

3388 Board #76 June 1 9:30 AM - 11:00 AM
Acute Effect of Ischemic Preconditioning on Special Judo Fitness Test

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Ischemic preconditioning improves the physical fitness of athletes of different sports modalities. However, until now, there is no evidence of the effect of ischemic preconditioning (IPC) on the performance of judo athletes.

PURPOSE: Verify the acute effect of IPC on the Special Judo Fitness Test (SJFT) performed by judo athletes. **METHODS:** The study involved 17 judo athletes (age=21.35 ± 3.46 years, practice experience=8.94 ± 3.88 years, height = 1.73 ± 0.9m, body mass=69.34 ± 10.94kg). In the first session, they answered the questionnaires, underwent the anthropometric evaluation and the familiarization of the SJFT. The SJFT was used to evaluate the athletes' physical fitness. In the second and third sessions, two experimental protocols were performed in a randomized and counterbalanced manner: a) IPC (3 cycles x 5 min ischemia at 220 mmHg / 5 min reperfusion at 0 mmHg) + SJFT and b) SHAM (3 cycles x 5 min ischemia at 20 mmHg / 5 min reperfusion at 0 mmHg) + SJFT. A 30 minute interval between the experimental protocols and the SJFT and 72 hours between the 2nd and 3rd sessions was observed. Statistical tests of variance homogeneity and Student's t test were performed to verify possible differences between the IPC and SHAM groups in the following measures: number of throws in the SJFT per series, total number of throw in the SJFT and SJFT index. The magnitude of the difference between IPC and SHAM conditions was assessed using the effect size (d=Cohen's). **RESULTS:** The IPC performed a larger number of throws in the SJFT per series (p=0.004, d=0.50, moderate effect) compared to SHAM. When we analyzed the total number of throws we found a significant difference between the IPC and SHAM groups (p=0.001, d=0.37, small effect). The SJFT index showed a significant difference between IPC and SHAM (p=0.001, d=0.50, moderate effect). **CONCLUSION:** IPC improves the physical fitness of judo athletes.

3389 Board #77 June 1 9:30 AM - 11:00 AM
Does Dynamic Stretching Warm-up Influence Hockey Players' Anaerobic Performance During A Wingate Anaerobic Test?

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PURPOSE: The aim of this study is to determine whether dynamic stretching warm-up prior the Standard National Hockey League Wingate Anaerobic Test (DSW+SNHL) would improve anaerobic performance compared with the Standard National Hockey League Wingate Anaerobic Test (SNHL) of hockey players. **METHODS:** Twenty volunteer ice hockey players (ten males and ten females) visited the laboratory twice to perform the DSW+SNHL and SNHL in a randomized and counterbalanced order. If participants performed the DSW+SNHL on the first day of testing, then they performed the SNHL on the second day of testing and vice versa. The dynamic stretching warm-up consisted of ten different dynamic movements that lasted ~six minutes and targeted the prime movers and the main joints involved in the skating technique. The Wingate Anaerobic Test was comprised of a thirty-second maximal effort sprint performed on a mechanical cycle ergometer with workload representing 7.5% of the participant's body mass. Peak power output (PPO), relative peak power (RPP), anaerobic capacity (AC), and anaerobic fatigue index (AFI) were calculated and compared between conditions (DSW+SNHL and SNHL). **RESULTS:** Paired T-test or Wilcoxon Signed Rank Test analyses showed that for PPO, there were no statistically significant differences between DSW+SNHL (855.3±168.7 W) and SNHL (831.9±159.1 W) (p=0.105). For RPP and AFI, statistical analyses showed that were marginal trends (p=0.055 and p=0.062, respectively) between DSW+SNHL (RPP=11.8 ± 1.5; AFI=48.9±8.7%) and SNHL (RPP=11.5±1.4; AFI=51.0±9.4%). AC showed statistically significant differences between DSW+SNHL (618.7±117.5 W) and SNHL (585.5±110.0 W) (p=0.0008). **CONCLUSION:** The dynamic stretching warm-up did not improve peak power output, but relative peak power and anaerobic fatigue

index may benefit from dynamic stretching warm-up. However, anaerobic capacity performance improved when dynamic stretching warm-up was performed prior to the standard National Hockey League Wingate Anaerobic Test. **Research supported by New Hampshire-INBRE through an Institutional Development Award (IDeA), P20GM103506, from the National Institute of General Medical Sciences of the NIH".**

3390 Board #78 June 1 9:30 AM - 11:00 AM
Validation of an 8-minute Self-Paced Graded Exercise Testing Protocol to Elicit Maximal Responses

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Recent examinations have turned to the development and validation of a 10-min self-paced graded exercise testing protocol. The 10-min duration was chosen because it represents the mean value of the recommended 8-12min ideal protocol duration; however, literature exists suggesting that an 8min duration may be more appropriate to elicit maximal exercise responses. Furthermore, a gender effect may exist to explain the finding. **PURPOSE:** We sought to examine maximal exercise responses during an 8-min self-paced (8SPV), 10-min self-paced (10SPV) and standardized graded exercise testing (GXT) treadmill protocols. **METHODS:** Sixteen recreationally active males (n=8) and females (n=8) completed three separate tests in a randomized order: a) 8SPV consisting of eight 1-min stages of increasing speed clamped by the Borg RPE₆₋₂₀ scale, b) 10SPV consisting of five 2-min stages clamped of increasing speed clamped by the Borg RPE₆₋₂₀ scale, c) traditional Bruce protocol as the GXT. 8SPV and 10SPV maintained a 3% grade. A two-way (gender x protocol) ANOVA with repeated measures was employed to examine differences in maximal responses between protocols. Paired samples t-tests were used to examine the difference in maximal velocity between 8SPV and 10SPV. **RESULTS:** No gender effects were revealed. Maximal values for 8SPV, 10SPV and GXT were similar (p > 0.05) for oxygen consumption (48.0±5.6; 51.8±10.5; 51.4±7.5 mL·kg⁻¹·min⁻¹), heart rate (193±11; 195±9; 194±13 beats·min⁻¹), respiratory exchange ratio (1.11±0.07; 1.12±0.06; 1.13±0.05), ventilation (103.2±22.4; 113.0±30.3; 112.3±33.0 L·min⁻¹), respectively. Maximal velocity for 8SPV and 10SPV were also similar (15.1±3.1 vs. 14.6±2.7 km·hr⁻¹, p > 0.05). **CONCLUSION:** Given no differences between protocols, 8SPV may serve as a valid and time efficient option to elicit maximal responses during self-paced exercise in recreationally trained college-aged men and women.

3391 Board #79 June 1 9:30 AM - 11:00 AM
Thirty Years Aerobic Power Secular Trend in an Epidemiological Transition Community

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 (No relevant relationships reported)

PURPOSE: To analyze the aerobic power in male students in a region with typical epidemiological shift (city of Ilhabela).

METHODS: The study is part of the Mixed-Longitudinal Study on Growth and Development from Ilhabela, organized by CELAFISCS since 1978. Sample consisted of 197 boys, aged from 12 to 14 years-old, divided in 4 groups: 1978 (n=41), 1988 (n=43), 1998 (n=61), and 2008 (n=52). Aerobic power was predicted through a cycle-ergometer submaximal test, that provided VO₂max in absolute and relative values. An ANOVA one way, with a post-hoc Scheffé, was taken to analyze the values. A p < .01 was taken as a significant one.

RESULTS: VO₂max in l/min and ml/kg/min values were, respectively, in 1978: 2.4 l/min and 61.7 ml/kg/min; in 1988: 2.0 l/min and 51.4 ml/kg/min; in 1998: 1.9 l/min and 44.5 ml/kg/min; and in 2008: 1.6 l/min and 33.6 ml/kg/min. It represented a VO₂ max decline of 41% in l/min and of 58.6% in ml/kg/min when 1978 data were compared to 2008. As another sign of aerobic deterioration, an increase of 10 bpm was observed in rest heart rate. In the same period it was observed an increase of 11.4 kg in body weight, and an increase of BMI from 17.1 to 18.1.

CONCLUSIONS: It was observed a marked decline in the aerobic power in absolute and relative values, between 1978 and 2008, suggesting a deterioration in physical activity level in that community.

- 3392** Board #80 June 1 9:30 AM - 11:00 AM
Physical Activity Characteristics of Recreational Doubles Pickleball
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(No relevant relationships reported)

Pickleball is the fastest growing racquet sport in the United States and is particularly popular among older adults. Because the typical frequency, intensity, and duration of play is undefined, the extent to which Pickleball participation can contribute to meeting physical activity guidelines is unknown. **PURPOSE:** To estimate the typical frequency, intensity, and duration of physical activity during recreational pickleball play. **METHODS:** A convenience sample of 25 players (59.0 ± 15.8 yrs) wore an Actigraph GT3X+ on their waist and rated their perceived exertion (RPE) for 2 to 5 games of recreational doubles play. Data were collected in 5-sec epochs and the Sasaki (2011) cutpoints were used to calculate the percent of game play spent in light, moderate and vigorous intensity activity. Players also reported their typical pickleball participation (frequency, duration, and subjective exertion level) during the past 3 months via an online survey. **RESULTS:** Players reported playing pickleball 96-240 minutes per session for 2-6 days per week (537.5 ± 381.3 mins/week). On average, $63.5 \pm 14.3\%$ of game play was at moderate or higher intensities ($47.1 \pm 10.3\%$ at moderate) based on Actigraph estimates. This was in general agreement with self-reported intensity levels (11.8 ± 1.3 on RPE scale). Assuming only 50% of reported weekly pickleball participation is spent in actual game play, it is estimated that players typically engage in an average of 162.5 ± 140.8 mins/week (range: 53.8- 526.2 mins/week) moderate and vigorous intensity activity during play. **CONCLUSIONS:** For most recreational pickleball players, over half of the duration of doubles play is spent at a moderate or higher intensity. This suggests that participation in recreational pickleball may be a viable strategy for increasing health enhancing physical activity in adults. However, the physical activity characteristics of pickleball play should be examined using alternative measures of intensity and in larger, more diverse, samples of players.

- 3393** Board #81 June 1 9:30 AM - 11:00 AM
Relationship Between Bone Mineral Density & Grip Strength in Collegiate Athletes
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(No relevant relationships reported)

Increases in bone mineral density (BMD) and hand-grip strength (HG) are important indicators of repetitive loading and resistance training. While the assessment of BMD is not always feasible, HG may provide an indicator of overall bone health. However, this relationship has yet to be determined in elite athletes. **PURPOSE:** The purpose of this study was to determine the relationship between HG and BMD in male and female NCAA collegiate athletes.

METHODS: Sixty-nine male and forty-eight female athletes from various sports (e.g., basketball, football, tennis, soccer) agreed to participate in this study. For each athlete, BMD was measured via dual energy x-ray absorptiometry; while HG was assessed with a hand-grip dynamometer. Each participant completed three HG trials for each hand with the elbows flexed at a 90-degree angle. Pearson's product correlations were used to determine the significance of the relationship between BMD and HG measurements.

RESULTS: Pearson's product correlations demonstrated a moderate-to-strong significant association between BMD and HG for both the dominant ($r=0.75$, $p<0.01$) and non-dominant hand ($r=0.72$, $p<0.01$) in the entire group. For males, BMD displayed a significantly low-to-moderate correlation with both dominant ($r=0.49$, $p<0.01$) and non-dominant ($r=0.46$, $p<0.01$) HG. For females, BMD exhibited a significant moderate correlation between HG in the dominant ($r=0.55$; $p<0.01$) and non-dominant ($r=0.49$; $p<0.01$) hand.

CONCLUSIONS: Results suggests that repetitive loading, along with increased resistance training, particularly in collegiate athletes may reflect this association between BMD and HG strength. While only HG strength was measured, stronger relationships may exist between BMD and lower body strength, as the athletes tested in the current study engaged in primarily lower-body dominant sports.

- 3394** Board #82 June 1 9:30 AM - 11:00 AM
Correlation Between Activity-type Heart Rate Estimated Energy Expenditure and Indirect Calorimetry
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Estimating energy expenditure (EE) during exercise is important for tracking energy balance as well as maintaining EE as an individual becomes more accustomed to exercise. Technological advances have led to the purported ability of heart rate (HR) monitors to accurately estimate EE based on user indicated activity (e.g., resistance training, interval training, etc.). However, the accuracy of these devices using "multi-sport" has yet to be established. **PURPOSE:** To determine the accuracy of user indicated activity HR chest strap monitors for estimating EE. **METHODS:** Fourteen males ($n=14$) ages 20-36 yrs completed two circuit weight training protocols with integrated high-intensity interval training. Both trials were equated for total volume-load and lasted exactly 43.25 min. Following the exercise portion, each participant completed a 20-min excess post-exercise oxygen consumption measurement. Prior to each exercise protocol the HR monitor watch was set using individual subject anthropometric data and age. Heart rate was continuously monitored during the trials by watch device and portable metabolic analyzer. Comparisons of EE (kcal) were performed between estimations by HR monitor and via indirect calorimetry. Device comparisons for EE were made using paired t-tests, Pearson correlation and Bland-Altman analysis (SPSS v22; $p \leq .05$). **RESULTS:** Estimated EE was significantly higher with the user indicated activity HR monitor chest strap compared to indirect calorimetry (596.9 ± 121.2 kcal vs. 484.2 ± 44.9 kcal, $p<.001$). Correlational analysis determined there was a significant moderate-strong positive relationship between HR monitor and indirect calorimetry ($r=0.56$, $p=.002$). Average HR during the protocol was 149.7 ± 14.3 bpm and percent-maximum HR was $78.5 \pm 5.9\%$. **CONCLUSION:** Despite accounting for activity type in the EE estimation software, HR derived estimations of EE appear to be far higher than those estimated by indirect calorimetry during high-intensity activity. Specifically, this is true for vigorous intensity exercise as indicated by %HRmax.

- 3395** Board #83 June 1 9:30 AM - 11:00 AM
Comparison of Student Administered vs Computerized Test Results in the Wingate Anaerobic Test
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PURPOSE: The Wingate test (WAnT) is an exercise test designed to measure anaerobic capacity and peak power output. WAnT procedures are conducted through observation of the number of revolutions on a stationary bike. The number of counted revolutions is then used to calculate power output at five-second increments for 30 seconds. It is suspected that student counts can introduce error and lack precision particularly in partial revolutions. The purpose of this study was to examine the deviation between student's calculations and computerized measurement.

METHODS: Undergraduate exercise physiology students ($N=28$) were selected to conduct the WAnT procedure. Student observations were collected using the Monark 894E ergometer so that computerized power ratings could be collected simultaneously to student counts. Student results were then directly compared to scores from the Monark software.

RESULTS: A paired samples t-test revealed that student estimates of peak power were significantly lower ($M = 676.72$ W, $SD = 260.09$) than computerized testing results ($M = 714.78$ W, $SD = 286.04$), with a statistically significant mean underestimate of 38.05 W, 95% CI [4.96, 71.14], $t(27) = 2.36$, $p = .026$, $d = .446$. Additionally student fatigue index calculations ($M = 43.9\%$, $SD = 9.7\%$) underestimated power drop compared to the computerized results ($M = 53.3\%$, $SD = 14.8\%$), with a statistically significant mean underestimation of 9.4%, 95% CI [5.38%, 13.42%], $t(27) = 4.80$, $p < .01$, $d = .907$.

CONCLUSIONS: The WAnT procedure can be an effective tool for measuring anaerobic capacity for both sports performance and research purposes, however, this study found that there were significantly different values between computer derived testing results and human counting. Therefore when a high level of precision is required, it is recommended that WAnTs are conducted using the computerized software to maximize accuracy, especially when being administered by students. In the classroom, exercise physiology instructors should emphasize practice of WAnT administration to ensure more accurate measurements.

3396 Board #84 June 1 9:30 AM - 11:00 AM Physiological Responses of Arena Polo Players during Simulated Game Play

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(No relevant relationships reported)

Arena polo is surging in popularity as compared to outdoor polo due to the reduced space and horse requirement. Limited information exists on the physiological demands of polo with no information for arena players. **PURPOSE:** To document the oxygen consumption (VO_2), ventilation (VE), and respiratory exchange ratio (RER) in conjunction with heart rate (HR) involved in arena polo to better inform players of the physical requirements of participation. **METHODS:** VO_2 , VE, RER, and HR were measured in triplicate with random assignment of horses using a portable telemetric oxygen analyzer coupled with a heart rate monitor on a convenient sample of five female arena polo players (Age: 27 ± 6 yr; Weight: 73 ± 13 kg; Height: 177 ± 3 cm). Data were recorded on each player during designated riding sessions which included a prescribed and free choice warmup, mock gameplay (chukker), and five-minute recovery. Descriptive statistics for each variable (Mean \pm SE) were calculated for each time period. A one-way ANOVA was performed to determine differences between time periods within a session, and a linear regression was used to determine if horses affected the physiological responses. **RESULTS:** Descriptive statistics are presented in Table 1 showing an increase in VO_2 , VE, and HR for free choice and chukker. Horse had no effect ($P > 0.05$) on HR ($r^2 = 0.04$), VE ($r^2 = 0.03$), VO_2 ($r^2 = 0.06$), or RER ($r^2 = 0.13$). **CONCLUSION:** Arena polo constitutes intense exercise with gameplay that mimics increased physiological demands comparable to traditional sports above warmup and recovery. Horse does not influence physiological responses, indicating that competition intensity is the primary driver of metabolic demand.

Table 1. Mean \pm SE of heart rate (HR), ventilation (VE), oxygen consumption (VO_2), and respiratory exchange ratio (RER) of arena polo players during each time period.

^{a,b,c}Values within a column lacking a superscript differ ($P < 0.001$).

	HR (bpm)	VE (L/min)	VO_2 (mL/min/kg)	RER
Warmup	139 \pm 1 ^b	37 \pm 1 ^b	17.4 \pm 0.3 ^b	0.97 \pm 0.01
Free Choice	164 \pm 2 ^a	61 \pm 2 ^a	23.3 \pm 0.6 ^a	0.97 \pm 0.02
Chukker	169 \pm 1 ^a	57 \pm 1 ^a	24.9 \pm 0.4 ^a	0.96 \pm 0.01
Recovery	136 \pm 2 ^b	26 \pm 1 ^c	10.8 \pm 0.5 ^c	0.98 \pm 0.01

3397 Board #85 June 1 9:30 AM - 11:00 AM Exploring Upper Quarter Y-Balance Test Biomechanical Strategies in Active College Students

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(No relevant relationships reported)

The Upper-Quarter Y-Balance test (UQYBT) is frequently used to assess shoulder function and stability, and core stability. UQYBT consists three reaching tests in push-up position, Superior-Lateral Reach (SR), Inferior-Lateral Reach (IR), and Medial Reach (MR). Several studies identified differences between genders, sports, and pathologies. However, mechanical strategies during the UQYBT were not explored between the reaching tests.

PURPOSE: To identify vertical ground reaction force (Fz) and center of pressure area (CPa) patterns globally between the three reaching tests and moderated by gender, and handedness. **METHODS:** Twenty college students participated, eight females (25 ± 5 yrs; 65 ± 11 kg; 164 ± 5 cm) and 12 males (23 ± 4 yrs; 83 ± 17 kg; 179 ± 7 cm). After 10 min warm up on an arm ergometer, participants performed three trials of UQYBT on a force plate. The highest scores for each test for each arm were collected and further analyzed. The average of the three reach scores, composite score (COMP), were calculated for each arm. All scores were normalized to the right arm's length. Fz was normalized to body weight in push-up position and CPa was calculated for each test. ANOVAs tests were used. **RESULTS:** No differences in force were observed between %MRFz, %IRFz, %SRFz ($80 \pm 22\%$, $81 \pm 16\%$, $90 \pm 23\%$, $p = 0.06$) and in area between IRCPa, MRCPa, SRCPa (126 ± 159 mm², 123 ± 119 mm², 127 ± 124 mm², $p > 0.05$). Females carried less body weight in the plank position ($66 \pm 3\%$ vs. $71 \pm 5\%$, $p < 0.01$) and had a higher score in the UQYBT %IR ($89 \pm 15\%$ vs. $78 \pm 9\%$, $p < 0.01$). No differences were observed in %SR ($75 \pm 15\%$ vs. $70 \pm 12\%$, $p > 0.05$), %MR ($97 \pm 8\%$ vs. $97 \pm 8\%$, $p > 0.05$), and %COMP ($87 \pm 11\%$ vs. $82 \pm 8\%$, $p = 0.07$). The non-dominant arm portrayed higher forces in %MRFz ($89 \pm 19\%$ vs. $70 \pm 21\%$, $p < 0.01$), %IRFz ($86 \pm 14\%$ vs. $75 \pm 17\%$, $p < 0.05$), %SRFz (98 ± 19 vs. $81 \pm 24\%$, $p < 0.05$). However, no differences were observed in UQYBT, %IR ($82 \pm 13\%$ vs. $82 \pm 13\%$, $p > 0.05$), %SR ($73 \pm 13\%$ vs. $71 \pm 14\%$, $p > 0.05$), %MR ($99 \pm 9\%$ vs. $96 \pm 8\%$, $p > 0.05$), and %COMP ($85 \pm 10\%$ vs. $83 \pm 9\%$, $p > 0.05$). **CONCLUSION:** Globally, no differences in Fz and CPa patterns were identified in UQYBT. Similar results were found between genders. In contrast,

differences in Fz were identified in the handedness condition, while no differences found in the UQYBT scores, which may be related to compensation mechanism in the non-dominant arm.

3398 Board #86 June 1 9:30 AM - 11:00 AM The Role of Asymmetrical Strength Deficit on Balance and Fall Risk in a Mature Population.

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(No relevant relationships reported)

The bilateral deficit (BLD) refers to the phenomenon where the sum of force from each leg is individually greater than the force produced of both legs simultaneously. Muscular strength is often measured in one limb and this tends to be stronger in the dominant leg, and the average or sum of strength in both legs is used for analysis. In many individuals, especially older populations, there can be a difference in muscular strength between each leg, which is termed the asymmetrical difference. There is a paucity of information regarding the asymmetrical difference on fall risk. **Purpose:** The purpose was to evaluate single leg strength and asymmetrical deficits relative to balance performance and fall risk in an active elderly population. **Methods:** 7 male and 5 female (Age: 72.3 ± 5.8 yr, Height: 169.7 ± 11.2 cm, Body Mass: 77.2 ± 15.8 kg) volunteered to participate. Subjects were healthy, asymptomatic, ≥ 65 years and participated in exercise an average of twice per week (including resistance and cardiovascular exercise). Leg strength was assessed with a unilateral (UL) 12-RM single-leg (left & right) and a bilateral leg protocol (BL) on a variable resistance leg press machine and balance was assessed with both the Bilateral Comparison Test (BCT) and the Fall-Risk Screening Test (FRST) on the Biodex Balance System. Familiarization trials preceded testing by a minimum of 72 hrs. with balance tests performed first followed by strength tests. **Results:** 5 participants displayed an asymmetrical difference (1.32 ± 1.8 kg), Pearson correlation statistical analysis revealed no significant relationship with overall balance performance (8.26 ± 2.27 composite score, $r = -0.151$, $p < 0.05$) and no significant difference between right UL (1.24 ± 0.36 overall sway, $r = -0.174$, $p < 0.05$) and left UL (1.34 ± 0.60 overall sway, $r = 0.405$, $p < 0.05$). **Conclusion:** This small sample of active seniors failed to provide a significant correlation between an asymmetrical deficit and balance performance. An asymmetrical deficit does not appear to increase the chance of falls in older adults in this cohort. A larger sample size and a comparison to a sedentary population may provide additional insight.

3399 Board #87 June 1 9:30 AM - 11:00 AM Alpha And Beta Wave Eeg Activity During A Self-paced Vo₂Max Test In Middle-aged Adults

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Electroencephalography (EEG) is a non-invasive method of assessing electrical activity of the brain, and can be used during exercise. Previous studies using younger adults have shown a decrease in relative power spectral density (PSD) toward the end of a maximal exercise test, suggesting an inhibitory role of the prefrontal cortex at high intensities. However, this response is not consistent between studies, and unknown in middle-aged individuals. **PURPOSE:** To determine how brain activity changes throughout a self-paced incremental maximal exercise test in middle-aged adults. **METHODS:** This study included ten middle-aged (49.1 ± 3.2 years) recreationally active individuals (3 men, 7 women). A self-paced $\text{VO}_{2\text{max}}$ (SPV) test was performed on a cycle ergometer, while subjects wore a wireless EEG electrode strip. This test consisted of five 2-min. stages using prescribed rating of perceived exertion (RPE) levels of 11, 13, 15, 17 and 20 (in that order). A ParvoMedics metabolic cart was used to analyze expired gases. Alpha (8-13 Hz) and beta (13-30 Hz) wave activity in the prefrontal and motor cortices (PFC and MC) were determined via PSD using Welch periodograms. Values were compared to an eyes open resting condition taken prior to exercise. Repeated-measures ANOVAs were used to determine the effect of test stage on EEG activity. **RESULTS:** The mean $\text{VO}_{2\text{max}}$ was 37.6 ± 7.2 ml·kg⁻¹·min⁻¹. Relative PSD in both the alpha and beta frequency bands increased with corresponding increases in exercise intensity. In the PFC, there was a significant main effect of test stage in both the alpha and beta frequencies ($p = .013$ and $.034$) respectively. In the MC, the main effect of time was significant in the alpha ($p = .033$), but not the beta ($p = .080$) frequency. Large increases in relative PSD were seen in the transition from RPE17 to RPE20 (e.g. 7.6 ± 2.0 $\mu\text{V}^2 \cdot \text{Hz}^{-1}$ to 16.1 ± 4.6 in the MC beta wave analysis). **CONCLUSIONS:** This study suggests that for middle-aged individuals, there is no decline in EEG activity in either the prefrontal or motor cortices during a maximal

exercise test. As a result of increasing RPE levels, there was a concomitant increase in relative PSD. These results also corroborate previous studies showing RPE17 as an important threshold for determining optimal cognitive function during exercise.

3400 Board #88 June 1 9:30 AM - 11:00 AM
Bilateral Weight Distribution Asymmetry in the Functional Movement Screen Deep Squat

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(No relevant relationships reported)

The functional movement screen (FMS) deep squat (DS) is used to identify movement deficiencies and potentially predict injury. While evidence does not support the predictive validity of FMS scores, useful information can still be obtained. Weight shifts are often observed in the FMS DS, but current literature lacks information about asymmetrical weight distribution. **PURPOSE:** To determine the amount of weight distribution asymmetry in physically active young adults during the FMS DS. **METHODS:** Nineteen physically active participants (11 F, 8 M, 20.2 ± 1.0 yo) were recruited and granted informed consent. Participants performed three trials of the FMS DS with feet flat (FF) followed by three trials with elevated heels (EH) elevated on a 2x6 board. Trials were completed on two embedded force plates (1200Hz). Vertical ground reaction force (vGRF) data were used to determine asymmetry in bilateral weight distribution. Six reflective markers placed bilaterally on the greater trochanter, lateral femoral epicondyle and lateral malleolus were tracked with a 10-camera motion analysis system (120Hz). A Matlab script processed the data and computed knee flexion angle and vGRF asymmetry at squat initiation and full squat. Paired samples t-tests with a significance level of 0.05 were used. **RESULTS:** A significant increase ($p < 0.01$) in knee flexion occurred in the EH squat condition (Left $105.9 \pm 20.2^\circ$, Right $105.8 \pm 20.5^\circ$) compared to FF (Left $100.8 \pm 22.5^\circ$, Right $101.0 \pm 23.1^\circ$). On average, participants experienced $>5\%$ asymmetry (0% being perfectly symmetric) for the starting position and full squat position during both FF and EH. There were no significant differences in weight distribution symmetry in the starting position ($p = 0.31$) between squat conditions. The EH condition did not significantly change weight distribution symmetry ($p = 0.69$) in the full squat position. Within squat condition, there was no significant differences between weight distribution symmetry from the starting position to the full squat position (FF: $p = 0.76$, EH: $p = 0.43$). **CONCLUSION:** Bilateral weight distribution asymmetry was present in the FMS DS both with flat and elevated heels in physically active participants. Coaches and trainers should consider implementing training programs to optimize biomechanical function during the FMS DS.

3401 Board #89 June 1 9:30 AM - 11:00 AM
Effect of a Suspension Training Certification Curriculum on Health Related Fitness and Functional Movement

Emily G. Hilliard¹, Megan Jackson¹, Alexander McDaniel¹, Ann T. Shields¹, Rachel E. Williams¹, Ryan Swiezy¹, Courtney K. Milleson¹, Adrian Gonzalez¹, Andrew Ortiz¹, Brad Hollingsworth¹, Sarah Noland¹, Raechel Santee¹, Phillip Morie¹, Lauren Ackerman¹, Emma Schmid¹, Kelsey Bryan¹, Frances M. Livingston¹, Tiago Barreira², Wayland Tsch¹. ¹University of North Carolina Wilmington, Wilmington, NC. ²Syracuse University, Syracuse, NY. (Sponsor: Dr. Robert Boyce, FACSM)

(No relevant relationships reported)

INTRODUCTION: There is limited research on the fitness benefits of certification courses offered in higher education. **PURPOSE:** To identify the fitness and functional movement effects from a 14-week, didactic, active learning suspension training certification course. **METHODS:** Forty-two participants (30 females; 12 males; Age = 25.6 ± 10.0 yrs; Height = 169.4 ± 9.8 cm; Body Mass = 69.7 ± 15.4 kg) in a suspension training curricular course completed 28 applied-learning sessions over a 14-week period. Initial 9 weeks were instructor-led educational lectures, workouts, and critique of techniques, whereas, the latter 5 weeks were student-led exercise programming and workouts for curricular evaluation. Throughout each 40-minute exercise session, six body positions were utilized across push, pull, rotational, squat, and lunge movements. Pre- and post-fitness assessments included body composition, muscular endurance, muscular strength, flexibility, and a functional movement screen (FMS). Dependent t-tests were used to determine if there were mean changes in fitness-related and functional movement status. Due to multiple comparisons, Bonferroni correction was used, therefore, alpha level was set at .007. **RESULTS:** There were no significant changes in mean body mass, fat mass, and lean mass. There were, however, significant positive changes in mean percent body fat ($24.0\% \pm 9.8\%$ to $22.9\% \pm 10.5\%$), sit-and-reach (41.5 ± 9.2 to 44.0 ± 7.9 cm), quantity of push-ups (25.9 ± 11.5 to 32.0 ± 13.5), handgrip dynamometer (83.1 ± 29.5 to 90.6 ± 30.5 kg), and FMS (14.9 ± 2.4 to 16.5 ± 2.2) values. **CONCLUSIONS:** Students participating within the 28-session suspension

training curriculum experienced significant decrements in percent body fat and gains in flexibility, upper body muscular endurance, upper body muscular strength, and functional movement screening scores.

3402 Board #90 June 1 9:30 AM - 11:00 AM
Physiological Differences Between Motorized and Non-Motorized Treadmill Running

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(No relevant relationships reported)

Non-motorized treadmills (NMT) are designed to replicate overground exercise and are used in fitness testing, simulation of team sport exercise, and sprint training. Limited research describes differences in physiological responses between running on a curved NMT and motorized treadmill (MT) at the same speed. **PURPOSE:** Examine physiological differences between running on a NMT and a MT at the same speed and identify at which MT grade the physiological response to running on a MT is similar to a NMT at the same speed. **METHODS:** Ten active females ran at three speeds (2.68, 3.13, and 3.58 m/s) on a curved NMT and a standard MT. Five participants also ran at 3.13 m/s and 4%, 6%, and 8% grades on the MT. $\dot{V}O_2$, blood lactate, heart rate, and rating of perceived exertion were compared between treadmills at each speed and grade using ANOVAs and paired samples t tests. **RESULTS:** NMT $\dot{V}O_2$ was significantly greater at 2.68 m/s (40.89 ± 2.13 vs. 35.73 ± 1.92 ml/kg/min; $p < 0.01$) and 3.13 m/s (47.7 ± 4.06 vs. 42.29 ± 2.14 ml/kg/min; $p = 0.004$), but not significantly different from MT at 3.58 m/s (50.30 ± 5.76 vs. 47.64 ± 2.73 ml/kg/min; $p = 0.085$). NMT blood lactate concentration was significantly greater at 3.13 m/s (8.83 ± 2.55 vs. 6.02 ± 2.75 mmol/L; $p < 0.01$) and 3.58 m/s (11.63 ± 2.25 vs. 8.10 ± 2.74 mmol/L; $p < 0.01$). At 3.13 m/s and a MT grade of 8%, $\dot{V}O_2$ ($r = -1.46$, $p = 0.22$) and blood lactate ($r = -2.64$, $p = 0.06$) were not significantly different from NMT at 3.13 m/s. **CONCLUSIONS:** The physiological response to running on a NMT was significantly greater than a MT at submaximal speeds. A greater non-oxidative contribution to running at 3.58 m/s on the NMT is likely due to runner position on the curved belt. Running on a MT at an 8% grade produces similar $\dot{V}O_2$ and blood lactate responses to running on a NMT at the same speed. Practitioners prescribing NMT exercise should consider exercise intensity and effect of the NMT incline.

3403 Board #91 June 1 9:30 AM - 11:00 AM
Functional Assessment of the Upper Limb: Support for Isotonic Measurement Devices

Mercedes K. Steidley, Emily L. Roessel, J. Mark VanNess, Natalie R. Schlenker, William P. Lydon, Sarah R. McDowell, Courtney D. Jensen. *University of the Pacific, Stockton, CA.*

(No relevant relationships reported)

Accurate evaluation of arm strength and function is important to prevent injury, aid rehabilitation, and enhance training. Traditional assessments involve isokinetic devices (e.g., Cybex) to determine post-injury abilities. However, this method is confined to a linear motion and fails to mimic normal isotonic movement patterns. Instruments that measure isotonic motions in three-dimensional space may be more appropriate. **PURPOSE:** Compare upper limb isokinetic force characteristics to those produced in isotonic actions. **METHODS:** 35 healthy college students (12 women, 23 men) performed biceps curls and triceps extensions of the dominant arm on one of two machines: Cybex HUMAC NORM isokinetic dynamometer (N=17) or Proteus (N=18), which measures upper limb motion in three-dimensional space using magnetically-mediated resistance. Subjects performed practice trials to minimize learning effects. After completing testing, we used independent and paired-samples t-tests to compare peak force ratios of biceps and triceps generated by the different testing devices. **RESULTS:** Peak biceps torque on the Cybex was 25.9 ± 8.5 ft-lb; peak triceps torque was 24.3 ± 6.3 ft-lb. On average, it took the biceps approximately 62% longer to reach peak torque than it did the triceps ($p < 0.001$). The isokinetic biceps-triceps strength ratio was $1.07:1 \pm 0.22:1$. This ratio was different between men and women ($p < 0.001$). Among men, it was $1.28:1 \pm 0.16:1$. Among women, it was $0.99:1 \pm 0.20:1$. This ratio was also different when compared to peak power calculated by Proteus ($p = 0.033$). In our sample, isotonic, free-motion testing associated with a higher and more variable biceps-triceps strength ratio: $1.38:1 \pm 0.99:1$. **CONCLUSION:** Performance prediction models and return-to-play testing batteries have traditionally captured functional profiles through isokinetic testing. Restricting movement to a limited range of isokinetic motion results in an inaccurate depiction of what a patient or an athlete does outside of the clinic. Isotonic resistance permitting three-dimensional assessment may be able to provide a more optimal analysis of upper limb function, which translates more directly to athletic and therapeutic contexts. More research is needed to understand how these values may help personalize training and rehabilitation programs.

3404 Board #92 June 1 9:30 AM - 11:00 AM**Special Fitness Judo Index Test to Evaluate Sports Performance According to the Training Stage In Athletes**

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(No relevant relationships reported)

Through precise training for the athlete we can improve their specific physical condition for each sport discipline, in the same way the tests we perform to see the metabolic changes according to the corresponding pathways to the sport activity must try to be as specific as possible and simulate sports techniques. **PURPOSE:** To analyze with specific judo fitness test, the sports performance according to the training stage in athletes. **METHODS:** Descriptive study, $n = 18$, 11 males, 7 females of the Judo Senior Team, age 20.4 ± 3.9 years, with a range of 15 to 29 y. The same test was performed three times, every 4 months. The test is performed to assess the sports training in judo. The first and second tests, 11 athletes were evaluated, and in the 3rd test, 16 athletes participated. The fitness index tests are specific, analyze the performance with Judo technique ("Ippon-sevi-nage"), the Index consists of the measurement of the maximum heart rate of effort (MHRE) plus the heart rate at the minute of recovery at the end of the test, in beats per minute, divided by the number of techniques, made from the 1st 15 seconds (s), 10 s recovery, 2nd 30 s, 10 s recovery and 3rd 30 s work, and the heart rate at the minute of recovery. It started at 0900 hrs, with an ambient temperature 20°C, monitoring the heart rate, during rest, warm-up, maximum effort and at one minute of recovery using PolarV800 heart rate monitors. Additional instruments used were writing board, sheets of bond paper, pencil, whistle and a chronometer. The information was tabulated in Microsoft Excel 2016. **RESULTS:** in the 1st test, 11 athletes, men (7), the results were, 4, 36.4% good, 1, 9% very good, 2, 18.2% excellent; women (4), 1, 9% bad and 3, 27.3% regular, in the 2nd test, 11, men (8), 1, 9% bad, 1, 9% regular, 3, 27.3% good and 3, 27.3% excellent; women (3), 1, 9% regular and 2, 18.2% good and in the 3rd, (16), men 10, 2, 12.5% regular, 6, 37.5% good and 2, 12.5% excellent; women 6, very bad 1, 6.3%, 2, 12.5% regular and 3, 18.7% good. **CONCLUSION:** With the special fitness Judo Index test we can track the sports preparation of judo athletes and evaluate their performance specifically with Judo technique ("Ippon-sevi-nage").

3405 Board #93 June 1 9:30 AM - 11:00 AM
Physiological Demands of Hard Shoe and Soft Shoe Irish Dancing: A Pilot Study

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(No relevant relationships reported)

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Purpose: Irish Step Dance is a form of dance characterized by maintaining an upright posture and primarily moving the lower extremities with two different shoe styles. Soft shoe (SS) dance requires light and delicate movements, while hard shoe (HS) dance requires forceful and powerful movements. Irish dance competition pieces can last 30-60 seconds and performance pieces can last 10 minutes. The purpose of this study was to characterize the cardiorespiratory demands of female recreational Irish dancers. **Methods:** Seven female dancers (35.8 ± 9.6 y; 166.6 ± 7.5 cm; 79.1 ± 13.1 kg) volunteered for HR monitoring during three separate 45 min classes ($n=16$ measurements). Classes consisted of a mixture of HS and SS dancing. Three female dancers (28.0 ± 13.9 y; 168.7 ± 1.2 cm; 76.5 ± 15.2 kg) volunteered for $\dot{V}O_2$ testing. Dancers completed a three minute reel and treble reel dances while wearing soft and hard shoes. Steady-state data were analyzed from the last 30 sec of the three minute dance test. The order of testing was randomized and the same piece of music was used for all dances. **Results:** The mean HR for a class session was 128 ± 14 bpm (69.7 ± 9.3 %HR_{max}). The mean maximal HR achieved in class was 184 ± 10 bpm (93.9 ± 8.7 %HR_{max}). There was no significant ($p < 0.05$) difference in $\dot{V}O_2$ (HS 23.33 ± 7.51 ml/kg/min; SS 23.57 ± 6.17 ml/kg/min), R-value (HS 1.31 ± 0.05 ; SS 1.31 ± 0.12), HR (HS 184.7 ± 8.7 bpm; SS 185.0 ± 2.0 bpm), or %HR_{max} (HS 96.3 ± 3.2 %HR_{max}; SS 94.5 ± 3.7 %HR_{max}) for HS and SS dance.

Conclusions: The class data suggest that Irish dance classes are a moderate intensity activity with vigorous intensity intervals. Hard shoe and soft shoe Irish dance are physiologically demanding aerobic activities with anaerobic contribution. Despite differences in dance style these data suggest that there is no difference between the metabolic demands of HS and SS Irish dancing.

3406 Board #94 June 1 9:30 AM - 11:00 AM**Elite Orienteering Athletes In Standardized Time-trial And Distance-trial Tests Own Better Physiological And Psychological Indicators On Treadmill**

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(No relevant relationships reported)

Orienteering founded in north europe is now gradually popular worldwide. However, how to train focus on event specificity has not been established well. **PURPOSE:** The goal of this preliminary study is to explore physiological and psychological characteristics of elite orienteering players. **METHODS:** Ten elite orienteering athletes (OA) (age: 25.4 ± 8.9 yrs; BMI: 20.2 ± 1.7 ; training: 9.2 ± 2.8 hrs/wk; 5 males and 5 females; $\dot{V}O_{2max}$: 48.8 mL/kg/min) and ten elite running athlete (RA) (age: 21.0 ± 1.5 yrs; BMI: 20.8 ± 1.1 ; training: 12.8 ± 2.7 hrs/wk; 5 males and 5 females; $\dot{V}O_{2max}$: 52.7 mL/kg/min) were recruited to attend a time-trial and a distance-trial treadmill tests in counterbalanced order. Athletic performance of participants were at least national level. Both tests were interspersed by 4 segments of mental games (named Peak in Apple Store) representing the capacity of problem solving, memory, concentration, and thinking ability in sequence. While playing mental games, participants kept on running with their effort. Performance indicators and ECG/EEG signals /game scores were analyzed using independent t test and mixed design of repeated measures respectively. Statistical significance was set at $p < .05$.

RESULTS: Better performance of time/distance trials (1084 min vs. 1100 min; 3338 m vs. 3211 m) in OA and most all indicators of OA were better than those of RA in main effect. Results indicated that attention index (55.6 vs. 44.3), game score (10929 vs. 8817) and %HRR (77.3 % vs. 67.6 %) of OA were significantly higher than those of RA during mental games in time-trial test ($p < .05$) in main effect.

CONCLUSIONS: We conclude that elite orienteering athletes own stronger power for mental management while keeping on higher intensity of running. Introducing mental challenges on running may enhance training effect of orienteering.

G-36 Free Communication/Poster - Methodology

Saturday, June 1, 2019, 7:30 AM - 11:00 AM

Room: CC-Hall WA2

3407 Board #95 June 1 8:00 AM - 9:30 AM**Accuracy Of The Equations For $\dot{V}O_{2max}$ In Aerobically Trained Women.**

Sergio A. García Corzo, Moises Arturo Cabrera Hernandez, Luis Javier Tafur Tascon, Yecid Mina Paz, Carmen Ximena Tejada Rojas, Hugo Hurtado Gutierrez. *Institucion Universitaria Escuela Nacional del Deporte, Cali, Colombia.*

(No relevant relationships reported)

PURPOSE: Evaluate the accuracy of the $\dot{V}O_{2max}$ equations for aerobically trained Colombian women. **METHODS:** Estimated values of $\dot{V}O_{2max}$ of the equations were compared with those of $\dot{V}O_{2max}$ measured in a maximum cycloergometer test (MCT). When examining the constant error (CE), standard error of estimation (SEE), total error (TE), the comparison of means (Student's t -test), the Bonferroni correction was used to adjust the level of significance, Pearson correlation coefficient (r) and Lin's concordance correlation coefficient (CCC). A total of nine female cyclists and three female triathletes were volunteers for this study. **RESULTS:** The athletes were aged 23.7 ± 5.8 years, with weight 54.2 ± 4.8 kg and height 161.1 ± 3.6 cm. They reached a maximum workload power of 262.5 ± 29.8 W and a $\dot{V}O_{2max}$ of 55.5 ± 7.3 mL.kg⁻¹.min⁻¹ (2992.1 ± 327.3 mL.min⁻¹). Table 4 depicts the results of the comparison analyzes for absolute and relative values. Only equations 1 and 5 show CE values significantly different from zero, both for absolute and relative values. There were significant positive correlations between the CE and $\dot{V}O_{2max}$ through the MCT values for equations 2, 5 and 6 in the relative values, and only for equation 5 in the absolute values. CCC rated all the equations with poor concordance.

Table 4. Comparison of absolute and relative values of VO2max predicted from the equations.

Equation	VO2max ml.min ⁻¹ (mean ± ED)	CE (media ± DE)	p value	r	SEE (ml.min ⁻¹)	TE (ml.min ⁻¹)
1	3271.3 ± 336.7	-279.2 (202.1)	.001	0.87*	161.3	339.7
2	2879.5 ± 282.6	112.7 (203.2)	.081	0.85*	172.4	224.8
3	2840.5 ± 305.1	151.6 (191.4)	.019	0.87*	161.3	237.9
4	2985.1 ± 321.5	7.0 (195.1)	.903	0.87*	161.3	187.0
5	2125.9 ± 132.0	866.2 (368.3)	.000	0.27	315.1	935.3
6	2957.3 ± 301.1	34.8 (193.4)	.546	0.87*	161.3	188.4
7	3131.4 ± 320.8	-139.2 (197.5)	.033	0.87*	161.3	234.8
	ml.kg ⁻¹ .min ⁻¹ (mean ± ED)					
1	60.6 ± 6.7	-5.1 (3.6)	.001	0.81*	4.3	6.2
2	53.4 ± 5.7	2.2 (3.8)	.078	0.78*	4.6	4.3
3	52.6 ± 6.1	2.9 (3.6)	.019	0.81*	4.3	4.5
4	55.3 ± 6.5	0.2 (3.6)	.852	0.81*	4.3	3.5
5	39.4 ± 2.9	16.1 (7.1)	.000	-0.12	7.3	17.5
6	54.8 ± 5.9	0.7 (3.6)	.500	0.81*	4.3	3.6
7	58.0 ± 6.4	-2.5 (3.6)	.036	0.81*	4.3	4.3

* = p value < 0.05

CONCLUSION: Equations 3, 4 and 7 meet all the statistical criteria used to evaluate the accuracy of the prediction in this study; however, none of the equations was rated as good concordance, when using the CCC method.

3408 Board #96 June 1 8:00 AM - 9:30 AM

The Development and Validation of a Functional Capacity Test for Dancers
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(No relevant relationships reported)

A peak functional capacity test that is incremental in nature, varying in intensity, and includes movements familiar to dancers is a necessary and important addition to the dance specific fitness tests in the current literature. **PURPOSE:** To design and validate a peak functional capacity test that is appropriate in time, intensity, and movement specificity to the dancer. **METHODS:** The Seifert Assessment of Functional Capacity for Dancers (SAFD) was developed using previous valid and reliable functional capacity protocols, published research in dance specific fitness tests, and consult with content experts. Final test parameters included 3 min. stages of increasing intensity utilizing both speed and difficulty of movements, continued until exhaustion. Following pilot testing, a survey of content experts supported the validity of the SAFD. Female dancers (N = 13) completed a total of four separate sessions, a familiarization trial of the SAFD, SAFD trial 1, a peak treadmill test, and SAFD trial 2. Each test measured time to exhaustion, peak oxygen consumption (VO_{2peak}), respiratory exchange ratio (RER), heart rate (HR), blood lactate (BLA-), and rate of perceived exertion (RPE). Tests were terminated upon volitional exhaustion or a total of three cues regarding poor movement quality or inability to keep pace with the metronome. Interclass Correlation Coefficients were used to assess reliability, while validity was analyzed using Pearson Product Moment Correlations. **RESULTS:** Strong correlations (≥.7) were found between time to exhaustion, VO_{2peak}, HR and RPE between SAFD trials. No significant (p > .05) differences existed in any of the physiological variables between the SAFD trials. Significant (p < .05) relationships were found between time to exhaustion, VO_{2peak}, HR, BLA-, and RPE between the SAFD and the treadmill test. **CONCLUSION:** The strength of key physiological correlations of time to exhaustion, VO_{2peak}, HR, and RPE provide strong evidence for the SAFD being both reliable and valid. Although the threshold value for correlation was not met in neither RER nor BLA-, results do present a particularly meaningful set of values to the physiology practitioner and thus, further support the conclusion that the SAFD is both a reliable and valid method of assessing peak functional capacity in the dance population.

3409 Board #97 June 1 8:00 AM - 9:30 AM

Examining the Learning Effect On An Isokinetic Fatigue Test Protocol
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(No relevant relationships reported)

When performing repeated repetitions of a task, the body becomes familiar with the task and can become more efficient. This is known as the learning effect and can alter performance. **PURPOSE:** To examine the learning effect when fatigue testing without familiarization. **METHODS:** 22 masters-aged [53±5 years], competitive female cyclists completed 3 separate 50-repetition knee flexion/extension tests on a Biodex isokinetic dynamometer, separated by one-week with no familiarization. **RESULTS:** No significant differences [Wilks Λ>.05] existed between trials, indicating no learning effect was associated with the tests for any variable: a) peak torque (T1 50.7±10.4 N·m; T2 53.0±11.5 N·m; T3 56.6±11.0 N·m), b) relative peak torque (T1 36.2 ± 6.7 N·m/kg; T2 37.9 ± 7.5 N·m/kg; T3 39.2 ± 7.3 N·m/kg), c) torque generated at 30° (T1 27.1 ± 10.0 N·m; T2 26.4 ± 10.2 N·m; T3 26.6 ± 9.4 N·m), d) torque generated at 0.18 s (T1 45.7 ± 9.0 N·m; T2 47.4 ± 10.1 N·m; T3 50.1 ± 9.0 N·m), e) relative work completed (T1 50.2 ± 9.7 J/kg; T2 50.5 ± 9.0 J/kg; T3 51.5 ± 10.9 J/kg), or f) total work completed (T1 2548.4 ± 524.4 J; T2 2544.8 ± 516.0 J; T3 2615.3 ± 579.3 J). **CONCLUSION:** No learning effect was seen with the isokinetic knee extension/flexion fatigue protocol in masters-aged, female cyclists. Therefore, these findings would suggest that previous experience in isokinetic muscular fatigue testing does not alter subsequent performance.

3410 Board #98 June 1 8:00 AM - 9:30 AM

A Novel Assessment of Baseball Throwing Mechanics
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To remain competitive, collegiate athletes constantly seek novel methods of performance enhancement. As technological advancements permit more sophisticated assessments, it is important to appraise their utility. **PURPOSE:** To establish a mechanical profile of baseball throwing and to test which kinematic domains associate with on-field performance. **METHODS:** 18 collegiate baseball players (11 fielders, 7 pitchers) were tested using Proteus (Boston Biomotion, USA), which analyzes isotonic force production concurrently in all 3 planes. Players performed 5 consecutive throw motions against 3lb of magnetic resistance. Proteus software calculated power, velocity, explosiveness (rate of force development), endurance (maintenance of force characteristics), consistency (repeatability of movement), and range of motion (ROM). Across the total sample, these values were used to generate throwing profiles; among the subsample of pitchers, the values were used in linear regressions to predict in-season performance. **RESULTS:** Across all players, power was 118.4 ± 80.0, explosiveness was 82.9 ± 29.4, velocity was 6.0 ± 1.2, endurance was 97.2 ± 5.9, consistency was 86.5 ± 9.1, and ROM was 4.0 ± 0.6. Consistency was inversely related to power (R = -0.639; p = 0.004). Explosiveness was inversely related to endurance (R = -0.879; p < 0.001). Pitchers exhibited patterns for higher power, velocity, and explosiveness, but none reached significance (p > 0.10). ROM differed between groups: the pitchers' ball path traveled 20.6% farther in 3D space (p = 0.007). Controlling for height, it remained 18.5% farther (p = 0.012). Among pitchers, in-season earned run average (ERA) increased with power (R = 0.933; p=0.002) and velocity (R = 0.931; p = 0.002) and decreased with consistency (R = -0.956; p = 0.001). Each additional point of power predicted an increase of 0.2 strikeouts per nine innings (p = 0.025) and a 0.2-point increase in ERA (p = 0.002). Each additional point of consistency, predicted 0.2 fewer strikeouts per nine innings (p = 0.047) and a 0.2-point decrease in ERA (p = 0.001). **CONCLUSIONS:** Novel instruments to assess pitching mechanics enable the generation of new normative data. Preliminary analyses suggest power and explosiveness are inverse to consistency and endurance, and they predict different performances on the field.

3411 Board #99 June 1 8:00 AM - 9:30 AM Acute Effects of Neuromuscular Electrical Stimulation on Vertical Jump

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Multiple studies have indicated improvements in muscular strength, power, and performance can be made over time using neuromuscular electrical stimulation (NMES). Yet no previous studies have conducted research into the effects of NMES on vertical jump immediately after isometric stimulation to the quadriceps group.

PURPOSE: To determine the acute effects of NMES on vertical jump. **METHODS:**

A group of 24 participants were randomly divided into an experimental and a control group. All participants were pretested in the countermovement jump (CMJ) to determine maximum jumping height. Participants in the treatment group were treated with NMES to the quadriceps. Participants in the control group received sham treatment in identical testing conditions. All participants then engaged in a post treatment CMJ test. The difference between pretest and posttest jump scores was computed to determine the effects of treatment.

RESULTS: A paired samples *t*-test showed a statistically significant increase in experimental CMJ scores from pre-test ($M = 28.69$, $SD = 6.87$) to posttest ($M = 30.14$, $SD = 7.42$), $t(11) = 1.796$, $p < .05$. (Figure 1). A statistically significant decrease in control CMJ scores occurred from pre-test ($M = 30.72$, $SD = 6.51$) to posttest ($M = 29.18$, $SD = 6.24$), $t(11) = 1.796$, $p < .05$. The mean increase in experimental CMJ scores was 1.45 with a 95% confidence interval ranging from 26.61 to 33.67. The mean decrease in control CMJ scores was 1.54 with a 95% confidence interval ranging from 26.21 to 32.15. Cohen's *d* (.24) indicated a small effect size. **CONCLUSION:** The acute application of NMES to the quadriceps group lead to significant improvements in vertical performance.

3412 Board #100 June 1 8:00 AM - 9:30 AM Correlation Analysis Of The Skulpt® And Bodpod®

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The BodPod® (BP) is a standard, reliable tool for measuring body composition. A new body composition measurement tool called the Skulpt® (SK) was created recently. The SK is a form of bioelectrical impedance analysis that measures at three different sites, tricep, abdomen, and thigh, but little to no research exists examining the validity of this form of measurement. For this reason, this study sought to determine the accuracy of the SK compared to the BP. If the SK is determined to be accurate, the low cost and convenience of the SK would make measuring body composition more accessible and available to the general population. **PURPOSE:** The purpose of this study was to test the accuracy of the SK against the BP when measuring body composition. **METHODS:** This was accomplished by measuring body fat percentage using the BP first and then the SK on 91 participants. Subjects for this study included: female (50) and male (41) subjects. Demographic data of each subject was taken before the assessment as well as height (cm) and weight (kg). The body fat percentage results were analyzed using SPSS software. **RESULTS:** A Spearman's R correlation coefficient was calculated for the relationship between the body fat % measured from the SK and BP. A strong positive correlation was found $R = 0.904$ ($p < 0.000$), indicating a significant direct relationship between the two variables. This suggests that a subject measuring a high % body fat on the BP also measures high on the SK®. A paired-samples *t* test was calculated to compare the mean body fat % from the SK® to the mean body fat % of the BP. The results conclude there was a statistical significant difference between the BP and SK of $p < 0.000$. An average of 5.55% difference was found between the results of the two measurement tools. The mean body fat % on the BP® was 21.824 ($sd = 10.05$). The mean body fat % on the SK was 27.371 ($sd = 8.67$). **CONCLUSION:** Since there was significant difference found between BP and SK, the SK is not a recommended body fat measurement tool in research settings, but is acceptable to use in general population settings. However, the positive correlation shows the SK can differentiate between individuals with high versus low body fat. These findings suggest an individual could use the SK to track changes in body composition, an important factor in a person's overall health and wellness.

3413 Board #101 June 1 8:00 AM - 9:30 AM Positional Difference in Linear Momentum During Vertical Jump in Division II College Football Players

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Linear momentum, the product of body mass and velocity, is the key determinant of the outcome of collisions. In collision-based sports, such as American football, players with the greatest momentum tend to achieve more favorable outcomes during on-field collision, or tackles. Therefore, today's players are constantly seeking to increase mass without sacrificing velocity. However, no study has quantified linear momentum in American football players.

PURPOSE: To examine the positional differences in linear momentum during a vertical jump in Division II college football players.

METHODS: 56 male Division II college football players were assessed for height, body mass, and vertical jump. All players were categorized according to playing position into defensive back (DB), defensive line (DL), running/full back (RB), linebacker (LB), offensive line (OL), tight end (TE), and wide receiver (WR) groups; all other positions were excluded due to insufficient sample. Height and body mass were assessed using a stadiometer and digital scale, respectively. A vertical jump test was performed to determine jump height, which was then used to calculate vertical jump velocity. Vertical jump momentum (VJM) was calculated as the product of body mass and vertical jump velocity. Positional comparisons in VJM were made using one-way ANOVA with LSD post hoc comparisons. Alpha level was set *a priori* to $p \leq 0.05$.

RESULTS: A significant main effect of position was observed for VJM ($p < 0.001$). Post hoc tests revealed that OL (439.6 ± 44.7 Ns) had significantly higher VJM than DB ($p < 0.001$; 317.3 ± 34.4 Ns), RB ($p = 0.001$; 371.7 ± 24.7 Ns), LB ($p = 0.006$; 376 ± 32 Ns), TE ($p = 0.013$; 377.4 ± 51.9 Ns), and WR ($p < 0.001$; 338.6 ± 25.0 Ns), while trending to be greater than DL ($p = 0.089$; 406.9 ± 59.6 Ns). Also, DL had significantly greater VJM than DB ($p < 0.001$) and WR ($p = 0.001$), and trended to be greater than RB ($p = 0.068$). LB ($p = 0.009$), TE ($p = 0.013$), and RB ($p = 0.004$) had significantly greater VJM than DB, but only RB trended to be greater than WR ($p = 0.086$).

CONCLUSIONS: While positional differences in VJM exist in collegiate American football, positions that regularly engage during game play (OL vs DL, WR vs DB, and LB vs RB vs TE) have no statistically significant differences. Therefore, these positions are most likely evenly matched when colliding on the field.

3414 Board #102 June 1 8:00 AM - 9:30 AM Validity And Reliability Of The Ymca Submaximal Cycle Test Using An Electrically-braked Ergometer

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PURPOSE: Electrically-braked ergometers allow a consistent power output regardless of variances in pedaling cadence. The present study sought to test the effect of using an electrically braked ergometer on the validity and reliability of the YMCA submaximal cycle test.

METHODS: 22 male and 13 female subjects (19 - 31 y) completed one maximal treadmill test and four submaximal cycle tests (using the YMCA protocol) to measure and estimate VO_{2max} , respectively. The submaximal trials consisted of two tests performed using a friction-braked ergometer (Monark) and two using an electrically-braked ergometer (Viasprint). All measured and estimated VO_{2max} values were compared using repeated measures ANOVA and post-hoc tests using paired *t*-tests. Paired *t*-tests were also used to determine potential differences between repeated submaximal trials using the same ergometer. Pearson correlation coefficients were used to determine validity and reliability coefficients.

RESULTS: The treadmill VO_{2max} protocol yielded markedly higher ($P < 0.05$) values (50.3 ± 7.7 mL/kg/min) than the YMCA submax protocol using the friction-braked (40.8 ± 5.5 mL/kg/min) and electrically-braked ergometer (38.8 ± 4.5 mL/kg/min). Furthermore, estimated VO_{2max} using the friction-braked ergometer was higher ($P < 0.05$) than that observed using the electrically-braked ergometer. There were similar reliability coefficients for the friction-braked ($R = 0.63$) and electrically-braked ($R = 0.52$) ergometers. Lastly, a moderately strong ($R = 0.74$) relationship was observed between actual VO_{2max} and prediction error ($VO_{2max} - \text{estimated } VO_{2max}$).

CONCLUSIONS: Both Monark and Viasprint ergometers underestimated VO_{2max} in a sample of fit, young individuals. The magnitude of underestimation was greater in individuals with higher VO_{2max} values. Using an electrically-braked ergometer did not improve either validity or reliability of VO_{2max} estimates from the YMCA protocol.

3415 Board #103 June 1 8:00 AM - 9:30 AM

A New Functional Screening Tool For Lower Limb Injury Risk: A Retrospective Cohort Study

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(No relevant relationships reported)

PURPOSE: The aim of the current study was to develop a new screening instrument for lower limb functional assessment. **METHODS:** Fifty-three athletes (33M,20F; mean age: 19.4 ± 2.5 years old) volunteered for the study. Athlete injury history and sport performance level (international, national, regional, recreational) were recorded. A lower limb functional screening tool was developed (the LoLiFST), based on 5 lower limb movements in different modes, planes, directions and at varying intensities. Both legs were assessed in a random order and each athlete was given a technique and a symptom score. Reliability was evaluated. Spearman's correlation was employed to examine the relationship between the measures and the incidence of injury. Receiver operating characteristic (ROC) analysis was employed to assess the instrument's capacity to classify injury status. **RESULTS:** (1) The test-retest reliability was 0.74. The inter-rater reliability was 0.95. (2) Twenty-five of the athletes had a history of low back or lower limb injuries in the past 12 months. (3) Both the technique and symptom scores from the LoLiFST were significantly correlated with the injuries ($\rho = -0.290$, $P = 0.035$; $\rho = -0.390$, $P = 0.004$), and the two scores were significantly inter-correlated ($\rho = 0.354$, $P = 0.009$). (4) When technique or symptom scores alone were included to differentiate between athletes with or without injury, the area under the ROC curve (AUC) scores were 0.668 ($P = 0.036$, 95% CI: 0.520-0.815) and 0.722 ($P = 0.006$, 95% CI: 0.582-0.862), respectively. With technique and symptom scores combined, the AUC discrimination score was 0.762 ($P = 0.001$, 95% CI: 0.634-0.890). When sport performance level was added into the variable set, the AUC discrimination score was 0.834 ($P = 0.00$, 95% CI: 0.728-0.939), meaning that 83.4% of cases can be correctly classified as low back or lower limb injured/non-injured using the decision point obtained from applying Youden's index to the ROC curve. **CONCLUSION:** The findings support the use of a functional movement screening tool that includes both technique and reported symptoms, that can be used in combination with sporting performance level to enhance capacity for identifying injuries. Future longitudinal studies are warranted to explore the validity of the LoLiFST in determining low back and lower limb injury risk.

3416 Board #104 June 1 8:00 AM - 9:30 AM

Comparison of Functional Tests of Leg Power in Collegiate Athletes

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(No relevant relationships reported)

In the field of sports medicine, functional tests, such as the single leg hop for distance (SLHD) and single leg vertical jump (SLVJ), are often used to determine an athlete's return to competition. Many sports medicine facilities, including Wake Forest University (WFU), have invested in pneumatic resistance machines, such as the Keiser Air420 Leg Press, that precisely measure single leg power in Watts. However, little is known regarding the agreement of the data obtained from the functional tests and the Keiser Air420.

PURPOSE: To compare the results of the Keiser leg press to those of the SLHD and SLVJ in WFU athletes. **METHODS:** Data were obtained from 79 (40 males and 39 females) healthy student-athletes at WFU. After a warmup, each subject performed the SLHD and SLVJ (cm) and the Keiser leg press (W/kg) in random order with a 5-minute rest period between each test. The relationship between tests was examined with Pearson Correlation Coefficients. **RESULTS:** The means for the Keiser, SLHD, and SLVJ tests (listed right and left, respectively) were 15.4 ± 3.7 W/kg and 14.9 ± 3.6 W/kg, 170.6 ± 27.8 cm and 172.9 ± 28.0 cm, 36.2 ± 7.4 cm and 36.2 ± 7.8 cm, respectively. The correlations of leg power were statistically significant at an alpha level of 0.01. The SLVJ and Keiser scores (right leg $r = 0.82$, left leg $r = 0.83$) had a slightly higher correlation than the SLHD and Keiser scores (right leg $r = 0.65$, left leg $r = 0.70$). **CONCLUSIONS:** As suggested by the observed relationships, both the SLHD and SLVJ data correlate significantly with leg peak power results obtained from the Keiser Air420 in healthy, collegiate athletes. Thus, this study suggests low-tech/low-cost functional tests like the SLHD and SLVJ appear to be appropriate for evaluating leg power and return to competition in this population.

3417 Board #105 June 1 8:00 AM - 9:30 AM

Investigation of Optimal Depth Jump Box Height for Reactive Strength Index

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Reactive strength index (RSI) is used to assess athleticism through use of the stretch-shortening cycle for power and is determined by jump height over ground contact time. RSI is typically assessed utilizing an incremental drop jump test and while it is well-established that plyometric training positively impacts power production, the optimal depth jump box height for RSI remains unknown. **PURPOSE:** To measure RSI between different depth jump starting heights. **METHODS:** 20 college students were recruited for this study ($M = 13$, $F = 7$; age: 22.8 ± 2.7 y, height: 175.65 ± 11.81 cm, mass: 78.32 ± 13.50 kg) and were prepped using reflective markers on their ASIS and PSIS, bilaterally, which allowed for vertical jump height measurements. After a specific warm-up, subjects were instructed to perform three maximal DJs onto a force plate from five different heights: 30cm (DJ30), 45cm (DJ45), 60cm (DJ60), 76cm (DJ76), and 91cm (DJ91). **RESULTS:** A repeated measures ANOVA revealed no effect of sex but significant differences in RSI between starting heights (DJ30 = 1.36 ± 0.11 ; DJ45 = 1.42 ± 0.12 ; DJ60 = 1.35 ± 0.12 ; DJ76 = 1.28 ± 0.12 ; DJ91 = 1.16 ± 0.11), with DJ45 and DJ60 being greater than DJ30, DJ76, and DJ91. **CONCLUSION:** A parabolic relationship was observed between depth jump box height and RSI, with the optimal depth jump starting heights being 45 and 60 cm. A potential avenue for future research would be to investigate training effects on RSI from various depth jump box starting heights.

3418 Board #106 June 1 8:00 AM - 9:30 AM

The Effects Of Different Local Muscular Endurance Training Protocols In Muscle Activity And Fatigue

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The present study assessed fatigue and neuromuscular changes after fatiguing submaximal horizontal chest press exercise between different strength trainings of concentric contractions intensities.

PURPOSE: The purpose of this study was to evaluate the effect of strength trainings with higher intensity contractions in EMG activity and fatigue. **METHODS:** Fifteen trained males (24.1 ± 2.9 years old, 181.8 ± 5.8 cm, 83.6 ± 9.6 kg) performed four different strength trainings protocols in horizontal chest press (HCP) with different intensities of a load % one repetition maximum (RM) with a similar total impulse and similar rest. Strength trainings protocols consisted of: **A)** 3 blocks x (1 repetition (reps) of 95% RM - 1 rep of 90% RM - 3 reps of 80% RM - 5 reps of 70% RM - 8 reps of 60% RM - 8 reps of 50% RM - 12 reps of 45% RM - 15 reps of 30% RM - 12 reps of 20% RM) rest 5 sec between sets et 3 min between blocks; **B)** 2 blocks x (6 x 15 of 50% RM) rest 30 sec between sets et 3 min between blocks; **C)** 3 sets x (3 reps of 90% RM) rest 30 sec between sets and 1 min rest after block and 4 X (15 of 50% RM) rest 20 sec between sets and 1'40" rest after block and 3 X (15 of 50%) rest 20 sec between sets; **D)** 3 blocks x (6 x 10 reps of 50% RM) rest 10 sec between sets and 2'30" after bloc. The maximal voluntary isometric contraction torque (MVIC) was assessed in the HCP exercise before and after exercise. Electromyography (EMG) of the pectoralis major (P), anterior deltoid (AD), and the long head of the triceps brachii (TB) were assessed during the different exercises. **RESULTS:** Similar reductions of the MVIC (1227.5 ± 184 vs 992 ± 196 N; $P < 0.01$) were observed after the four strength training protocols. EMG DA activity was greater in protocol C compared to the other protocols (0.956 ± 0.336 vs 0.878 ± 0.347 mV; $P = 0.01$). EMG TB activity was greater in protocol C compared to the other protocols (0.534 ± 0.194 vs 0.473 ± 0.249 mV; $P = 0.01$). EMG P activity was greater in protocol B and D compared to the A and C (0.343 ± 0.115 vs 0.329 ± 0.170 mV; $P = 0.01$). **CONCLUSIONS:** The effect of strength endurance trainings with higher load % RM contractions compared to the others with a lower, affect similarly the loss of performance in the HCP exercise but with greater activity of DA and T muscles.

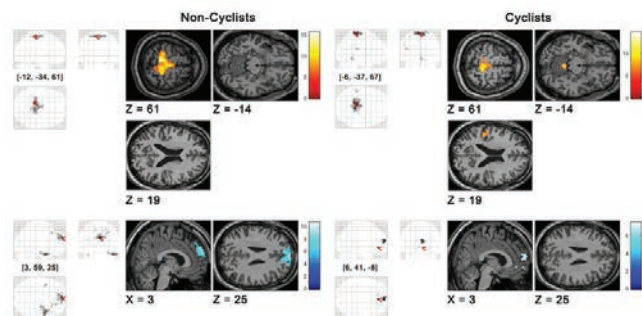
3419 Board #107 June 1 8:00 AM - 9:30 AM

Cyclists' Brain Cycling: An fMRI Study

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(No relevant relationships reported)

Functional and structural changes in the brain have been associated with regular aerobic exercise and expertise in several sports. A variety of neuroimaging techniques have revealed changes in brain activation with increased exercise intensity; however, how expertise modulates neural activation is still unclear for some sports, like cycling. **PURPOSE:** Using an adapted cycling MRI ergometer, we compared the neural patterns of cycling experts and non-cyclists during cycling periods of different intensities. **METHODS:** 22 participants were divided into two groups: 12 healthy adults who performed physical activity 4-6 h/week and 10 trained cyclists (>2 yrs of training and competitive experience, cycling 4-6 days/week for ~60 min). The participants performed an incremental test on an adapted cycling MRI ergometer while whole-brain activity was recorded with functional MRI. Using a one-sample t-test ($p < 0.05$ family-wise error corrected for multiple comparisons), we identified the positive (activation) and negative (inhibition) blood-oxygenation-level-dependent responses associated with all cycling intensities in each group. **RESULTS:** The analysis revealed that both cycling experts and novices activated the precentral gyrus, postcentral gyrus, paracentral lobule and medial frontal gyrus ($ts > 11.1$), while the cerebellum and insular cortex were activated only in cyclists ($ts > 6.83$). In addition, both groups had inhibition of prefrontal cortical areas ($ts > 7.44$) during cycling, but the non-cyclists had larger areas of the prefrontal cortex inhibited ($ts > 7.52$). **CONCLUSION:** Cycling expertise impacts the modulation of subcortical and prefrontal brain areas during cycling. We believe that these findings suggest that regular practice of cycling may enhance the neural regulation of cognitive, motor and homeostatic resources during exercise at different intensities, which may explain the higher performance of cycling athletes.

3420 Board #108 June 1 8:00 AM - 9:30 AM
Comparison of Maximal Aerobic Capacity Between the Treadmill and a Skiing Ergometer

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(No relevant relationships reported)

Cross-country skiing is known to be an extremely aerobically demanding sport. Therefore, the use of a skiing ergometer (ie. SkiErg) to replicate similar aerobic training is increasing in use in lab and fitness settings. The SkiErg is widely used in gyms, research laboratories, and rehabilitation centers, and provides a low impact and total body cardiovascular and muscular endurance workout. Technique for training on the SkiErg can be quickly learned and adapted for immediate use by most individuals. Because of its lower cost and minimal required floor space, this piece of fitness equipment can be used at almost any location for exercise and training. Due to the benefits, convenience, and accessibility, the SkiErg may be a viable alternative max or peak graded exercise test (GXT) mode. To the best of the researchers' knowledge, a comparison of aerobic capacity between a SkiErg and treadmill has not been assessed. **PURPOSE:** To compare treadmill (TM) $\dot{V}O_{2\max}$ values vs. those elicited from a SkiErg (SE) GXT. **METHODS:** Descriptive data (HT = 176.1 ± 8.2 cm, WT = 80.5 ± 10.1 kg, BF% = 15.1 ± 5.8 %, age = 22.7 ± 2.4 yrs) was measured for 21 averagely fit college-age males. In a counterbalanced order and separated by 72 hours

of rest, each subject completed 2 GXT protocols to the point of volitional exhaustion on a TM and SE. Max or peak values for $\dot{V}O_{2\max}$, HR, VE, and RER were compared between TM and SE using a Paired-Samples t-Test with an alpha level at $p \leq 0.05$. Peak RPE was compared using a Wilcoxon Signed Rank Test. **RESULTS:** TM was significantly greater than SE in regard to mean $\dot{V}O_{2\max}$ (51.1 ± 5.0 vs 44.5 ± 3.8 ml/kg/min, $p < 0.01$), HR (191 ± 11 vs 186 ± 10 bpm, $p < 0.01$), and RPE (19.6 ± 2.2 vs 18.3 ± 1.6 , $p = 0.039$). TM was not significantly greater than SE regarding RER (1.2 ± 0.0 vs 1.2 ± 0.1 , $p = 0.862$) or VE (146.2 ± 16.5 vs 144.3 ± 21.5 L/min, $p = 0.614$). **CONCLUSIONS:** The TM appears to yield higher max values for $\dot{V}O_{2\max}$, HR, RER, VE, and RPE values compared to SE in college-age males. Although TM elicited higher values than SE, SE $\dot{V}O_{2\max}$ was only 15% lower than values measured from TM. This percent difference is comparable to other currently accepted alternative forms of aerobic capacity testing such as leg and arm cycle ergometers. Future studies should assess how gender, protocol variations, SE technique, or various athletic populations may impact $\dot{V}O_{2\max}$ values during a peak SE GXT.

3421 Board #109 June 1 8:00 AM - 9:30 AM

Short-Term Back Squat Protocol Effect on 5km Run Performance

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(No relevant relationships reported)

Purpose: Previous research indicates conflicting data on concurrent training. For instance, high intensity strength training, an uncommon training method for runners, has the potential to be beneficial as studies show it allows for enhanced fatigue resistance during high intensity endurance performance. Conversely, some evidence suggests high intensity strength training is harmful for endurance running performance and may alter fuel substrate utilization. Therefore, this study sought to determine the effects of a short-term, high repetition back squat training protocol on 5km run performance as well as on carbohydrate and fat oxidation rates. **Methods:** Fifteen runners [4 men, 11 women; 150+ minutes of endurance exercise per week; age = 22 ± 5.1 ; 20.4 ± 5.2 body mass index] completed two weeks of a high repetition back squat training protocol consisting of three sets of 15-24 repetitions at 60% of one-repetition max (1RM), three times per week. Pre- and post-tests included a 5km timed run on an outdoor track, respiratory exchange ratio (RER) through indirect calorimetry during two different intensities of steady-state treadmill exercise (60% and 70% heart rate max (HRmax)), and 1RM for back squats. **Results:** Back squat 1RM significantly increased by 15% with training (48.0 ± 27.9 to 56.7 ± 30 kg, $P < 0.001$). However, no statistically significant differences were found in 5km times adjusted for heat-stress of outdoor conditions (Pre: 21.6 ± 8.3 vs. Post: 21.1 ± 8.0 minutes, $P = 0.20$), which potentially had a significant confounding effect on post-training outcomes. RER at 60% HRmax (Pre: 0.81 ± 0.04 vs. Post: 0.79 ± 0.05 , $P = 0.45$) and 70% HRmax (Pre: 0.84 ± 0.04 vs. 0.85 ± 0.04 , $P = 0.85$) was unchanged. **Conclusions:** Performing a high repetition back squat protocol for two weeks does not appear to impact 5km running time or alter the body's fuel utilization during exercise but is an effective way to improve lower body strength. Further studies are necessary in a temperature-regulated testing environment to determine whether high repetition strength training alters 5km running performance and fuel utilization.

3422 Board #110 June 1 8:00 AM - 9:30 AM

Proximity To Failure And Repetitions Per Set Effect Rpe Accuracy In The Squat, Bench Press, And Deadlift

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The repetitions in reserve (RIR)-based rating of perceived exertion (RPE) scale has gained significant popularity. Previous data has shown that intra-set RIR predictions become more accurate closer to failure. However, research has yet to examine this concept in the deadlift. **PURPOSE:** This investigation examined proximity to failure and total repetitions per set on intra-set RPE accuracy. **METHODS:** Ten males (age: 25.0 ± 4.0 yrs, body mass: 84.1 ± 14.3 kg, training age: 6.9 ± 4.0 yrs) performed 4 sets to failure at 80% of one-repetition maximum (1RM) on the squat, bench press, and deadlift in successive weeks; in a counterbalanced order. During all sets, subjects indicated when they believed to be at a 6 and 9RPE (i.e. 4 and 1RIR). The RIR difference (RIRDIFF) was calculated by subtracting the predicted number of

repetitions from the actual number of repetitions performed. Thus, if 10 repetitions were performed, but a 9RPE was called after 7 repetitions (predicting 8 repetitions), then the RIRDIFF would have equaled 2 (i.e. $RIRDIFF = 10 - 8$). The RIRDIFF at the called 6 and 9RPE was analyzed with a paired t-test and Pearson's correlations were used to assess the relationship between repetitions per set and RIRDIFF; significance was set at $p \leq 0.05$. **RESULTS:** The RIRDIFF across all sets of all exercises and within each individual exercise was significantly lower ($p < 0.01$) at the called 9 vs. 6RPE. Across all squat sets the RIRDIFF at 6RPE was 1.00 ± 1.13 vs. 0.67 ± 0.69 at the called 9RPE ($p = 0.04$, effect size-ES=0.35). Bench press RIRDIFF across all sets was 0.84 ± 0.81 at the called 6 vs. 0.51 ± 0.58 at the called 9RPE ($p < 0.01$, ES=0.46). Additionally, deadlift had an RIRDIFF of 1.12 ± 1.05 at the called 6RPE vs. an RIRDIFF of 0.56 ± 0.70 at the called 9RPE ($p < 0.01$, ES=0.62). Total repetitions performed per set were significantly related to a higher RIRDIFF (i.e. more inaccurate RPE ratings) on squat at 6RPE ($r = 0.47$, $p < 0.01$), and bench at 6RPE ($r = 0.50$, $p < 0.01$) and bench at 9RPE ($r = 0.60$, $p < 0.01$). There was no relationship between repetitions performed and RIRDIFF at the squat called 9RPE or either called RPE on the deadlift ($p > 0.05$). **CONCLUSIONS:** These results suggest that intra-set RPE ratings are more accurate closer to failure on all three exercises and that more repetitions per set may lead to more inaccurate RIR predictions on the squat and bench press.

3423 Board #111 June 1 8:00 AM - 9:30 AM
Standardization of the Technique for a Medicine Ball Throw Test

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Muscular power is an essential component of numerous activities. Maximal throws are sometimes used to assess upper body power, but the angle of the throw, which could make an impact on the distance achieved, is typically either controlled with complicated methods or not controlled at all in the existing literature.

PURPOSE: Establish consistent and simple procedures to control the effort of a medicine ball throw protocol and establish the reliability and norms for the test. **METHODS:** 124 males and 96 females sat on the floor with their back against a wall, knees bent, and feet flat on the ground. On the adjoining wall a sheet of paper displayed lines at a 45 degree angle. After a technician aligned the subject's outstretched arms with the lines on the sheet, subjects were told to find a point of reference that they were pointing at with their hands. They then held a 6-pound medicine ball at their sternum and were instructed to launch the ball directly at the spot selected. Hand chalk was applied to the ball to indicate the landing spot. After three light practice throws subjects performed a maximal effort three times, with the distance from the wall to the nearest point of the landing spot determined. On a separate occasion 38 subjects completed the protocol a second time to establish test-retest reliability.

RESULTS: Subjects found the process for launching the ball at the proper angle simple to follow. Paired T-test revealed no significant difference between the best throw and the average of the two best throws ($p < 0.01$). Interclass correlation revealed a high test-retest reliability for the procedure ($r = 0.98$). Maximal throw distance showed moderate to good correlation with both height ($r = 0.72$) and weight ($r = 0.63$). The median distance for males was 223.4 inches, with 25th and 75th percentile values of 199.6 and 245.4 inches, respectively. The median distance for females was 143.1 inches, with 25th and 75th percentile values of 128.4 and 154.6 inches, respectively. Relative to height and weight, males and females had median values of 3.22 and 2.21 inches per inch of height, respectively, and median values of 1.27 and 0.99 inches per pound, respectively.

CONCLUSIONS: The protocol demonstrates high reliability and provides a simple mechanism to assist subjects in achieving the desired angle of launch.

3424 Board #112 June 1 8:00 AM - 9:30 AM
Effects of an Acute Strength and Conditioning Training Session on Dual Energy X-ray Absorptiometry Results

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(No relevant relationships reported)

In the use of dual x-ray absorptiometry (DXA) scans to obtain reliable measures of body composition, athletic staff must be aware of acute factors that may alter scan estimates, such as hydration status. **PURPOSE:** The purpose of this study was to determine if a strength and conditioning (S&C) training session, based upon what athletes regularly engage in, will alter body composition estimates (lean mass, fat mass, and bone mineral content) of a DXA scan. **METHODS:** The S&C session lasted ~90 minutes and consisted of upper and lower body resistance exercises and interval running. Twenty-two strength-trained subjects (15 men, 7 women, age 24 ± 2 yrs, height 174.2 ± 8.5 cm, weight 83.5 ± 15.0 kg) volunteered to participate in the study.

Each subject completed two standard DXA scans on the same day, before and after the S&C session. Following the consumption of a free-living meal prior to the first scan, subjects avoided all food intake until completing the second scan. Throughout the S&C session, subjects were encouraged to drink water ad libitum. **RESULTS:** The results of this study were analyzed via correlated t-test ($p < 0.05$ considered significant) and significant values are listed in Table 1 below. **CONCLUSION:** The acute physiological effects of a S&C session alter body composition measures obtained by DXA scan. Thus, athletic staff should consider the timing of DXA scans in relation to S&C sessions.

TABLE 1.

	Total mass (kg)	Arms tissue mass (kg)	Arms lean mass (kg)	Legs tissue mass (kg)	Legs lean mass (kg)	Trunk lean mass (kg)
PRE	83.8 ± 14.9	20.5 ± 9.0	10.8 ± 2.3	23.2 ± 8.3	21.5 ± 5.3	28.7 ± 5.3
POST	$83.5 \pm 15.2^*$	$19.9 \pm 9.1^*$	$11.0 \pm 2.5^*$	$22.6 \pm 8.7^*$	$21.8 \pm 5.0^*$	$28.2 \pm 5.4^*$

* Significantly different from PRE ($P < 0.05$)

3425 Board #113 June 1 8:00 AM - 9:30 AM
Effects Of A Short-term Core Stability Exercise On Functional Movement And Balance

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 (No relevant relationships reported)

Recently, the importance of maintaining the alignment of the human muscles and managing the left and right symmetry has been widely recognized in fields that study pain medicine, physical therapy and exercise rehabilitation. As a result, core stability exercise has been spotlighting. **PURPOSE:** To investigate the effects of a short-term core stability exercise on functional movement and balance in subjects with mild lower-limb discomfort. **METHODS:** Twenty people with mild lower-limb discomfort were randomly assigned to a non-training control (CG, $n = 10$) and core stability exercise training group (EG, $n = 10$). While CG maintained their daily routine, EG completed twenty 30-min training sessions consisted of 10 modified mat pilates program exercises aimed at increasing core stability. Functional movement, dynamic balance, and discomfort level were assessed before and after twenty sessions of core stability training using functional movement test, balance test and visual analog scale (VAS), respectively. Two-way (group by time) repeated measures ANOVA's were performed for all dependent variables, and the significance for all statistical tests was set at $p < .05$. **RESULTS:** EG demonstrated a significant increase in functional movement indicated by increased hurdle step (CG; -4.7 vs. EG; 25%, $p = 0.024$, group \times time effect) and shoulder mobility (CG; -13.04 vs. EG; 5%, $p = 0.037$, group \times time effect). The dynamic balance score was significantly improved only in EG for both limbs (right: EG = 7.7%, $p = 0.007$; left: EG = 8.10%, $p = 0.011$, time effect). A significant reduction of VAS score in ankle was exhibited in EG (EG; -74.76%, $p = 0.024$, time effect). **CONCLUSION:** This study highlights that twenty sessions of short-term core stability exercise can positively affect the lower limb's functional movement and balance ability in people with mild lower-limb discomfort.

3426 Board #114 June 1 8:00 AM - 9:30 AM
Validity And Reliability Of The Computrainer® During 40 km And 100 km Time-trials

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The ecological validity of findings can substantially be improved when laboratory-based research studies use experimental designs attempting to emulate real-world exercise conditions. The exercise science literature contains ample of research that looked at the impact of various interventions using running and cycling time-trial (TT) protocols. Regarding cycling TT performances, the Computrainer® (CT), an electromagnetically brake bike trainer applying resistance to the rear wheel of a standard bike, has been extensively used for over a decade. Yet, it is unknown whether the CT provides valid and reliable power output data under TT conditions. **PURPOSE:** Determine the validity and reliability of two CTs during 40 km and 100 km TTs. **METHODS:** Power output data of two CT Lab® were compared against those of a calibration rig (Drouet, J.M. et al. Sports Eng. 2008. 15-22.) connected to left side of the crank axle of a road bike with a driving shaft, allowing direct measurement of the true workloads generated by both CTs. The measurement process consisted of comparing the power delivered by the calibration rig to the power displayed by the CTs. Power uncertainty delivered by the calibration rig is $\pm 0.9\%$. Each TT was performed under standardized conditions on two occasions with both CTs®. TTs were completed on a flat course and designed upon previously published results in elite/highly-trained cyclists. **RESULTS:** Mean power outputs generated by the two CTs for the 40 km and 100 km TTs were respectively of 359 ± 38 and 282 ± 56 watts. Mean biases between the CT 1 and the rig for the 40 km TTs varied from -0.8 to -0.7%, and between the CT 2 and the rig for the same distance from -2.7 to 3.6%. For the 100 km TTs, biases between the CT 1 and the rig ranged from -1.4 to -0.4%, whereas for the

CT 2 from -5.9 to -3.4%. For repeated trials, biases within 40 and 100 km TTs for CT 1 were < 1% whereas, for CT 2, bias was also < 1% for the 40 km TTs, but reached 2.5% for the 100 km TTs. **CONCLUSIONS:** Our results indicate that accuracy differs between CTs during 40 and 100 km TTs, suggesting that CTs should not be used interchangeably. Both CTs were shown to provide repeatable data for the 40 km TTs. Whereas for one CT this was also the case for the 100 km TT, for the other CT it was observed that the rig had to produce less torque on one of the two trials to keep the power output generated by CT constant.

3427 Board #115 June 1 8:00 AM - 9:30 AM
Exercise and Non-Exercise Methods for Determining
Cardiorespiratory Fitness

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(No relevant relationships reported)

Cardiorespiratory fitness (CRF) is a criterion measure expressed as maximal volume of oxygen consumption per unit of time ($\text{VO}_{2\text{max}}$). The criterion measure is closely related to functional capacity of the heart. Functional capacity of the heart has direct ties to risks associated with cardiovascular disease and cardiac mortality. CRF is traditionally measured using exercise protocols. Exercise protocols can be contraindicated for clinical high-risk populations. Instances where exercise tests are contraindicated, prediction equations have been useful to estimate CRF. **PURPOSE:** The purpose of this study was to determine the validity between a treadmill exercise test and a prediction equation to determine CRF level.

METHODS: Participants (N=25) were collegiate level students who were recreationally active and met physical activity standards. CRF was assessed using two methods, a Bruce treadmill test (BTT) and the World Fitness Level (WFL) prediction equation. The prediction equation used to estimate $\text{VO}_{2\text{max}}$ uses age, body mass index (BMI), resting heart rate (RHR), physical activity index (PA-I) and is specific to gender. Women: $70.77 - (0.244 \times \text{age}) - (0.749 \times \text{BMI}) - (0.107 \times \text{RHR}) + (0.213 \times \text{PAI})$
 Men: $92.05 - (0.327 \times \text{age}) - (0.933 \times \text{BMI}) - (0.167 \times \text{RHR}) + (0.257 \times \text{PAI})$. Participants completed the BTT on a separate day as the WFL questionnaire. Participants were asked to complete the BTT to volitional fatigue. Heart rate, blood pressure, and $\text{VO}_{2\text{max}}$ were recorded. Pearson product-moment correlations, mean average percentage error (MAPE), and 95% limits of agreement were performed to assess validity.

RESULTS: The correlation between the treadmill test and questionnaire was moderate ($r = 0.75$, $r^2 = 0.56$), whereas the observed MAPE values were large (18%). The 95% limits of agreement for the mean difference between the treadmill test and questionnaire were poor ($-18.94 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$ to $10.99 \text{ mL} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$).

CONCLUSIONS: The results would suggest the WFL prediction equation is not a valid predictor for CRF. It is important to consider that the PA-I is subjective and may not accurately represent the true physical activity levels of the participants in this study.

3428 Board #116 June 1 8:00 AM - 9:30 AM
The Relative Intensity of Split Squat Exercise
Performed on Stable vs Unstable Surfaces

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The intensity of exercise may vary relative to the stability of the surface the exercise is performed on. There is limited data in regards to suspension training and whether it can modify the intensity of a resistance training session. Motor unit activation can be inferred through surface electromyography, therefore the recorded activity can translate to the relative intensity of a specific exercise. **Purpose:** The purpose of this study is to determine the magnitude of motor unit activation while performing a split squat on a stable surface (SS), and on an unstable surface (US) (suspension cables). **Methods:** 18 subjects (age 19 ± 3.7 y/o, height 166.7 ± 20.1 cm, weight 71.4 ± 11.0 kg, 9 ♀) volunteered to participate in a randomized cross over study. EMG electrodes were placed on four primary muscles (bicep femoris [BF], gluteus maximus [GM], rectus abdominis [RA], rectus femoris [RF]) involved in the split squat. Each participant was familiarized with the correct biomechanical movement of the split squat. All trials required the rear foot elevated 40.6 cm above the floor. Both SS and US trials were conducted with no external load present and required the subject to perform 5 correct repetitions at a 3-1-3 cadence. **Results:** EMG peak millivolts for the RF was 1.41 ± 0.27 & 1.45 ± 0.53 , BF was 0.77 ± 0.52 & 0.22 ± 0.35 , GM was 0.75 ± 0.28 & 0.96 ± 0.48 , and RA was 0.19 ± 0.21 & 0.22 ± 0.11 for SS and US, respectively. Paired T test revealed a significant difference ($p < .05$) only for the GM trials. **Conclusion:** Although suspension training may create a new challenge while exercising, increased motor unit activation on the unstable surface may be limited to select muscles. Unstable surface training does not appear to increase the overall muscle activation for this given activity.

3429 Board #117 June 1 8:00 AM - 9:30 AM
Reliability of Single Limb Squat and Lateral Step Down
Assessment in Novice and Expert Clinicians

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(No relevant relationships reported)

The single limb squat (SLS) and lateral step down (LSD) are common lower extremity tests used to assess gross lower extremity strength and motor control. **PURPOSE:** To compare intra-rater reliability of lower extremity tests between novice and expert clinicians between sessions. **METHODS:** Six licensed physical therapists (3 "novice" and 3 "expert") rated 20 frontal plane video recordings of healthy adults who participated in a previous study performing the SLS and LSD. The sample size required to find a kappa of at least 0.50 with a 95% confidence interval of ± 0.40 was estimated to be 18. Novice physical therapists were operationally defined as those within 3 years of initial licensure. Expert physical therapists were licensed for at least 10 years and held a board certification in either orthopedics or sports. Prior to data collection, clinicians practiced rating the SLS and LSD on a separate set of recordings. Kappa statistics were calculated based on previous reported formula and interpreted using a standard index. If bias or prevalence indices were above 0.5, the prevalence-adjusted bias-adjusted kappa (PABAK) was calculated. **RESULTS:** For the SLS, intra-rater reliability of all raters, except one, had moderate reliability or better. For the LSD, most raters had substantial reliability except for two raters, one novice and one expert, who had fair and moderate reliability, respectively. **CONCLUSIONS:** Our findings suggest using the SLS to assess lower limb strength and control given its higher reliability in novice and experts. The SLS rating was based on knee movement, while LSD was based on trunk, arm, pelvis, knee, and foot. The higher reliability on SLS than LSD may be due to evaluating only one component rather than several simultaneously.

Table 1: Intra-rater reliability of single leg squat and lateral step down test performance by novice and expert raters; kappa (95% confidence interval)

	Novice Clinicians			Expert Clinicians		
	1	2	3	4	5	6
Single Leg Squat (κ)	0.71 (0.40 - 1)	0.79 (0.52 - 1)	0.60 (0.25- 0.95)	0.89 (0.69 - 1)	0.49 (0.10- 0.88)	0.90 (0.71 - 1)
Lateral Step Down (PABAK)	0.70 (0.39 - 1)	0.50 (0.12- 0.88)	0.70 (0.39 - 1)	0.70 (0.39 - 1)	0.70 (0.39 - 1)	0.30 (-0.12- 0.72)

κ = unadjusted kappa; PABAK = prevalence-adjusted bias-adjusted kappa

3430 Board #118 June 1 8:00 AM - 9:30 AM
Correlation Of Functional Movement Screen (FMS) And
Mobility, Activation, Posture, And Symmetry (MAPS)
Among Older Adults

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(No relevant relationships reported)

PURPOSES: 1) To determine the relationship between Functional Movement Screen (FMS) and Mobility, Activation, Posture, Symmetry (MAPS) within an older adult population, 2) to identify the number of "declined attempts" among the 7 FMS tests, and 3) to determine if there was a relationship between the FMS Deep Squat test scores and MAPS scores. **METHODS:** Informed consent was received from 97 volunteers between the ages of 69-95 years of age (65 females; 32 males; Age = 81.9 ± 5.8 yrs; Height = 165.9 ± 10.4 cm; Body Mass = 74.2 ± 15.0 kg) who were asked to complete the FMS and MAPS. Spearman correlation was run to determine the relationship between FMS and MAPS. The frequency of "declined attempts" was quantified for each of the 7 FMS tests. One-Way ANOVA was used to investigate the relationship between FMS Deep Squat and MAPS scores due to the categorical nature of the Deep Squat scores. **RESULTS:** Data revealed a significant but low-to-moderate correlation between FMS and MAPS ($r = 0.46$). On average, there were 7 "declined attempts" per FMS test. Hurdle Step and Active Straight Leg Raise had the lowest "declined attempts" with 0, whereas Trunk Stability Push Up had the highest "declined attempts" with 17. One-Way ANOVA results showed a significant difference between groups ($p < .001$). Participants that scored a 2 on the Deep Squat had higher average MAPS scores compared to participants that scored 0 or 1 ($p < .001$). Participants that scored 1 on the Deep Squat had higher average MAPS scores than participants who scored 0 ($p = .011$). **CONCLUSIONS:** Of the 97 participants, as many as 18% declined

to attempt at least one of the 7 FMS tests, whereas all participants completed the MAPS assessment. A higher score on the FMS Deep Squat was related to a higher score on MAPS; however, given the 21% common variance, FMS and MAPS are not interchangeable. From a practical perspective, one cannot replace the other when assessing movement in older adults.

3431 Board #119 June 1 8:00 AM - 9:30 AM
Impact of Short Cranks on 3-Min All-Out Cycling Test and Critical Power Metrics

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The 3-minute all-out cycling test (3MT) is a valid, practical, and time effective method for determining Critical Power (CP) and intensities used in training and competition for cyclists. Changing the crank length (CL) on a bicycle may affect an individual's ability to produce and/or maintain power output while cycling. A change in CP due to CL differences would lead to a change in the ability of the cyclist to maintain power output. **PURPOSE:** To determine the impact of short crank arms on the metrics of the 3MT. **METHODS:** A total of 9 recreationally trained male cyclists (27.6 ± 7.5 yrs.) participated in the study. Subjects completed an incremental cycle test to determine $\dot{V}O_{2peak}$ (57.4 ± 6.4 ml/kg/in; 366 ± 47 W) and gas exchange threshold (276 ± 59 W) to calculate the resistance for the 3MT. Session two consisted of a familiarization trial of the 3MT. For sessions three and four, subjects completed the 3MT using CLs of 145 (short crank, SC) and 175mm (normal crank, NC). CL was determined in a randomized counterbalanced format. T-tests were utilized to determine differences between outcome variables of the 3MT. **RESULTS:** Peak power and peak cadence were significantly higher in the SC trial compared to the NC trial (SC 531 ± 116 vs NC 496 ± 113 W, $p = 0.00$; SC 168.9 ± 9.2 vs NC 157.6 ± 8.9 RPM, $p = 0.00$). The mean cadence over the last 30 sec of the 3MT did not differ between CLs (SC 93.4 ± 13.9 vs NC 93.0 ± 13.0 RPM, $p = 0.79$), but the average pedal speed over the same 30 sec was significantly slower in the SC trial compared to the NC trial (SC 1.41 ± 0.21 vs NC 1.70 ± 0.23 m/s, $p = 0.00$). CP (SC 287 ± 41 vs NC 287 ± 46 W, $p = 0.97$) and work above end power (WEP) (SC 12.2 ± 4.0 vs NC 11.4 ± 3.4 kJ, $p = 0.08$) were not significantly different between CL trials. **CONCLUSION:** CP was not different in the current study and demonstrated that changing CL by as much 30mm may not be a major factor in maintaining submaximal power output when position on the bike is maintained between CLs. However, individual differences among the subjects reveal changing CL could affect CP by up to 20 watts; some individuals performed better with 175mm while others performed better with 145mm. Cyclists should begin testing CLs to determine if a CL outside of the typically prescribed norms of within 2.5mm of 172.5mm could possibly benefit their performance and comfort while cycling.

3432 Board #120 June 1 8:00 AM - 9:30 AM
Correlation Of Functional Movement Screen (FMS) And Mobility, Activation, Posture, Symmetry (MAPS) Among College Students

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 (No relevant relationships reported)

INTRODUCTION: Despite the growing popularity of functional assessment and corrective exercise prescription, there is limited research evaluating the correlation between two functional movement assessments: the Functional Movement Screen (FMS) and the Movement, Activation, Posture and Symmetry (MAPS). FMS is a commonly-used tool that takes approximately 20-25 minutes for a trained technician to subjectively score participants on 7 movements. MAPS is a novel assessment tool that takes about 45-60 seconds for a computer-based system to objectively score participants completing 1 movement. **PURPOSE:** To evaluate the relationship between FMS and MAPS among an apparently healthy, young adult population. **METHODS:** Two hundred and nineteen participants (140 Females; 79 Males; Age = 19.5 ± 1.7 yrs; Height = 169.4 ± 10.1 cm; Body Mass = 68.5 ± 15.5 kg) completed FMS and MAPS within a single testing session. Pearson's correlation coefficients were used to determine the relationship between FMS and MAPS, as well as FMS and the four individual MAPS components. **RESULTS:** A weak correlation was observed between FMS and MAPS ($r = 0.25$, $p < 0.001$). Furthermore, all individual MAPS components demonstrated a negligible to weak relationship with FMS ($r = 0.29$,

0.11, 0.12, and 0.06 for Mobility, Activation, Posture, and Symmetry, respectively).

CONCLUSION: These findings suggest that FMS and MAPS are relatively independent of one another. From an applied perspective, one cannot replace the other in terms of evaluation. Future research will have to examine the value of MAPS as a tool to monitor improvements during exercise interventions.

3433 Board #121 June 1 8:00 AM - 9:30 AM
Agreement And Reliability Between Powertap™ Power Measurement Pedals And Velotron™ Load Generator Ergometer

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 (No relevant relationships reported)

Title:

Agreement and reliability between PowerTap™ power measurement pedals and Velotron™ load generator ergometer

Author Block:

Frank Plonka, Brandon Bastianelli, Andrea Workman, Stephen McGregor. Eastern Michigan University, Ypsilanti, MI.

Abstract:

The PowerTap P1 pedal based power meter allows for measurement of power at the pedal/rider interface independent of crank or hub. This allows for the use of the measurement of power at the pedal to examine putative effects of changes in components such as the crank. The Velotron cycle ergometer is an extensively used ergometer for laboratory testing.

Purpose:

To test the agreement between a portable pedal power measurement system (PowerTap; PT, Saris, WI) and Velotron (VCE, Racermate, WA) stationary ergometer. Additionally, to determine the test-retest reliability of PT relative to VCE.

Methods:

16 trained cyclists and/or triathletes consented to procedures approved by the EMU-HRSC, which consisted of three visits. For visit 1, subjects completed and incremental trial on VCE and using indirect calorimetry (Parvomedics, CO) to determine power and ventilatory threshold (pVT) and $\dot{V}O_{2MAX}$. During visits 2 and 3, subjects warmed-up on VCE and then completed twelve, six-minute stages which consisted of pedaling at a given cadence while maintaining a power output equivalent to 70, 80, or 90 percent of pVT. The six min stages were randomized, power was measured at the pedal (PT), and the load applied by VCE. Linear regressions to determine agreement across power and intraclass correlations to determine reliability were performed using SPSS 24.0 (IBM, IL) with an alpha = 0.05.

Results:

Across all absolute VCE power (125-305 watts), linear regression showed strong agreement ($r^2 = 0.94$; $p < 0.001$) between VCE and PT. Intraclass correlations showed strong agreement between tests ($r = 0.983$; $p < 0.001$). Overall, the ratio of PT/VCE was 0.98 and 0.97 and coefficients of variation were 5.6% and 4.1% for visits 2 and 3, respectively.

Conclusion:

These results indicate that the PowerTap P1 power measurement pedal agrees strongly with the Velotron cycle ergometer and is reliable from a test-retest perspective. Therefore, a PowerTap pedal system can be used to evaluate the effects of component changes with the use of a Velotron ergometer.

3434 Board #122 June 1 8:00 AM - 9:30 AM
Novel Crank with Elastomer Spring Improves Effective Power in Trained Cyclists and Triathletes

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 (No relevant relationships reported)

Purpose

Test claims a novel cycling crank (IMPACT, Huron Cycling, LLC) may increase effective cycling power. The crank incorporates an elastomer spring and is purported to return energy during the "dead spot" of the pedal revolution, thus improving the net transfer of external power.

Methods

15 trained cyclists/triathletes (38 ± 7 y, 74.5 ± 9.9 kg, 174.7 ± 6.6 cm) consented to procedures approved by the EMU-HRSC. The study consisted of three visits. During V1, subjects performed a graded exercise protocol on a Velotron (Racermate, WA) cycle ergometer (VCE) to determine ventilatory threshold (VT) (Parvomedics, CO) and power at VT (pVT). During V2 and V3, subjects warmed-up on VCE then completed twelve, six-minute stages which consisted of pedaling at a 85 rpm while maintaining a power output equivalent to 70, 80, or 90 % of pVT. Additionally, a cadence effect was tested at 80% pVT at 75, 85 or 95 rpm. The six stages were randomized, and each stage was completed twice; i) with a pin in the crank (CON),

and ii) without the pin (EXP). The pin eliminated the spring effect of the elastomer, thus making a traditional rigid crank. There was a minute rest between each stage, except when changing from EXP to CON (3 minutes) to change the pin and allow subject to drink. The VCE was used as the external load generator and power was also measured at the pedals (PowerTap P1, WI; PT) to determine if any difference in power between external load and power necessary to turn the cranks against the load was present. MANOVA statistical tests compared %pVT between PT and VCE and VO₂ in both EXP and CON ($\alpha=.05$).

Results

Across all conditions, there was a Large effect for EXP power being 1.3 % lower than CON ($p=.008$; $\eta^2=.028$). Although not significant, there were small effects for cadence at 80% pVT, where EXP was lower than CON, but to a greater extent at 85 and 95 than 75 rpm (77.7 \pm 2.8, 77.1 \pm 3.6 and 78.5 \pm 4.2 %, respectively, $\eta^2=.019$). There was no significant difference between VO₂ at each workload when expressed as a percentage of VT between EXP and CON. There were no significant differences by trial for any variables tested.

Conclusion

Lower power, but similar VO₂ during EXP compared to CON supports the notion that the IMPACT crank improves effective power during cycling. Although small in magnitude, the effect was large and could be of interest to competitive cyclists or triathletes.

3435 Board #123 June 1 8:00 AM - 9:30 AM A New Equation to Estimate VO_{2max} for a Racquet Sport Modality

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(No relevant relationships reported)

The 'padel' is a relatively new racquet modality (less than 30-year-old in USA) played in a 20x10 meters enclosed court. There is little information about its metabolic characteristics, and a lack of tests to estimate physiological performance on the field. The goal of this study was to describe body composition and aerobic capacity of amateur padel players; additionally, we aimed to develop an equation to estimate aerobic capacity (VO_{2max}) on padel players. **Methods:** Thirty-three male padel players with a valid direct VO_{2max} test were included in this analysis (36.4 \pm 5.9 years; BMI, 24.5 \pm 2.1 kg/m²; %fat mass (%FM), 20.5 \pm 5.7%). Body composition (lean mass and %FM) was measured by DXA; appendicular lean tissue was used to derive skeletal muscle mass (SMM). A specific progressive shuttle-run test was created to measure VO_{2max} inside the padel court; briefly, each player needed to run from one wall to the other wall of the court grasping his racquet, pace feedback was provided by a digital audio system, starting at 8.5 km/h the speed increased 0.5 km/h. VO_{2max}, anaerobic threshold (AT) and heart rate (HR) was directly measured by a portable indirect calorimeter over the all-out test. Stepwise multiple regression analysis was utilized to derive an equation to estimate VO_{2max}. The concordance coefficient correlation (cc) was used to assess the accuracy of the equation. **Results:** Body composition and metabolic exercise variables are shown in table 1.

Table 1. Physiological characteristics of amateur padel players.

Variables		Mean	SD
Age	(years)	36.4	\pm 5.9
Lean	(kg)	61.5	\pm 5.7
SMM	(kg)	33.0	\pm 3.4
HR _{max}	(beats/min)	179	\pm 9
VO _{2max}	(l/min)	3.822	\pm 0.611
VO _{2max}	(ml/kg/min)	48.8	\pm 6.4
VO _{2max}	(ml/kg _{lean} /min)	62.7	\pm 6.3
AT	(ml/kg/min)	33.2	\pm 6.2
%AT	(%)	68.3	\pm 11.0
HR _{AT}	(beats/min)	134	\pm 21.8

SD, standard deviation; AT, %AT and HR_{AT} indicate oxygen uptake, % of VO_{2max} and HR at anaerobic threshold, respectively.

SMM and number of stages were the main predictors of absolute VO_{2max} ($R^2 = 0.72$, $P<0.001$); the equation was $VO_{2max} \text{ (L/min)} = -0.00195 + 0.148 \times \text{SMM (kg)} \cdot \text{Stage (number)}$. The cc between measured and estimated VO_{2max} was moderately high ($cc=0.807$). **Conclusions:** We have provided references for body composition and maximal aerobic capacity variables in amateur padel players and a new equation to estimated aerobic capacity from a specific test for the sport of padel. Larger and more heterogeneous datasets are necessary to validate these results.

3436 Board #124 June 1 8:00 AM - 9:30 AM Dual Stress Warm-Up Protocol Does Not Significantly Improve Anaerobic Performance

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(No relevant relationships reported)

Dual stress challenges (e.g. paired physical and psychological challenges) have been shown to increase sympathetic activity above that of exercise alone. Although the rise in sympathetic activity represents a maladaptive increase in physiological load, there is a possibility that a dual stress challenge in a warm-up setting may optimize sympathetic activation while minimizing peripheral fatigue. **PURPOSE:** To determine whether a dual stress warm-up protocol improves performance on the 30 s Wingate Anaerobic Test (WAnT). **METHODS:** Thirteen college-aged subjects (Mean \pm SD; age = 21 \pm 3 yr; Height = 177 \pm 9 cm; Weight = 81.8 \pm 11.8 kg) volunteered to participate and completed a familiarization WAnT on a Monark cycle ergometer using a resistance of 7.5% bodyweight prior to testing. On two separate visits, separated by at least 3 d but no more than 1 wk, subjects randomly completed a WAnT preceded by either a 5 min warm-up at a resistance of 1.5% BW at a pedal rate of 70-80 rpm (CTRL) or the same warm-up while also completing the Paced Auditory Serial Test, which is a mental arithmetic challenge (EXPT). Zephyr Bioharnesses were used to record heart rate (HR) during the testing sessions. Difference in HR during the warm-up, and WAnT peak power, average power, and power drop were investigated using paired samples *t*-tests. **RESULTS:** There were no significant differences in performance or HR response during the warm-up between the CTRL and EXPT. **CONCLUSION:** These findings suggest that the addition of a mental task during a warm-up on a cycle ergometer has no effect on sympathetic activity or performance during a 30 s WAnT. The lack of significant findings may be due to the small sample size. Future work should focus on more challenging psychological stressors in conjunction with warm-up protocols to determine whether dual stress challenges can be utilized to optimize performance.

3437 Board #125 June 1 8:00 AM - 9:30 AM Vertical Jump Versus Kinematic Sequencing: Advanced Technology Doesn't Always Enhance Appraisal

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(No relevant relationships reported)

In an age when science informs sport, new technology for athlete appraisal is often adopted before it is tested. Sparta kinematic sequencing (Sparta Science Corp.) is an instrument for player assessment that's employment has outpaced its examination. **PURPOSE:** To evaluate the effectiveness of Sparta data in predicting basketball performance. **METHODS:** We analyzed 37 basketball players from a D1 collegiate basketball program over a 4-year period (2013-2014 through 2016-2017). Each player's vertical jump (VJ) was measured and tested on a Sparta force plate, which provides 3 proprietary outputs: Load, Explode, and Drive. On average, each player was tested 24.9 \pm 20.3 times; there were 922 total observations evenly distributed over the 4 years and over year in school. The Sparta outputs were used to predict on-court performance of each athlete during each season that the values were collected via multiple linear regression analyses. The dependent variables were in-game statistics per 40 minutes of court time: points, rebounds, assists, blocks, and turnovers. **RESULTS:** Athletes played 19.3 \pm 12.7 games per year. On average, they scored 12.8 \pm 4.4 points, had 6.6 \pm 2.7 rebounds, and turned the ball over 2.4 \pm 1.0 times. Regression analyses found no significance with Load, Explode, or Drive in points per game, field goals per game, or assists per game. In each analysis all 3 Sparta outputs had negative associations that didn't reach significance while VJ had a positive association that failed to reach significance. Load predicted rebounds per game ($\beta=0.18$; $p<0.001$) and blocked shots per game ($\beta=0.03$; $p=0.021$). Explode and Drive had non-significant negative relationships and VJ had a non-significant positive relationship. Explode ($\beta=0.31$; $p=0.017$) and Drive ($\beta=0.304$; $p=0.011$) predicted more turnovers per game, VJ predicted fewer ($\beta=-0.982$; $p=0.020$), and Load had a non-significant positive association. Without controlling for the full Sparta profile, Explode associated with fewer rebounds ($p<0.001$) and more turnovers ($p=0.020$); it had no association with improvements in performance. **CONCLUSION:** Athletic programs are often quick to incorporate new technology believing that it equates to improved player assessment. More analyses are required before simple jumping analyses can be displaced by sophisticated equipment.

3438 Board #126 June 1 8:00 AM - 9:30 AM
Differences In Performance Traits In Intermittent Versus Continuous Exercise Testing Of Handball Players and Triathletes

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 (No relevant relationships reported)

External validity of endurance performance diagnostics may depend on type of sports. In order to reflect different load quality for the muscle specific endurance testing regimes have been developed for intermittent sports. Here we examined the influence of an intermittent versus a typical continuous step-wise progressive treadmill protocol on metabolic and cardiorespiratory parameters. **PURPOSE:** To determine if handball players (HB) in comparison to triathletes (T) show differences in typical submaximal lactate thresholds (LT and LT + 1.5 mmol), or in VO₂max depending on either continuous or intermittent type of a step-wise progressive exercise testing. **METHODS:** 13 HB and 13 T; mean (SD) age 24.7 (3.1 yrs) height 184.2 (7.2 cm), weight 82.7 (10.8 kg) with a training load of 6.8 (3.1) h/wk in HB versus 8.8 (3.3) h/wk in T. Each subject performed two treadmill protocols within one week. First a typical step-wise incremental treadmill test (CTT) starting at 6 km/h increasing every 3 min by 2 km/h until exhaustion. Second a step-wise incremental intermittent test (IMT) with steps split into 6x15s load phase interlaced with 6x15s active recovery. Load phase started at 8 km/h and was increased every 3 min by 2 km/h, while active recovery remained at 6 km/h throughout all steps until exhaustion. VO₂max, velocity at LT, velocity at LT + 1.5 mmol/l lactate (LAT). **RESULTS:** VO₂max in ml/min/kg was not significantly different between sports and testing protocols (all 4 groups) with CTT for HB 50.5 (4.7) and T 53.2 (3.5), or with IMT 50.1 (3.7) in HB and 51.2 (4.2) for T. Velocity in km/h at LAT was not significantly different between all groups with CTT for HB 11.9 (0.8) and 12.4 (1.3) for T, or with IMT 11.2 (0.4) for HB and 11.5 (0.7) for T. For the LT in km/h we revealed in an analysis of co-variance a slightly significantly higher velocity of $\Delta V = 0.74$ km/h (95% CI = 0.03-1.45, $p < 0.04$) in T than in HB in CTT. **CONCLUSIONS:** We recruited a collective of HB and T with an almost comparable weekly training load. HB and T showed comparable typical performance trait characteristics for the higher work-load demand (VO₂max and LAT), which was even independent of type of test. The slightly better performance of T in specifically the continuous test setting principally reflects higher load and potentially a better adaptation to this type of working demand.

3439 Board #127 June 1 8:00 AM - 9:30 AM
A Comparison of Techniques for Estimating and Detecting Changes in Skeletal Muscle Cross-Sectional Area

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 (No relevant relationships reported)

Muscle biopsy and subsequent histological analysis of muscle fibers is a criterion technique for determining hypertrophy of skeletal muscle in resistance- and endurance-trained individuals. However, due to the training necessary to complete the biopsy, and the invasive nature of the biopsy itself, alternative methods for depicting muscle fiber hypertrophy offer increased ability to gather data discerning skeletal muscle hypertrophy. Furthermore, such procedures require less training and are noninvasive. **PURPOSE:** This project sought to determine if estimated mid-thigh whole muscle cross-sectional area (CSA) is related to muscle fiber CSA from muscle biopsies. **METHODS:** Twenty-nine resistance-trained men (age: 21 ± 2 yrs, weight: 83.6 ± 11.0 kg, height: 178.7 ± 8.1 cm) underwent six weeks of total-body resistance training. Muscle biopsies were taken from the Vastus lateralis prior to and following training. Mid-thigh circumference and skinfold measurements (anterior, posterior, medial, and lateral) were used to estimate whole muscle mid-thigh cross-sectional area using the methods of Moritani and deVries. **RESULTS:** Whole-muscle CSA did not significantly increase from pre- (272.737 ± 37.401 cm) to post-training (277.286 ± 29.474 cm; $p = 0.201$). Muscle fiber CSA did not significantly increase from pre- (4068 ± 865 μm) to post-training (4221 ± 704 μm; $p = 0.368$). Additionally, pre muscle fiber CSA did not correlate to pre whole-muscle CSA ($r = 0.029$, $p = 0.882$). Also, Muscle fiber CSA percent change did not correlate with whole-muscle CSA percent change ($r = -0.064$, $p = 0.741$). **CONCLUSION:** Estimated whole-muscle CSA and muscle fiber CSA do not appear to correlate well. A lack of a relationship between the changes in these measurements following hypertrophy are puzzling and warrant further study.

3440 Board #128 June 1 8:00 AM - 9:30 AM
Is Core Temperature Influenced by Triathlon Wetsuit Models When Swimming in Warm Water?

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Swim-related fatalities have raised safety concerns in the sport of triathlon. As a majority of deaths occur during the swim, there are strict guidelines related to water temperatures and the use of wetsuits in triathlon events governed by USA Triathlon (USAT). Due to the varying water temperatures, athletes can select from a wide variety of wetsuit models. Two main categories of wetsuit models are sleeveless and full sleeve. The use of a wetsuit in warm water may increase body heat storage and may result in an increase in core temperature. However, there are no data investigating the influence of triathlon wetsuit design on core temperature when swimming in warm water. **PURPOSE:** The purpose of this study was to examine the influence of wetsuit design on core temperature responses during swimming in warm water (25.5 °C). **METHODS:** Three experienced triathletes (mean ± standard deviation (SD), age 48 ± 4.93 years, height 1.73 ± 0.09 m, weight 71.62 ± 8.54 kg) participated in the study. At least 8 hours prior to attending the test session, participants swallowed an ingestible core temperature pill. Before beginning the test session, core temperature (T_c) data were transferred to the monitor and sample rate was set to 0.1 Hz (1 sample every 10 s). Testing consisted of a self-directed warm-up followed by a 500-m swim in an indoor pool (set to either 25-m or 50-m in length) for each condition: no wetsuit (NW), sleeveless wetsuit (SL), and full sleeve wetsuit (FS). Participants swam at a self-selected pace at a somewhat hard intensity (Borg Rating of Perceived Exertion = 13). Participants were required to rest until core temperature was within 0.5 °C of baseline before beginning the next condition. Core temperature data were transferred to the monitor after each swim. Average T_c during the first and last minute of each swim was computed for analysis. A 2 (time) x 3 (wetsuit condition) repeated measures ANOVA was used ($\alpha = 0.05$). **RESULTS:** T_c was not influenced by the interaction of time and wetsuit ($p > 0.05$) and there was no main effect for time ($p > 0.05$) nor wetsuit condition ($p > 0.05$). Mean values for T_c between NW, SL, and FS were 37.82 ± 0.44 °C, 37.64 ± 0.68 °C, and 37.64 ± 0.42 °C, respectively. **CONCLUSIONS:** These pilot results indicate that wetsuit design does not significantly influence thermoregulatory responses.

3441 Board #129 June 1 8:00 AM - 9:30 AM
Synchronous Music Does Not Appear to Change YMCA Bench Press Results

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 (No relevant relationships reported)

Listening to music while exercising is thought to enhance physical performance by enhancing focus, elevating mood, increasing motivation, and decreasing perceived effort. Research, however, has debated the actual effects of music on performance, as results of the ergogenic effect vary with different music types, modes of exercise, intensities, and training status. One of the variations observed both in and outside the laboratory is exercise which is synchronized with the rhythm of the music. It is unclear how synchronous music affects maximal exercise testing when a cadence is required as part of the protocol, such as during the YMCA bench press test. **PURPOSE:** The purpose of this study was to investigate the effect of synchronous music on the YMCA bench press test. **METHODS:** Sixteen subjects (6 males, 10 females, 22.1 ± 4.1 years) self reported being active or non-active according to ACSM physical fitness guidelines. Each performed a YMCA bench press test at a cadence of 60 repetitions per minute under two conditions: (1) using a metronome set at 60 bpm and (2) with pre-determined synchronous music with a beat of 120 bpm. With the metronome, each bench press repetition was completed with each beat, while the music trial required subjects to complete each repetition every other beat. The number of successful repetitions completed was recorded and means from each condition were compared using a dependent t-test ($\alpha = .05$). Individual differences between the conditions were also identified and the difference between conditions for active subjects ($n = 11$) was compared to non-active subjects ($n = 5$) using an independent t-test. **RESULTS:** There was no significant difference in the number of repetitions completed during the metronome condition (39.1 ± 22.3 repetitions) and the synchronous music condition (39.1 ± 23.1 repetitions, $p = .99$). There was also no significant difference in change of repetitions completed between active (0.5 ± 6.3 repetitions) and non-active subjects (-1.0 ± 8.3 repetitions, $p = .74$). **CONCLUSION:** Synchronous music did not have an effect on the YMCA bench performance. Because the test requires maximal effort, it may be that the beneficial distraction often caused by music was muted by the high intensity required for the exercise.

3442 Board #130 June 1 8:00 AM - 9:30 AM
Validity of a New Portable Metabolic Gas Exchange System

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Valid and reliable methods to measure oxygen consumption ($\dot{V}O_2$) and carbon dioxide production ($\dot{V}CO_2$) are required in the assessment of exercise capacity and energy expenditure. However, research is often restricted by financial and portability issues with existing open circuit spirometry, metabolic cart or portable devices. **PURPOSE:** Evaluate a new, light-weight and scalable metabolic system (CO_2/O_2 Breath & Respiration Analyzer, COBRA) against a criterion metabolic cart system (Parvomedics TrueOne 2400®, PARVO). **Methods:** Fourteen volunteers (13 male, 1 female; 24 ± 6 y (mean ± SD), 76 ± 13 kg BW, $\dot{V}O_{2peak}$ 3.8 ± 0.7 L·min⁻¹) performed four identical trials over two laboratory test days. The COBRA and PARVO were used to monitor four steady-state work rates: sitting rest, walk (23-36% $\dot{V}O_{2peak}$), jog (49-67% $\dot{V}O_{2peak}$), and run (60-76% $\dot{V}O_{2peak}$) on a treadmill in a laboratory (20 ± 0.5 °C; 45 ± 22 % RH). Simultaneous gas samples were averaged over 3-4 minute steady-state periods for each work intensity. Coefficient of determination and Concordance Correlation Coefficients (CCC) were used to evaluate the agreement between the systems when measuring $\dot{V}O_2$, $\dot{V}CO_2$, and minute ventilation (\dot{V}_E). Systematic bias was examined to assess the accuracy of the COBRA. **Results:** The COBRA and PARVO produced highly correlated measures of $\dot{V}O_2$ ($R^2 = 0.98$), $\dot{V}CO_2$ ($R^2 = 0.98$) and \dot{V}_E ($R^2 = 0.99$). The COBRA had very low bias compared to the PARVO for $\dot{V}O_2$ (0.01 ± 0.13 L·min⁻¹), $\dot{V}CO_2$ (0.06 ± 0.13 L·min⁻¹), and \dot{V}_E (2.12 ± 2.75 L·min⁻¹). COBRA was in high agreement (CCC = 0.99) with the PARVO across each measure of $\dot{V}O_2$, $\dot{V}CO_2$ and \dot{V}_E . **Conclusion:** The COBRA device is an accurate mobile metabolic system for measuring respiratory variables across a range of work intensities.

Disclaimer: The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

3443 Board #131 June 1 8:00 AM - 9:30 AM
Relationship of OMNI Scale of Perceived Exertion to Heart Rate and RER During Incremental Exercise

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The OMNI rating of perceived exertion (RPE) scale is a subjective indicator of physiological strain experienced during aerobic exercise. Unlike its predecessor the Borg RPE scale, relatively few studies have examined the relationship between OMNI Scale reported and the measured heart rate (HR) and respiratory exchange ratio (RER) during exercise. **PURPOSE:** To analyze the strength of the relationship between RPE scores from the OMNI scale and HR and RER during incremental exercise. **METHODS:** Twelve active military personnel (11 male, 1 female; 24 ± 5 yr; height, 175 ± 9 cm; body mass, 79 ± 14 kg) completed two trials over one test day. Each trial consisted of three exercise intensities (walk, jog, run) based on percentages of their maximal oxygen uptake (% $\dot{V}O_{2max}$) performed at baseline separated by a 20-30 minute rest between trials. Measures of RER were collected using a metabolic cart (ParvoMedics TrueOne® 2400), HR with a commercial chest belt monitoring system (Polar T31 Heart Rate Sensor), and RPE with the OMNI-walk/run scale (Adult OMNI Scale of Perceived Exertion 2004). **RESULTS:** The calculated Pearson's correlation of coefficients for RPE was moderately correlated with HR ($r = 0.83$) but weakly correlated with RER ($r = 0.47$). The average RPE for walk (RPE, 2 ± 1), Jog (RPE, 4 ± 1), and Run (RPE, 6 ± 1) increased with each higher work rate. **CONCLUSION:** The OMNI RPE Scale is positively related to heart rate responses elicited by exercise, but is less correlated to changes in RER and therefore less indicative of the transition to greater reliance on glycolytic energy pathways.

DISCLAIMER: The views expressed in this paper are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the US Government. This research was supported in part by appointments to the Postgraduate Research Participation Program at the US Army Research Institute of Environmental Medicine administered by the Oak Ridge Institute for Science and Education through an interagency agreement between the US Department of Energy and USAMRMC.

3444 Board #132 June 1 8:00 AM - 9:30 AM
A Comparison of Waist-to-Height Circumference Ratios to Standardized Measures of Overweight and Obesity

David Q. Thomas, FACSM, Marin McElroy, Ayunna Moore, Jennifer Spring. *Illinois State University, Normal, IL.*

(No relevant relationships reported)

Several methods have been used to screen people for overweight and obesity. Recently, waist-to-height circumference ratios have been gaining in popularity due to their ease of measure and focus on central adiposity. However, research on this method is lacking. **PURPOSE:** To determine the relationship between waist-to-height circumference ratios (WTHR) and more traditional methods (body mass index, waist-to-hip ratio, sum of skinfolds, and percent fat) of screening for overweight and obesity. **METHODS:** Thirty-one volunteers (17 females and 14 males) ages 18-24 (20.8 ± 0.98 yrs.) participated in the study. After completing informed consent, each participant had height, mass, waist and hip circumferences, skinfolds (tricep, bicep, mid-axillary, abdominal, supra-iliac, anterior thigh, medial calf, and pectoral {men only}) and percent fat (via air-displacement plethysmography - ADP) measured. **RESULTS:** Height (1.71 ± 0.10 m), mass (69.98 ± 14.20 kg), waist circumference (76.7 ± 8.61 cm), and hip circumference (98.94 ± 7.71 cm) were determined following standard procedures. Body mass index (BMI) was calculated by dividing mass in kg by height in meters squared (23.68 ± 3.27). Skinfolds (SF) were summed (111.20 ± 42.17 mm). Waist-to-hip (WTH) ratio (0.77 ± 0.06) and WTHR (44.77 ± 4.40) were calculated by dividing waist circumference by hip circumference (WTH) and by height (WTHR). Percent fat (21.06 ± 9.33) was measured by ADP. Pearson product-moment correlations for WTHR and BMI ($r = 0.83$), WTH ($r = 0.63$), SF ($r = 0.57$), and percent fat ($r = 0.55$) were calculated. **CONCLUSIONS:** Waist-to-height circumference ratios had a strong positive relationship with BMI and moderate positive relationships with WTH, SF, and percent fat. It appears that WTHR may be an acceptable alternative to screening for overweight and obesity. Since WTHR only involves the measure of height and waist circumference, this method has a high degree of feasibility. Its focus on central adiposity is an additional benefit. Further research is necessary to determine if these relationships hold true for other populations varying in age and body composition.

G-37 Free Communication/Poster - Predictive

Saturday, June 1, 2019, 7:30 AM - 11:00 AM
 Room: CC-Hall WA2

3445 Board #133 June 1 9:30 AM - 11:00 AM
Can the Talk Test Be Used to Predict Training Induced Changes in Ventilatory Threshold?

Carl Foster, FACSM, Kristen M. Deal, John P. Porcari, FACSM, Richard P. Mikat, FACSM, Cristina Cortis, Andrea Fusco. *University of Wisconsin-La Crosse, La Crosse, WI.*

(No relevant relationships reported)

PURPOSE: To test the reliability of the talk test (TT) for tracking changes in ventilatory threshold (VT). **METHODS:** Thirteen healthy college-age students (mean ± SD; age, 20.5 ± 1.91 years; BMI, 25 ± 2.8 kg/m²; Females=6) completed a TT and graded exercise test (GXT) before and after six weeks of increased training or detraining. The TT was used to predict VT by assessing the ability to talk comfortably during 3-minute exercise stages. The criterion measure of VT was respiratory gas exchange during the GXT using the v-slope method. Training and detraining were self-directed. Subjects recorded their exercise minutes and average rating of perceived exertion during the training session (sRPE) using the CR10 scale, which was used to calculate training LOAD. A two-way repeated measures analysis of variance (ANOVA) with Tukey's post-hoc analysis was used to detect differences between the change in power output (PO) during the TT and at VT ($p < .05$). **RESULTS:** No significant differences were found between the PO at equivocal stage (EQ) of the TT (135 ± 29.8 W) and $\dot{V}O_2$ at VT (134 ± 32.4 W) ($p > .05$). There was no significant change between exercise baseline minutes (160 ± 7.6 minutes) and experimental minutes (213 ± 46.6 minutes) ($p > .05$). However, there was a significant change between sRPE and LOAD at baseline (4.5 ± 0.17 and 715 ± 204.7, respectively) and experimental (5.9 ± 0.23 and 1302 ± 228.5, respectively; $p < .05$). Baseline training loads were considerably more than the 150 min/week at moderate intensity (RPE=3) recommended by ACSM (2017) for basic fitness with 68% of subjects exceeding the recommendations. **CONCLUSION:** The TT was shown to be reliable in tracking changes in VT over time. The results suggest that tracking training induced changes in exercise capacity can be done using the simpler method of the TT.

- 3446** Board #134 June 1 9:30 AM - 11:00 AM
U.S. Navy Physical Readiness Test Modality Pilot Study
 Rebecca S. Weller¹, Douglas M. Jones¹, Katherine M. Wilson¹, Andrew J. Ordille¹, Dale A. Hirsch¹, John J. Fraser¹, Trevor B. Viboch¹, Aaron J. Wolf¹, Valerie M. Costantini¹, Heath Clifford², Jay H. Heaney¹, Melissa D. Laird¹. ¹Naval Health Research Center, San Diego, CA. ²21st Century Sailor, Millington, TN. Email: rweller223@gmail.com
 (No relevant relationships reported)

The U.S. Navy is transitioning from a culture of fitness testing to a more pervasive culture of functional fitness. The objective is to shift away from the current Physical Fitness Assessment, which evaluates general physical fitness levels and disease risk, toward more operationally relevant metrics of performance fitness and mission readiness. **PURPOSE:** To assess and down-select from 11 fitness tasks to 3-5 modalities for potential inclusion in an alternative Physical Readiness Test (PRT). **METHODS:** Forty-one active duty sailors (30 males; 11 females) completed traditional strength tests and 11 performance fitness modalities consisting of upper/lower body strength and power events, total body strength events, timed sprints/runs, and a core strength task. Modality down-selection was based on scalability, physical space and equipment requirements, safety, time and cost to administer, and correlations of sailors' individual performance on the new modalities to both their performance on traditional strength tests and most recent PRT (curl-ups, push-ups, 1.5 mile run). **RESULTS:** Seated medicine ball throw (SMBT)—the only modality that measured upper body strength and power—had a strong correlation with the 1 repetition maximum (1RM) bench press ($r=0.79$). Standing long jump (SLJ) evaluated lower body strength and power and had a moderate correlation with 1RM seated leg press ($r=0.50$) and 1.5 mile run ($r=0.59$). The repeated 300-yd shuttle run (300SR) assessed agility and aerobic/anaerobic capacity and was highly correlated ($r=0.82$) with participants' 1.5 mile run times on their most recent PRT. Forearm plank (FP) did not show significant correlations to traditional strength tests or previous fitness test scores (PRT), with the exception of a moderate correlation to PRT push-up scores ($r=0.51$). **CONCLUSION:** SMBT, SLJ, 300SR, and FP were the modalities recommended for inclusion in an alternative PRT. These new modalities evaluate more operationally relevant measures of performance fitness, thereby providing advanced knowledge of a sailor's physical capabilities and/or limitations. Future considerations should include a follow-on, large scale validation study to develop the appropriate norms and performance standards across gender/age brackets.

- 3447** Board #135 June 1 9:30 AM - 11:00 AM
Trauma Exposure Predicts Functional Movement Characteristics of Male Tactical Athletes
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 (No relevant relationships reported)

Accumulating data have demonstrated a link between psychological distress and musculoskeletal injury (MSKI) prevalence. High levels of physical stress are commonly experienced during the career of a military tactical athlete, which can result in injury and subsequently affect functional movement (FM) outcomes. It is also plausible that trauma exposure (TE), a psychologically salient factor, may influence FM characteristics. It is vital to understand psychological predictors of FM in tactical athletes to optimize performance and to help attenuate MSKI incidents. **PURPOSE:** The primary objective was to determine the associations of combat exposure (CE) and TE with FM characteristics in tactical athletes. Secondary objectives were to explore the confounding influences of age and physical injury history as well as the mediating role of bodily pain. **METHODS:** Eighty-two male, active duty U.S. Navy Explosive Ordnance Disposal personnel (mean age \pm SD = 34.0 ± 6.7 years) self-reported CE, TE, physical injury history, and bodily pain. FM characteristics (i.e., Functional Movement Screen [FMS], Y-Balance Test) were assessed by trained researchers, from which a composite functional status (CFS) measure was derived. Hypotheses were tested using correlational and multiple regression (causal steps) models. **RESULTS:** In unadjusted models, TE was inversely associated with FMS ($r = -0.32, p = .005$) and CFS ($r = -0.30, p = .009$). In adjusted models, these relationships were robust to the confounding influences of age and physical injury history. In causal steps models, TE and bodily pain were substantive, independent predictors of FMS ($R^2_{adj} = .20, p = .02$) and CFS ($R^2_{adj} = .18, p = .02$), implying additive, rather than mediated, effects. CE did not predict FM characteristics. **CONCLUSIONS:** To our knowledge, this is unprecedented evidence of the influence of TE on FM characteristics of male tactical athletes that is independent of age, physical injury, and bodily pain. The shared variance of TE and FM characteristics implies that the addition of TE, and other psychologically relevant constructs in association with FM, may advance FM theories. Including TE into physical assessments may not only optimize performance in the tactical environment, but also advance MSKI prevention and treatment.

- 3448** Board #136 June 1 9:30 AM - 11:00 AM
A New and Simple Prediction Equation For Health-Related Fitness: Use of Honest Assessment Predictive Modeling
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 (No relevant relationships reported)

PURPOSE: Health-related fitness is a set of attributes that relate to the ability to perform physical tasks and also relate to health outcomes. To assess an individual on all health-related fitness attributes can be time consuming. Thus, it would be useful to fitness specialists if a simpler and valid assessment was available to measure overall health-related fitness. The purpose of this study was to employ honest assessment predictive modeling to find a parsimonious set of variables that can predict overall health-related fitness. **METHODS:** Data used for this study came from college students who completed a fitness test battery. An overall health-related fitness score (T-score) was constructed using maximal oxygen consumption (VO_{2max} , ml/kg/min), 1RM bench press (BP, lb), maximal push-up repetition (PU, #), and percent body fat (PBF, %). The set of possible predictor variables consisted of participant age (yr), sex (male/female), body mass index (BMI, kg/m²), waist circumference (WC, cm), 1RM leg press (LP, lb), countermovement vertical jump (VJ, in), flexed arm hang (FAH, sec), physical activity rating (PAR, 0 thru 10), and sit-and-reach (SNR, cm). The honest assessment predictive modeling procedure included three steps: 1) development of competing models using a TRAINING dataset, 2) selection of an optimal model using a separate VALIDATION dataset, and 3) assessment of fitness score construct validity using a final SCORING dataset. **RESULTS:** Stepwise model selection with Schwarz Bayesian criterion (SBC) on the TRAINING data resulted in five possible models including sex, VJ, PAR, and WC. Results on the VALIDATION data indicated a three-variable model had the lowest average squared error (ASE) and consisted of sex, VJ, and PAR ($F=107.8, p<.001, R^2=.82, SEE=3.09$). Finally, predicted values from the SCORING data showed that athletes ($Mean=54.9, SD=5.1$) had a significantly ($p<.001$) greater mean fitness score than non-athletes ($Mean=39.8, SD=4.8$). **CONCLUSION:** This study presents a valid equation that can simply predict overall health-related fitness in college students.

- 3449** Board #137 June 1 9:30 AM - 11:00 AM
Ability to Predict Impending Volitional Exhaustion Based on Aerobic Capacity
 Dustin W. Davis, Jenna L. Carducci, Matthew J. Garver, Whitley J. Stone, Meera Penumetcha, Nicolas M. Philipp, Josie H. Hair, Jordan R. Elledge, Haley R. Williams, Matthew T. Oliphant, Zachariah S. Hopkins. University of Central Missouri, Warrensburg, MO. Email: dwdavis@ucmo.edu
 (No relevant relationships reported)

Maximal relative oxygen consumption (VO_{2max}), assessed via a treadmill test to volitional exhaustion, is the foremost measure of aerobic capacity in healthy, recreationally active young adults. Habitual exercise may improve the ability to perceive exercise difficulty and predict impending exhaustion. **PURPOSE:** The primary aim of this investigation was to determine if a correlation existed between VO_{2max} and time to test termination after participants indicated they were 30 s from volitional exhaustion. A secondary aim was to ascertain if participants more accurately predicted impending exhaustion during a repeated trial. **METHODS:** Participants completed a familiarization trial to minimize learning effects and determine treadmill speed for maximal testing. During the familiarization trial, participants self-selected a zero-grade jogging speed associated with a value of 12-13 on Borg's 6-20 RPE scale when steady-stated. This speed was used during two maximal tests separated by 36-72 h. During maximal testing, grade was increased 2% every two minutes until volitional exhaustion. VO_{2max} was measured as a 15-breath moving average via a metabolic cart. Participants were instructed before and during testing to tap on the treadmill when they perceived themselves to be 30 s from volitional exhaustion. **RESULTS:** Thirteen (Females: 8, Males: 5) recreationally active individuals (20.7 ± 1.4 yrs., 72.4 ± 12.3 kg) completed the protocol. Mean VO_{2max} during session 1 (10.00 ± 2.46 min) was 47.0 ± 7.4 ml·kg⁻¹·min⁻¹, and time to test termination after the tap was 36.2 ± 7.4 s. Mean VO_{2max} during session 2 (10.08 ± 2.38 min) was 47.5 ± 7.7 ml·kg⁻¹·min⁻¹, and time to test termination after the tap was 40.0 ± 18.5 s. No significant correlation was detected between VO_{2max} and time to test termination after the tap in session 1 ($r = -.032, p = .917$) or session 2 ($r = .315, p = .295$). A dependent t-test ($t(12) = -.800, p = .439$) did not reveal significant differences in time to test termination after the tap between session 1 and session 2. **CONCLUSIONS:** Aerobic capacity did not affect the ability of healthy, recreationally active young adults to predict impending volitional exhaustion during maximal treadmill running. Time to test termination after the tap did not significantly change during a repeated trial.

3450 Board #138 June 1 9:30 AM - 11:00 AM
Bilateral And Split Stance Isometric Midthigh Pulls Can Equally Predict Change Of Direction Ability

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(No relevant relationships reported)

The isometric midthigh pull (IMTP) has been shown to be able to predict change of direction (COD) ability. This is of interest for sports that require COD movements, as it could potentially be used to identify standout athletes in their respective sports. However, no literature to our knowledge has assessed split stance isometric midthigh pull (SSIMTP) as a predictor of COD ability compared to the IMTP. **Purpose:** The purpose of this study was to determine whether SSIMTP is a better predictor of COD ability than the IMTP. **Methods:** Seventeen (12M and 5F) university aged adults participated in the following study. Mean height, weight, and age were 176 ± 8.6 cm, 172 ± 24.2 kg, and 22 ± 3 years, respectively. Participants completed two sessions randomized in order that were two to five days apart; four trials of the SSIMTP (two trials per lead leg) and the other session involved two trials of the IMTP. Each day also consisted of four trials of the 505-agility test. Two trials involved pivoting off of the left foot and two trials pivoting off of the right foot, which was randomized in order. **Results:** All results are Pearson Correlation Coefficients presented with their respective p-value. The combined peak force (PF) of the IMTP and the best 505-agility time for the left and right foot had r values of -0.648 ($p < 0.09$) and -0.464 ($p < 0.08$), respectively. The r values during the SSIMTP condition were -0.722 ($p = 0.02$) and -0.462 ($p = 0.07$) when the left leg is the lead leg and COD to the left and when the right leg is the lead leg and COD to the right, respectively. **Conclusion:** The main finding of this study is that the combined PF produced during the IMTP and the PF produced by the lead leg during the SSIMTP can both uniformly predict COD. For the SSIMTP condition, a significant strong inverse correlation exists between left COD ability and left leg when it is forward and a moderate inverse correlation between right COD ability and the right leg when it is forward. For the IMTP condition, there is a strong inverse correlation between the combined PF and COD ability to the left and moderate inverse correlation between the combined PF and COD to the right. Previous literature has found correlations between IMTP and COD ability anywhere between -0.47 to -0.89.

3451 Board #139 June 1 9:30 AM - 11:00 AM
Use Of A Clinic-Based ACL Prediction Algorithm In Division III Female Soccer And Basketball Players

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(No relevant relationships reported)

During landing and pivoting movements female athletes have an increased lower extremity valgus alignment and knee abduction moment (KAM) making them four to six times more likely than males to sustain a sports-related, non-contact anterior cruciate ligament (ACL) injury. **Purpose:** To utilize a clinic-based ACL prediction algorithm developed by Myer, Ford and Hewett (2011) that determines the probability of high knee abduction moment (KAM) in Division III female soccer and basketball players. **Methods:** Twenty female athletes were recruited ($n = 10$ basketball, $n = 10$ soccer). Five measures were obtained and utilized in the prediction algorithm, namely tibial length, body mass, knee valgus, knee flexion range of motion, and quadriceps-to-hamstring isokinetic strength ratio. A prediction nomogram was applied to award a point value for each variable, which when summed generated a probability of high knee abduction moment (KAM). High KAM is associated with a higher risk of ACL injury. In each group a dependent t-test was used to compare KAM in the left and right leg. Significance was tested at $p < 0.05$. **Results:** The probability of high KAM in basketball and soccer players was higher in the left leg compared to the right leg. In soccer players, this difference in KAM between the left and right leg was significant (basketball: $t = 0.76 \pm 0.27$, $r = 0.71 \pm 0.24$, $t(9) = 0.82$, $p = 0.43$; soccer: $t = 0.64 \pm 0.31$, $r = 0.49 \pm 0.31$, $t(9) = 2.65$, $p = 0.03$). **Conclusion:** The higher KAM scores for the basketball players suggest that they may be at a greater risk for ACL injury compared to the soccer players. The significant difference in bilateral KAM scores in the legs of the soccer players suggests a greater risk of ACL injury in the left leg compared to the right leg. This difference may be attributed to leg dominance, although leg dominance was not measured in this study. The current study supports the use of a clinic-based ACL prediction algorithm to evaluate ACL injury risk of athletes when advanced biomechanical equipment is unavailable. Identification of risk of ACL injury allows for potential implementation of injury prevention training.

3452 Board #140 June 1 9:30 AM - 11:00 AM
Can a Field Based Neuromuscular Test Determine Readiness to Train in Female Team Sport Athletes?

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(No relevant relationships reported)

Purpose: To determine if a field-based neuromuscular test (Counter Movement Jump (CMJ)) could accurately detect EIMD-related performance decrements incurred by repeated sprinting in female team sport athletes. **Methods:** 10 female athletes (Age: 21.7 ± 2.5 y) performed an eccentrically-biased, repeated sprint protocol consisting of 5 sets of 8 maximal sprint (MS) trials (20m in length, 5m deceleration zones). Participants then immediately performed three CMJs on a force plate (FD4000, NMP ForceDecks Ltd, UK) to assess fatigue before beginning the next set of 8 sprints. Blood lactate and RPE were assessed following the completion of the sprint protocol. After 24-48h, participants returned to complete soreness ratings, 3 CMJs and 3 MSs. This process was completed 4 times (each "Trial" = 1 repeated sprint protocol visit + 1 24-28h follow up visit). **Results:** A number of CMJ metrics were significantly lower ($p < 0.05$) when measured during the 24-48h follow up visits, however the only one that was consistently lower across all 4 trials was concentric RFD (N/s/kg) (Pre v 24-48h post: Trial 1 = 36.03 ± 16.81 v 20.64 ± 13.49 ; Trial 2 = 49.37 ± 32.29 v 29.44 ± 21.87 ; Trial 3 = 50.45 ± 40.86 v 27.59 ± 24.43 ; Trial 4 = 43.87 ± 32.37 v 31.01 ± 29.41). No significant differences ($p > 0.05$) were found for peak or average velocity during the MSs across any trial. Lower body soreness was significantly greater ($p < 0.05$) during the 24-48h follow up visits as assessed via a 0-10 visual analogue scale. The sprint protocol induced a high internal physiological load, evidenced by significantly elevated post-exercise blood lactate levels (pre: 1.51 ± 0.50 vs post: 5.6 ± 2.53). **Conclusion:** Concentric RFD determined using a CMJ was the best metric for detecting performance impairments, as it consistently declined 24-48h after completing a repeated sprint protocol. The other CMJ metrics, as well as MS performance did not decrease across all trials. A CMJ test that assesses concentric RFD may be a useful tool for coaches to determine readiness to train in female athletes. Future research should seek to replicate this protocol using higher sprinting volumes, to determine whether concentric RFD declines in a predictable dose-response manner. Limitations of this study were the small sample size and the lack of control for external damaging activity (i.e. rugby training).

3453 Board #141 June 1 9:30 AM - 11:00 AM
Predict Failure: Muscle Oxygen Dynamics In Elite Climbers During Finger Hang Tests

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Reported Relationships: A. Feldmann: Salary; Part-Time employment in development. Industry contracted research; private industry contribution. Ownership/interest/stock; own stocks.

Introduction: Failure in elite sport climbing is associated with an inability to maintain isometric muscle contraction. The ability to supply and utilise oxygen is the primary bioenergetic contributor to muscle contraction and can be examined locally using near-infrared spectroscopy (NIRS). Examining changes in NIRS derived muscle oxygenation (SmO_2) have shown to be related to changes in performance output during gripping exercises. **Purpose:** The aim of this study is to measure SmO_2 dynamics in a climbing specific test until task failure in varying conditions. Our prediction is that SmO_2 should be a good marker to predict task failure. **Methods:** Eight elite level climbers performed a finger-hang test with four different intensities maintaining grip until voluntary exhaustion. During each trial SmO_2 and time to failure (TTF) were measured. TTF was then compared to the minimally attainable value of SmO_2 ($\text{SmO}_{2\text{min}}$) and time to $\text{SmO}_{2\text{min}}$ (TTmin). **Results:** Two-one-sided tests (TOST) resulted in $\text{SmO}_{2\text{min}}$ equivalence for the high intensity conditions ($M_1 = 21.9\%$ $SD_1 = 5.0\%$; $M_2 = 25.4\%$; $SD_2 = 6.5\%$; $M_3 = 24.1\%$, $SD_3 = 5.9\%$), $t(7) = 2.72$, $p = 0.015$; $t(7) = 3.85$, $p = 0.003$, but failed to show equality for the fourth and lowest intensity condition ($M_4 = 32.4\%$, $SD_4 = 8.8\%$), $t(7) = -1.01$, $p = 0.173$. Equivalence was also found between TTF and TTmin for the high intensity conditions. **Conclusion:** The duration with which oxygen is extracted and utilised changes, while the attainable $\text{SmO}_{2\text{min}}$ remains constant at high intensity conditions and is related to the ability to maintain task performance.

- 3454** Board #142 June 1 9:30 AM - 11:00 AM
Prediction Of 1rm Bench Press From Repetitions To Fatigue In Untrained, Trained, And Athletic Men
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 (No relevant relationships reported)

Numerous prediction equations have been developed to estimate one-repetition maximum (1RM) bench press in various subject populations. While many of these equations have been validated on various groups, rarely have groups of various levels of training been combined to evaluate the accuracy of separate and combined equations developed on participants of differing strength levels and training backgrounds.

PURPOSE: To produce and evaluate 1RM bench press prediction equations developed on untrained, trained, and athletic men. **METHODS:** Untrained college men (UT, n = 166), resistance-trained college men (RT, n = 170), and college athletes (ATH, n = 179) were measured for 1-RM bench press and repetitions-to-fatigue (RTF) on separate days. RT men had trained 3 days/wk for 12 wks using a linear periodization program. ATH had trained for several years using either linear periodization or autoregulatory progressive resistance training. Linear regression equations were generated on validation samples of each group (UT = 119, TR = 120, ATH = 131) using a weight (RepWt) that produced between 2 and 10 RTF. **RESULTS:** All 3 groups differed significantly in 1RM (UT = 74.1 ± 15.5 kg, RT = 88.8 ± 21.7 kg, ATH = 136.2 ± 21.8 kg) but not in % 1RM used for RTF (UT = 83.4% ± 7.4%, RT = 83.0% ± 5.5%, ATH = 83.4% ± 6.0%). Despite the nonsignificant difference in %1RM, ATH (6.7 ± 2.4) produced significantly more RTF than UT and RT men (6.1 ± 2.2 and 6.0 ± 2.1, respectively). Multiple correlations and standard errors of estimate (SEE) for group equations were similar for UT (R = 0.94, SEE = 5.7 kg), RT (R = 0.97, SEE = 5.3 kg), and ATH (R = 0.96, SEE = 6.1 kg). A global equation compiling all 3 groups had comparable results [1RM (kg) = 1.16 RepWt (kg) + 2.07 RTF - 9.4, R = 0.98, SEE = 6.2 kg]. Cross-validation of each equation on 25% randomly selected subsamples accurately predicted 89%-96% of each group within ±10% of actual 1RM. The global equation predicted slightly better in RT (94%) and ATH (96%) than in UT (87%). **CONCLUSIONS:** A newly developed global prediction equation appears to have acceptable accuracy for estimate 1RM bench press in men with varying resistance training backgrounds.

- 3455** Board #143 June 1 9:30 AM - 11:00 AM
Lower Limb Kinematic Assessment to Predict Water Polo Performance
 Cameron A. Williams, J. Mark VanNess, Joey Rossi, John Mayberry, Courtney D. Jensen. *University of the Pacific, Stockton, CA.*
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 (No relevant relationships reported)

Water polo requires leg muscle biosequencing that is different from weight bearing sports. The kinematics and forcefulness for each player could be optimized for different positions and help predict player success. Comparing vertical jump with kinematic biosequencing, and comparing each with athletic performance, may enhance training assessments. **PURPOSE:** To test the effect of vertical jump and Sparta Science force plate technology outputs on in-season performance of women's water polo players. **METHODS:** 14 Division 1 women's water polo players were evaluated during two consecutive seasons: 2015-2016 and 2016-2017. Statistics tabulated for each season were: Games played, shots, goals, shooting percentage, assists, steals, exclusions (EX), and exclusions drawn (DEX). All players were tested for vertical jump once a week during conditioning prior to resistance training using Sparta force plate and proprietary outputs, which calculated "Load" (rate of eccentric force), "Explode" (power generation during concentric force output), and "Drive" (neural impulse on timing and range of motion). Linear regression tested Sparta data on in-season performance outcomes. **RESULTS:** Athletes weighed 70.2 ± 8.6 kg, had a vertical jump of 30.7 ± 4.3 cm and Sparta Load of 45.4 ± 6.2, Explode of 34.8 ± 4.1, and Drive of 65.3 ± 10.0. On average, throughout each season, the athletes played 29.5 ± 6.3 games, took 92.7 ± 61.5 shots, scored 31.3 ± 8.1% of shots taken, had 24.3 ± 12.5 steals, and 16.4 ± 14.4 assists. Vertical jump predicted a higher shooting percentage ($\beta=0.010$; $p<0.001$), more steals ($\beta=0.820$; $p=0.043$), fewer assists ($\beta=-1.324$; $p=0.005$), and fewer EX ($\beta=-1.466$; $p<0.001$). Load predicted a lower shooting percentage ($\beta=-0.003$; $p=0.001$) and more EX ($\beta=0.284$; $p<0.001$) and DEX ($\beta=0.219$; $p=0.002$). Explode predicted a higher shooting percentage ($\beta=0.003$; $p=0.009$), more steals ($\beta=0.642$; $p<0.001$), and lower EX ($\beta=-0.454$; $p<0.001$). Drive predicted a higher shooting percentage ($\beta=0.002$; $p<0.001$), fewer assists ($\beta=-0.221$; $p=0.007$), lower EX ($\beta=-0.099$; $p=0.017$), and higher DEX ($\beta=0.107$; $p=0.017$). **CONCLUSION:** These findings indicate that both vertical jump and force plate biosequencing data may be useful predictors of water polo performance and could be employed to identify athletic capacities that need improvement.

- 3456** Board #144 June 1 9:30 AM - 11:00 AM
Use of Traditional and Modified Functional Movement Screening to Predict Balance with Military Load
 Eric M. Scudamore¹, Sandra L. Stevens², Dana K. Fuller², John M. Coons², Don W. Morgan, FACSM². ¹Arkansas State University, Jonesboro, AR. ²Middle Tennessee State University, Murfreesboro, TN. (Sponsor: Don W. Morgan, FACSM)
 (No relevant relationships reported)

Use of Traditional and Modified Functional Movement Screening to Predict Balance with Military Load

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PURPOSE: To determine if Functional Movement Screen (FMS) or modified Functional Movement Screen (mFMS) item scores predict dynamic balance scores of potential military recruits who wore a 24.2 kg military load. **METHODS:** Thirty physically-active males and females who displayed anthropometric and physical fitness characteristics typical of military recruits entering basic training completed FMS and mFMS. Torso-loaded balance was assessed as loaded composite reach distance (LCR) and loaded overall stability indices (LOSI) measured using the Y Balance test and Biodex Balance System, respectively. **RESULTS:** FMS composite scores exhibited the strongest relationship with LCR and participants with higher FMS composite scores (≥ 15) displayed higher LCR values compared to those with lower FMS composite scores (≤ 14). Analysis of FMS subscores using penalized regression indicated that an in-line lunge score of 1 predicted a shorter LCR (Coef for score of 2 = 6.86 (95% CI = 2.88, 10.93)); Coef for score of 3 = 8.36 (95% CI = 3.96, 13.70)) and a shoulder mobility score of 3 predicted better LOSI (Coef = -2.38 (95% CI = -3.56, -0.57)). Loaded shoulder mobility (Coef = -2.11 (95% CI = -4.12, -0.26)) and trunk stability push-up (95% CI = Coef = 1.61 (0.08, 3.13) scores of 3 also predicted better and worse LOSI, respectively. **CONCLUSION:** The in-line lunge item score from the FMS may be the best predictor of torso-loaded balance and the FMS may be more appropriate than items from a torso-loaded FMS battery in predicting torso-loaded balance in military recruits. Use of the FMS by clinicians may aid in mitigating musculoskeletal injuries in service members, thus minimizing losses that contribute to decreased military readiness.

- 3457** Board #145 June 1 9:30 AM - 11:00 AM
A Fitness Field Test to Predict VO₂max in Female Collegiate Field Hockey Players
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 (No relevant relationships reported)

Field hockey is a competitive sport requiring aerobic fitness. The gold standard method for determining aerobic fitness is a maximal oxygen consumption (VO₂max) test performed in a laboratory on a motorized treadmill (LAB) by a trained professional. The 30-15-intermittent fitness test (FIELD) is a new maximal effort running test designed to predict VO₂max on the field relative to a traditional treadmill graded exercise test (GXT).

PURPOSE: To compare the predicted VO₂max using the 30-15-intermittent FIELD test to the measured VO₂max LAB test in collegiate female field hockey players. **METHODS:** Nine (N=9) experienced female collegiate field hockey players (mean age=19.78±1.56 y, field hockey experience=8.80±2.49 y) were classified as healthy via a health assessment consisting of height, weight, and body fat (BF%). Each participant completed a LAB GXT test in a temperature-controlled laboratory using a metabolic cart and motorized treadmill, followed by the FIELD test a month later on a standardized turf field as a group under the same conditions. The FIELD test consists of a series of 30 second shuttle runs with 15 second intermittent walking breaks with an increase in speed every shuttle run of 0.5 km/h. The FIELD test uses an equation to predict VO₂max. Both tests were completed to exhaustion. All results are reported as mean±SD. Statistical significance was accepted at $\alpha=0.05$. Paired *t*-tests ($\alpha=0.05$) were utilized to compare means between groups. **RESULTS:** There was no significant difference between predicted VO₂max (FIELD 46.15±3.22 mL/kg/min) and measured VO₂max (LAB 48.68±6.94 mL/kg/min) ($p=0.102$). The percent difference between the LAB test and FIELD test averages was -4.25±8.37. There was a significantly greater percentage difference between the most fit participants ($n=4$) (-11.23±5.84) compared to the least fit participants ($n=4$) (+2.46±5.21) ($p=0.011$). **CONCLUSION:** The predicted VO₂max values using the FIELD test were similar as compared to the measured LAB test. However, greater percentage differences were seen in higher fit athletes. Coaches and athletes should consider the 30-15 intermittent field test as a potentially inexpensive and time efficient test for predicting VO₂max in a large group.

- 3458** Board #146 June 1 9:30 AM - 11:00 AM
Prediction of Lower Extremity Injuries from Vertical Jump Kinetic Data in Collegiate Athletes
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 (No relevant relationships reported)

Purpose: The vertical jump provides critical kinetic information regarding athletic performance, and can be quantified by the force-time (F-T curve) with defined phases of movement. Alterations in the efficiency of mechanisms used for force production could potentially lead to abnormal force dissipation and resultant injury. The purpose of this study was to identify which force plate variables from a vertical jump task could identify collegiate athletes who sustained a lower extremity injury. **Methods:** Vertical jump testing using a force plate with dedicated software (SpartaTrac system) was performed by all healthy varsity collegiate athletes at several intervals throughout the athletic year over 3 academic years. The testing procedure consisted of each subject performing a series of 6 consecutive vertical jumps. Injuries were documented by the team athletic trainers and verified with the health care organization's electronic medical documentation system. Injuries were defined as occurring no more than 60 days after a jump and defined as lower extremity by SICs 10 code. 234 lower extremity injuries were identified. Subjects were matched by age, sex and sport. Vertical jump variables used were load, explode and drive, operationally defined as the average eccentric rate of force development, average concentric force, and concentric impulse, respectively. Logistic regression was used to determine if the battery of variables could predict whether or not an athlete would sustain a lower extremity injury. Additionally, athletes who sustained an ACL injury were identified, matched, and analyzed correspondingly. **Results:** Load, explode, and drive, when entered into the regression equation, showed the ability to predict lower extremity injury, $\chi^2=14.6$, $df=4$, $P<0.01$; with explode independently showing significant prediction at $P=0.02$. Load, explode, and drive also showed the ability to predict ACL injury, $\chi^2=13.92$, $df=3$, $P<0.01$, with load and explode independently showing significant prediction at $P<0.05$. **Conclusion:** The force plate variables collected from vertical jumps were able to identify athletes who sustained a lower extremity injury. Additionally, these variables were able to identify athletes who sustained an ACL injury.

- 3459** Board #147 June 1 9:30 AM - 11:00 AM
Validation Of A Cycle Ergometer Protocol In The Prediction Of $\dot{V}O_{2\max}$
 Alyssa A. Feher, Ashley L. Heffelfinger, Cassidy A. Barrett, Emily A. DeDonna, Alissa Rusbarsky. *Cedar Crest College, Allentown, PA.* (Sponsor: Michael D. Brown, FACSM)
 (No relevant relationships reported)

Protocols for the prediction of maximal oxygen uptake ($\dot{V}O_{2\max}$) on a cycle ergometer have been criticized for either being too long or aggressive for individuals of variable fitness and/or disease status. Current protocols typically increase workload by adding resistance to the flywheel at a fixed RPM. Increases in RPM rather than resistance later in the test may provide increased physiological efficiency, yielding a more valid prediction of $\dot{V}O_{2\max}$. **Purpose:** The purpose of this study was to design and validate a novel $\dot{V}O_{2\max}$ cycle ergometer protocol using workload increments based on the subject's predicted heart rate reserve (HRR) in order to individualize the test protocol while adhering to well-documented $\dot{V}O_{2\max}$ testing principles. **Methods:** Subjects included 12 females (20-27 y/o) who performed a $\dot{V}O_{2\max}$ test using the new cycle ergometer protocol. Prior to testing, seat height on a Monark cycle ergometer was standardized with a 5-10 degree knee bend in the pedal-down position with the sole of the foot parallel to the floor. $\dot{V}O_2$, blood pressure, rating of perceived exertion (RPE), and heart rate using ECG were measured at rest and throughout the cycle ergometer exercise test, as well as the assessment of signs and symptoms. Workload increases were based on pre-determined Incremental Target Heart Rates (ITHR) using HRR. Stages commenced at a workload of 150 kgm/min (0.5 kg; 50 RPM) and were increased every 2 minutes by adding 0.5 kg or 1.0 kg resistance based on achievement of ITHR for each stage. When an ITHR representing $\geq 60\%$ HRR was achieved, workloads were increased by 10 RPM for each subsequent stage. Exercise tests were terminated when the subject could not maintain RPM or reached volitional exhaustion. Correlation between predicted (ACSM cycle equation) and measured $\dot{V}O_{2\max}$ at peak workload was examined using Pearson's r . **Results:** The range for measured $\dot{V}O_{2\max}$ was 20.7 - 37.4 mL/kg/min and 23.29 - 37.57 mL/kg/min for predicted $\dot{V}O_{2\max}$. There was a statistically significant correlation between predicted and measured $\dot{V}O_{2\max}$ ($r=0.894$; $p<0.001$). **Conclusion:** This novel cycle ergometer protocol was demonstrated to be a valid predictor of $\dot{V}O_{2\max}$ for the population tested. Further testing on other diverse populations is warranted.

- 3460** Board #148 June 1 9:30 AM - 11:00 AM
Can A Simple Transfer Task Predict Lower-extremity Physical Function As Measured By Standardized Clinical Measures?
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PURPOSE: Lower-extremity physical function (LEPF) is associated with health outcomes such as risk for falling, physical disability, and mortality in older adults. Due to increasing evidence of disability onset occurring earlier in the lifespan, expanding assessment of functional status in middle-age adults is of growing importance. Furthermore, administering many of the current standardized objective tests (i.e. 6-Minute Walk Test, Timed Up and Go, and 30-second Chair Stand tests) in clinical settings is not feasible due to limited time, space, and equipment. Identifying simple, cost-effective assessments to evaluate LEPF status is paramount due to the potential for clinical application. Thus, this study aimed to evaluate if a simple transfer task could predict LEPF in middle-age and older adults. **METHODS:** Middle-age and older adults ($n=230$, 17% male; 52-89 yo; 29.1 ± 5.8 kg/m²) completed a transfer task (TRANSFER). This required them to start in a standing position, and without the use of assistive devices, sit on the floor, and return to a standing position as quickly as possible. LEPF was calculated using a composite Z-score based on scores from conventional and standardized 6-Minute Walk Test, Timed Up and Go, and 30-second Chair Stand tests. **RESULTS:** Bivariate correlations revealed that TRANSFER was associated with age ($r=0.27$, $p<0.01$), comorbidities ($r=0.33$, $p<0.01$), and BMI ($r=0.28$, $p<0.01$). Using linear regression analyses, TRANSFER was a significant predictor of LEPF Z-score (standardized $\beta=-0.73$, $p<0.01$) independently accounting for 39.6% of the variance after adjustment for covariates. **CONCLUSION:** Our results suggest that the ability to lower oneself to the ground and return to a standing position is a significant indicator of LEPF in middle-age and older adults. Further study is warranted to determine the clinical relevance of this simplified evaluation of LEPF and its ability to predict falls, physical disability, and mortality.

- 3461** Board #149 June 1 9:30 AM - 11:00 AM
The Association Between Step Frequency Test, Sprint And Agility Performance
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 (No relevant relationships reported)

A variety of training methods have been described in the literature to improve speed and agility. Step frequency, which is the rate at which steps can be reproduced, is one of the traditional step kinematic measure used to describe running technique. Previous research has illustrated the importance for faster acceleration (Murphy, Lockie, & Coutts, 2003). This has led athletes to investigate time in different step frequency training (i.e. ladder training) in order to gain increase in sprint or acceleration performance. **PURPOSE:** The purpose of this study was to investigate the association between two different step frequency test, sprinting and agility performance in sport science students. In addition, we aimed to investigate any gender differences in the association between variables.

METHODS: The present study used a correlational research design in order to investigate the association between step frequency test (anterior-posterior and medial-lateral), agility test (5+5 meter) and 20-meter sprinting performance. Twenty-one male (height 181.1 cm, mass 79.6 kg) and seventeen female students (height 169.9 cm, mass 68.9 kg) sport science were included as subjects in the study. All subjects performed two different step frequency tests (anterior-posterior and medial-lateral), one agility test and a 20-meter sprint test. Pearson's correlation analysis were used in order to investigate the association between step frequency and sprint and agility performance. **RESULTS:** Overall, modest correlations between step frequency (anterior-posterior and medial-lateral) and sprint performance ($r=0.36$ and $r=0.42$, respectively ($p<0.05$)). In addition, this study found correlation between agility test and sprint test ($r=0.53$, ($p<0.001$)). No correlation were found between either of the step frequency tests and the agility test (5+5 meter). **CONCLUSIONS:** This study found modest association between step frequency tests and 20-meter sprint performance in sport science students. The fact that no association was found between step frequency tests and the agility test makes it difficult to conclude any relationship between step frequency test performance and acceleration performance.

3462 Board #150 June 1 9:30 AM - 11:00 AM
Do Physical Activity Behaviors Predict Fitness Gains To An Aerobic Exercise Trial?

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 (No relevant relationships reported)

PURPOSE: Investigate whether baseline physical activity behaviors predict aerobic fitness adaptations following an individualized structured exercise intervention in an older adult population.

METHODS: Twenty-four cognitively healthy adults (age=64.8±4.6 years) from the Wisconsin Registry for Alzheimer's Prevention participated in this study. Subjects were randomized to an individualized 6-month treadmill training program (3x week; 70-80% heart rate reserve) or a control group. Baseline and post-intervention measurements included a maximal exercise test and 7 days of physical activity monitoring via accelerometry. Aerobic fitness was defined as the highest oxygen consumption ($\dot{V}O_{2peak}$, ml/kg/min) value recorded during the exercise test and physical activity was defined as total minutes spent in moderate-vigorous physical activity. A repeated measure ANOVA design, adjusted for age, gender, APOE status, and BMI was used to examine changes in fitness. Bivariate Pearson correlations were used to investigate 1) the relationship between baseline physical activity and baseline fitness across the entire group (n=24) and 2) baseline physical activity and changes in fitness ($\% \dot{V}O_{2peak}$) within participants randomized to the exercise intervention (n=12).

RESULTS: For the entire sample, baseline physical activity was significantly and positively associated with baseline fitness ($r = .452$; $p = .026$). Demonstrating the effectiveness of our trial we observed a significant group by time interaction for fitness ($p = .018$; $\eta^2_p = .260$), participants randomized to aerobic exercise displayed on average, a 17.5% increase in their fitness level. This observed fitness adaptation was weakly associated to baseline physical activity behaviors ($r = .25$).

CONCLUSIONS: Six-months of aerobic exercise training significantly improved fitness levels in our older adult population. As expected, baseline physical activity and fitness were positively associated. However, baseline physical activity did not predict aerobic fitness gains to a structured exercise training program. Future exercise trials with larger sample sizes are needed to determine whether it is necessary to recruit inactive participants.

3463 Board #151 June 1 9:30 AM - 11:00 AM
Body Composition Assessment Does Not Improve Prediction of $\dot{V}O_{2max}$ Using a Yo-Yo Intermittent Shuttle Test

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 (No relevant relationships reported)

The gold standard for determining aerobic fitness is $\dot{V}O_{2max}$ testing, a time-consuming test which requires expensive equipment. The Yo-Yo Intermittent shuttle test is a field test purported to provide a more soccer-specific estimate of aerobic fitness, but its validity varies with the population being tested.

PURPOSE: To determine whether the addition of anthropometric measures and body composition data would strengthen the predictability of the Original Yo-Yo (YYO) test for estimating $\dot{V}O_{2max}$ for collegiate women soccer players.

METHODS: Division II female soccer players who completed fitness assessments as part of their normal pre-season evaluation were invited to participate. Thirty-one women (18-23 yrs) consented and 29 completed assessments. Fitness assessments were conducted during fall camp on a rest day. Measures of height, weight, waist circumference, and sum of 7 skinfolds were collected by a trained investigator; body fat percentage was estimated with the Bod Pod; $\dot{V}O_{2max}$ was measured on a motor driven treadmill with gas analysis using a ParvoMedics TrueOne metabolic system. The Yo-Yo test was performed as a group two days later. Regression analysis was used to determine which variables impacted the prediction equation, and correlation analysis was used to compare the original (YYO) and revised (YYR) Yo-Yo formulas against measured $\dot{V}O_{2max}$.

RESULTS: Analysis showed that the Yo-Yo distance ($p = .00075$) but not anthropometrics and body composition ($p > .05$) significantly impacted the $\dot{V}O_{2max}$ prediction resulting in the following YYR formula: $\dot{V}O_{2max} = (0.00574 \times \text{Yo-Yo distance (m)}) + 30.952$. Measured $\dot{V}O_{2max}$ (45.2 ± 1.1 ml/kg/min) was correlated with predicted $\dot{V}O_{2max}$ from YYR ($45.4 \pm .67$ ml/kg/min, $r = .58$) and YYO ($57.6 \pm .98$ ml/kg/min, $r = .58$).

CONCLUSION: The addition of body composition variables did not strengthen the ability of the Yo-Yo Intermittent shuttle test to accurately predict $\dot{V}O_{2max}$ in women soccer players.

3464 Board #152 June 1 9:30 AM - 11:00 AM
Ability Of Oddvar-holton Diagram To Predict Repetitions Achieved At 60% And 80% Loads In Females.

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 (No relevant relationships reported)

To determine the appropriate load for resistance training (RT), exercise professionals (EPs) commonly have clients complete one repetition maximum (1RM) testing. Then, submaximal loads can be easily estimated for RT sessions and expected repetitions can be determined utilizing published prediction tables. **PURPOSE:** To determine the ability of Oddvar Holton (OH) diagram to accurately predict repetitions achieved at 60% and 80% loads in female lifters. **METHODS:** Participants were 19 college-aged (25 ± 4.3 years) females with a minimum of 2 months RT experience (average experience 76 ± 42 months). Three exercise sessions were completed under the supervision of certified EPs. For session one, 1RM testing was completed. For sessions two and three, participants completed as many reps as possible for 60% 1RM or 80% 1RM (load and order was randomized) for 8 cam-mediated variable resistance training exercises (bench press, leg press, shoulder press, pull-down, knee extension, knee flexion, elbow extension, and elbow flexion). First, for all 8 exercises, an error-score was calculated (for each individual) by comparing the actual number of repetitions completed to the OH 1RM prediction diagram. The OH predicted values for 80% 1RM and 60% 1RM were 11 reps and 30 reps, respectively. Then, for each exercise, the overall error score was calculated (mean error for all 19 subjects). A t-test was utilized to determine differences in mean error score between loads. **RESULTS:** For most exercises, the repetitions achieved deviated substantially from the expected repetitions (14 of 16 exercises deviated by 3+ repetitions). These findings were most extreme at lower loads: 60% load error scores (11.9 ± 2.7 reps) were significantly greater ($p < 0.01$) than 80% loads error scores (3.9 ± 1.4 reps). **Conclusion:** Considerable variability exists among females in the repetitions achieved versus the repetitions predicted by OH. In all exercises, greater deviations from expected values occurred at lower loads.

3465 Board #153 June 1 9:30 AM - 11:00 AM
Maximal Oxygen Consumption Prediction Equation For Athletes Undergoing Cardiopulmonary Exercise Testing On A Treadmill Ramp Protocol

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 (No relevant relationships reported)

PURPOSE: To develop an equation for predicting $\dot{V}O_{2max}$ in athletes submitted to cardiopulmonary exercise test (CPT) using a treadmill ramp protocol. Secondly, we evaluated the influence of the use of supplements on $\dot{V}O_{2max}$.

METHODS: 77 athletes were evaluated in a cross-sectional design. 65 percent of them were men (34.7 ± 7.9 years, BMI 24.7 ± 3.3) and 35 percent were women (36.8 ± 11.1 years, BMI 22.7 ± 2.5). The sample consisted of 66 percent of athletes practicing endurance sports, of which 55 percent were runners or triathletes. After participants answered an inquiry about the use of dietary supplements, time of practice and the weekly training volume, they underwent anthropometric evaluation, spirometry and CPT. CPT was performed on a treadmill using ramp protocol, where increments in speed and incline were empirically individualized. At least 14 mL/min/kg were added to the $\dot{V}O_{2max}$ estimate of active performers so that the test lasted 10 minutes on average. Following univariate analysis, we evaluated the predictors of $\dot{V}O_{2max}$ using stepwise multiple linear regression analysis.

RESULTS: BCAA (39 percent), creatine (13 percent) and whey protein (43 percent) were the most frequent responses in the survey about the use of supplements. $\dot{V}O_{2max}$ was 51.8 ± 9.2 and 44.1 ± 7.5 mL/min/kg for men and women respectively. In the univariate analysis significant correlations were found ($p < 0.05$) between $\dot{V}O_{2max}$ and age, sex, BMI, practice time, endurance sport modality, running practice, use of BCAA, use of creatine and use of supplements in general. In the multivariate model, running practice, age, BMI, sex, weekly training volume and supplement use in general together accounted for 68.4 percent of total $\dot{V}O_{2max}$ variability. The equation was: $\dot{V}O_{2max}$ (mL/min/kg) = $84.78 + (5.53 \times \text{running}) - (0.39 \times \text{age}) - (1.42 \times \text{BMI}) + (8.05 \times \text{sex}) + (0.21 \times \text{training volume}) + (2.95 \times \text{use of supplements})$.

CONCLUSIONS: The developed equation allows for individualized assessment of athletes using ramp warm-up protocol, as well as exploring dynamic physiological variables that are not properly evaluated in traditional staggered protocols.

3466 Board #154 June 1 9:30 AM - 11:00 AM

Predicting Metabolic Costs Of Heavy Backpacking

David P. Looney, Peter N. Frykman, Laurie A. Blanchard, Christopher R. Chalmers, Eric O. Hansen, Everett A. Harman, Holly L. McClung, Scott J. Montain, FACSM, Adam W. Potter, William R. Santee. *USARIEM, Natick, MA.* (Sponsor: Dr. Scott J. Montain, FACSM)

(No relevant relationships reported)

The US Army Load Carriage Decision Aid (LCDA) is a planning tool composed of biomedical models that predict Warfighter physiological responses during dismounted operations. The LCDA's metabolic model requires new equations to accurately predict the added metabolic cost of carrying varying types and amounts of military equipment.

Purpose: Develop an equation for the LCDA metabolic model that better predicts the metabolic costs of carrying backpack loads.

Methods: Thirteen studies in which volunteers walked while carrying heavy pack loads were obtained for analysis. Treadmill speeds ranged between 1.1 - 1.8 m·s⁻¹ with maximum pack loads exceeding 55% body mass. We used k-fold cross-validation to test how well the new model generalized to new data. Equivalence of predicted and measured metabolic rates was tested using the two one-sided t-test (TOST). We compared the new backpacking equation's accuracy against the LCDA graded walking equation using the Concordance Correlation Coefficient (CCC).

Results: Predictions from the LCDA metabolic model were statistically equivalent to metabolic rates measurements during each step of the k-fold cross-validation ($p < 0.05$). Predictions from the new backpacking equation had a much higher correlation with measured energy expenditures (CCC, 0.93) than the existing LCDA graded walking equation (CCC, 0.44). The median absolute error was considerably lower for the backpacking equation (0.46 ± 0.36 W·kg⁻¹) versus the existing LCDA graded walking equation (1.61 ± 1.32 W·kg⁻¹).

Conclusions: The LCDA metabolic model accurately predicts the metabolic costs of backpacking. Military mission planners, backpackers, and trail walker can rely on improved guidance from the LCDA metabolic model for training, nutritional intake, and heat injury prevention.

The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government.

3467 Board #155 June 1 9:30 AM - 11:00 AM

Accuracy Of Indirect Calorimetry And Predictive Equations For The Measurement Of Resting Metabolic Rate

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(No relevant relationships reported)

Indirect calorimetry is used to measure oxygen consumption for estimating resting metabolic rate (RMR). Laboratory devices are available for the measurement of RMR, such as the BodyGem® indirect calorimeter and the Vacumed VO₂ Lab metabolic measuring system. Established prediction equations, such as the Mifflin-St. Jeor (MSJ), Harris-Benedict (HB), and Fleisch, can also be used to provide an estimate of RMR.

Purpose: The purpose of this study was to compare the RMR of college-aged participants measured using a BodyGem® indirect calorimeter, a Vacumed VO₂ Lab metabolic cart, and established prediction equations. **Methods:** Each participant (male = 15; female = 15; age = 22.7 ± 3.3 yrs; wt = 77.5 ± 14.5 kg; ht = 173.5 ± 9.6 cm) completed a thirty-minute supine resting session in a quiet environment. Five minutes of resting data were then collected using the Vacumed while in the supine position. Immediately thereafter, five minutes of resting data was collected using the BodyGem® indirect calorimeter while in the seated position. The RMR values for the HB and Fleisch prediction equations were calculated using the proprietary software utilized by the Vacumed metabolic system, while the MSJ estimate of RMR was hand-calculated. **Results:** A repeated measures ANOVA showed a significant difference among the measurement methods (BodyGem® = 1995.0 ± 540.5 kcal; Vacumed = 1520.9 ± 452.5 kcal; MSJ = 1669.3 ± 242.9 kcal; HB = 1749.0 ± 275.1 kcal; Fleisch = 1690.3 ± 220.7 kcal) ($p < .001$). A Post hoc paired samples t-test indicated RMR measured using the BodyGem® was significantly higher than the Vacumed, HB, Fleisch, and MSJ ($p < .01$). The HB estimation of RMR was greater than that of the Vacumed measurement ($p < .025$). For the equations, the RMR estimate of the Fleisch was higher than the MSJ ($p < .025$), while the HB was greater than both the Fleisch and the MSJ ($p < .01$). **Conclusion:** The Vacumed VO₂ Lab metabolic cart measured RMR closer to the prediction equation estimates compared to the BodyGem® indirect calorimeter. Further research needs to be conducted comparing laboratory instruments to established prediction equations, on various populations, before those methods can be deemed accurate for measuring RMR.

G-38 Free Communication/Poster - Training

Saturday, June 1, 2019, 7:30 AM - 11:00 AM
Room: CC-Hall WA2

3468 Board #156 June 1 8:00 AM - 9:30 AM

Effects Of A Pre-season Intervention On Hydration In Female Collegiate Volleyball Athletes

Alyssa M. Pollard-McGrandy¹, Brian C. Rider², Adam M. Coughlin¹. ¹Saginaw Valley State University, University Center, MI. ²Hope College, Holland, MI. (Sponsor: Tamara Hew-Butler, FACSM)

(No relevant relationships reported)

Urine specific gravity (USG) is commonly utilized to assess hydration status. Athletic performance has been shown to be affected by hydration status. In addition to nutritional and hydration practices, environmental conditions can also influence hydration status. Therefore, healthcare professionals should also consider environment, both indoor and outdoor, when assessing hydration. **Purpose:** To compare base-line USG to season-long urine collections following a one-time, pre-season hydration intervention. **Methods:** Fourteen NCAA Division II female collegiate volleyball athletes participated in this study. Urine was collected in sterile cups in the hours preceding either a game or practice. Collections were roughly two weeks apart, starting August 25th and ending November 4th, 2017, resulting in eight total collections. The hydration intervention consisted of information and guidelines presented to the team and coaching staff. The intervention was administered verbally immediately following base-line urine collection. Written guidelines were left with athletes and coaching staff. Urinalysis was conducted via reagent strips. Data was analyzed via SPSS v.22 with an a priori level of 0.05. Subsequent urinalyses were compared to the baseline urinalysis. **Results:** USG statistically decreased from base-line to the second collection and did not statistically differ again until the final three collections (base-line = 1.021 ± 0.008 , $1.007 \pm 0.003^*$, 1.015 ± 0.008 , 1.013 ± 0.006 , 1.020 ± 0.016 , $1.014 \pm 0.005^*$, $1.011 \pm 0.008^*$, and $1.013 \pm 0.003^*$, * $p < 0.05$ compared to baseline). **Discussion:** The hydration intervention illustrated a short-term effect on USG. A correlation between USG and environmental temperatures was evaluated post hoc for the final six urine collections, arguably when the effects of the intervention had subsided. The coefficient of determination (r^2) revealed that 35.7% of the difference in USG was due to the environmental temperature, which was statistically significant ($r = 0.597$, $p < 0.05$). **Conclusion:** The intervention appeared to have a limited impact on USG. Differences in USG were evident again later in the season (late October to early November). Further analysis demonstrated a statistical influence of cooler temperatures on lower USG near the end of season.

3469 Board #157 June 1 8:00 AM - 9:30 AM

The Effects of Back Squats and Front Squats on Sprint Speed and Vertical Jump within Active Individuals

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(No relevant relationships reported)

The back squat (BSQ) is among the most popular resistance training (RT) modalities for the purpose of increasing muscular strength and power output. Front squats (FSQ), while not as popular as the BSQ, are arguably another squat modality that may improve muscular strength/power. **Purpose:** This study compared the effects of performing the BSQ and FSQ on squat strength, sprint speed, and vertical jump (VJ). **Methods:** Active individuals both male ($n=9$, age: 30.6 ± 7.6 yrs, height: 179.1 ± 3.8 cm, mass: 87.8 ± 7.8 kg) and female ($n=16$, age: 29.4 ± 6.5 yrs, height: 165.3 ± 5.9 cm, mass: 68.5 ± 10.7 kg) were separated into two groups via a randomized matched pair design based on initial one repetition maximum (1-RM) squat strength. Both experimental groups employed linear periodization RT protocols differing only in that one group executed the BSQ and the other group performed the FSQ as the lower body exercise. No additional lower body auxiliary movements were performed in the study. The dependent variables (DV's) of VJ, 36.6 meter sprint speed, and 1-RM squat strength were collected prior to and following the 6-week RT period. Dependent t-tests were used to compare the DV's from pre to post RT intervention within experimental groups. Independent t-test were used to compare the gain scores for each of the DV's between experimental groups. **Results:** The VJ had a significant improvement from pre to post RT for both the BSQ (pre: 52.9 ± 10.1 , post: 56.0 ± 10.9 cm) and FSQ (pre: 47.4 ± 10.9 , post: 49.9 ± 12.1 cm) groups ($p < 0.05$). The 36.6 m sprint improved significantly from pre to post RT for both the BSQ (pre: 5.9 ± 0.7 , post: 5.6 ± 0.5 sec) and FSQ (pre: 6.3 ± 0.7 , post: 5.8 ± 0.6 sec) groups ($p < 0.05$). The squat 1-RMs also improved significantly from pre to post RT for both the BSQ (pre: 100.5 ± 34.2 , post: 110.3 ± 36.6 kg) and FSQ (pre: 77.8 ± 31.0 , post: 87.5 ± 29.1 kg) groups ($p < 0.05$). When comparing gain scores between each group there were no significant differences between the BSQ and FSQ groups for any of the DV's ($p > 0.05$). **Conclusion:** Within the parameters of this study, both FSQ and BSQ RT programs improved muscular strength, power and

sprint speed in active individuals. Coaches and active individuals may consider the FSQ and BSQ as interchangeable squat modalities providing squat modality variability within RT protocols.

3470 Board #158 June 1 8:00 AM - 9:30 AM
Impact Forces When Exercising On The Freebouncer™

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(No relevant relationships reported)

The Freebouncer™ Fitness and Rehab Machine consists of a spring-loaded platform attached to a metal frame and has characteristics similar to those of a mini-trampoline. The Freebouncer™ purportedly reduced the impact forces on the lower body during an aerobic workout. **PURPOSE:** This study was designed to compare the ground reaction forces (GRF) and loading rate (LR) when subjects exercised on the Freebouncer™ compared to walking and running on a treadmill and double leg-bouncing on a mini-trampoline. **METHODS:** Eighteen volunteers (9 M and 9 F) between 19-28 years of age completed 4 conditions, in random order: walking at 3.0 mph on a motorized treadmill, running at 6.0 mph on a motorized treadmill, double-leg bouncing on a mini-trampoline at 80 jumps/min, and double-leg bouncing on the Freebouncer™ at 60 bounces/min. During all testing plantar forces were collected using Loadsol in-shoe sensors. Data were recorded during the last 10 seconds of each trial, with 5 representative strides being analyzed for GRF and LR. **RESULTS:** The GRF (Freebouncer™ = 564 ± 126.2 , walking = 918 ± 232.5 , mini-trampoline = 1415 ± 353.2 , running = 1668 ± 395.4) and LR (Freebouncer™ = 518 ± 260.2 , walking = 5315 ± 1094.1 , mini-trampoline = 7454 ± 1898.1 , running = 14555 ± 3895.7) when exercising on the Freebouncer™ were significantly lower ($p < .05$) when compared to walking and running on a treadmill and double-leg bouncing on a mini-trampoline. **CONCLUSION:** These findings suggest that the Freebouncer™ is an excellent low-impact option for individuals looking for an alternative aerobic exercise modality compared to more traditional modes of exercise.

3471 Board #159 June 1 8:00 AM - 9:30 AM
Effects of Whole Body Vibration Training on Muscular Strength and Balance Ability of Elderly Men

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(No relevant relationships reported)

PURPOSE: As we age, various functional functions of our body such as muscular strength and balance ability will gradually decline. The decline of muscular strength associated with aging is a major cause of decreased balance ability and gait instability. The purpose of this study was to examine the effects of whole-body vibration training (WBVT) on muscular strength and balance ability of elderly men. **METHODS:** 30 elderly men aged 60-79 years, who met the inclusion criteria, were recruited and randomly assigned into training and control groups. Training group carried out 12-wk WBVT at the same amplitude (3mm) and frequencies (25-30Hz) on the Power-Plate vibration platform, while control group had no any training. Muscular strength of back and knee, static and dynamic balance ability were measured respectively by portable digital muscle strength tester (microFET3, American) and dynamic balance assessment training system (Biodex-950-440, American) before and after the experiment. **RESULTS:** The core and lower extremity muscular strength of the subjects in training group were significantly enhanced after 12-wk WBVT, with the average increase of dorsal extensor muscular strength by 15.3% and extensor knee muscular strength by 7.42%; with the eyes open, the overall (1.93 ± 0.49 vs. 1.70 ± 0.27), left-and-right (1.71 ± 0.42 vs. 1.57 ± 0.51) static balance index decreased significantly and the overall (4.86 ± 0.21 vs. 3.41 ± 0.29), fore-and-aft (4.51 ± 0.30 vs. 2.53 ± 0.14), left-and-right (4.21 ± 0.26 vs. 2.95 ± 0.18) static balance index with the eyes closed also decreased significantly; the dynamic balance scores in the front (36.63 ± 12.41 vs. 38.72 ± 16.27), left (43.95 ± 16.42 vs. 47.52 ± 16.51) and right (44.34 ± 14.92 vs. 47.39 ± 18.91) enhanced significantly. Meanwhile, there was no obvious change in muscular strength and balance ability in the control group at the end of experiment. **CONCLUSIONS:** It was concluded that the core and lower extremity muscular strength as well as static and dynamic balance of elderly men could be improved with a 12-wk WBVT.

3472 Board #160 June 1 8:00 AM - 9:30 AM
Energy Contributions of Short-distance Running with Change of Direction in Tennis Baseline Practice

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Short-distance running with change of direction (SR-COD) is one of the baseline practice regularly performed in tennis training, but the energy contributions of this practice is relatively lacking.

Purpose: To investigate the energy contributions of tennis SR-COD, with the emphasis on the duration, distance, and frequency.

Methods: 16 collegiate male tennis players (22.2 ± 1.7 yrs, 175 ± 5 cm, 69.2 ± 6.1 kg) volunteered to this study. Two duration (1 and 2 min), two distance (1 and 2 min) and two frequency (20 and 30 stroke/min) were utilized, i.e. 1min-2m-20stroke/min, 2min-2m-20stroke/min, 1min-4m-20stroke/min and 1min-2m-30stroke/min. A portable spirometric system (K4b², Cosmed, Italy) was utilized to measure the ventilatory activities. Capillary blood from earlobe was collected and analyzed with blood lactate analyzer (Biosen C-line, EKF, Germany) prior to and post the test. The aerobic (Aer), anaerobic lactic (Anl), anaerobic alactic (Anal) energy contributions were calculated with the method based on the accumulated oxygen uptake and blood lactate during the practice, as well as the fast part of the oxygen uptake kinetics during the recovery, respectively. The relative energy contributions from the corresponding three pathways were also calculated as Aer%, Anl%, and Anal%.

Result: The energy contributions of SR-COD was Anal 37.4~40.1kJ (32.1~41.7%), Anl 15.1~33.5kJ (14.8~30.4%) and Aer 37.8~100.8kJ (33.9~61.9%), respectively. With the increase of duration, distance and frequency, there was no significant change in Anl, there was significant increase in Anal and Aer ($P < 0.05$, except Aer when increasing frequency). Further, %Anal decreased with the increase of duration, distance, and frequency ($P < 0.05$). %Anl enhanced significantly with the increased distance and frequency ($P < 0.05$), but declined insignificantly with increased duration ($P < 0.05$). %Aer increased significantly with longer duration ($P < 0.05$), but reduced with longer distance and higher frequency ($P < 0.05$).

Conclusion: Longer duration of SR-COD mainly increases the stimulation on Aers system, while longer distance and higher frequency of SR-COD mainly increases the stimulation on Anl energy. These findings should be taken into account when designing the SR-COD training program in tennis.

3473 Board #161 June 1 8:00 AM - 9:30 AM
The Effects Of Leg-drive On Bench Press Performance: Results Of A 5-week Training Study

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(No relevant relationships reported)

Among common resistance training methods, the bench press is often implemented to train upper body strength. Recently, curiosity regarding the potential impact of lower extremity involvement on overall bench press performance has gained in popularity. While the effectiveness of bench press training on strength has been shown in the literature, many suggestions as to the importance of leg-drive have been offered. Yet, to our knowledge, no studies have evaluated the impacts of leg-drive technique on bench press performance. **PURPOSE:** To determine if bench press training with leg-drive elicits similar strength characteristics to a standard bench press in strength and body fat measures after 5 weeks of bench press only training. **METHODS:** 23 apparently healthy, college-age men were randomized into two groups: standard bench press (STD) ($n = 12$, age 22.2 ± 2.3 yrs, height 173.2 ± 6.8 cm, mass 75.1 ± 7.5 kg), and leg-drive (LD) ($n = 11$, age 22.5 ± 1.9 yrs., height 176.8 ± 5.0 cm, mass 82.0 ± 10.4 kg). Pre and post analyses of bench press 1-repetition maximum (1RM), and changes in body fat percentage were conducted. Average bench-press volume was determined on a weekly basis. The training consisted of two sessions per week for five weeks of either standard bench press or bench press using leg-drive. For each session, participants completed four sets of bench press to volitional fatigue at 80% of his 1RM. During week three of training, a new 1RM was conducted to determine whether to move the participant up in weight. A 2×2 repeated measures ANOVA (RMANOVA) was conducted for 1 RM and body fat, and a 2×5 RMANOVA was conducted for average weekly lifting volume. **RESULTS:** Significant condition main effects were found with both groups experiencing an approximate 5% increase in 1RM strength (p -values < 0.001), and an approximate 0.5% reduction in body fat percentage ($p = 0.040$). A condition main effect was found for average lifting volume ($p = 0.041$) and post-hoc analysis revealed that week three was significantly higher than all other weeks. No significant group main effects were observed for any of the variables (all p -values $>$

0.05). **CONCLUSIONS:** Five weeks of bench press training did result in favorable strength outcomes for both groups, but leg-drive focused training did not produce noticeable changes in performance compared to the standard bench press.

3474 Board #162 June 1 8:00 AM - 9:30 AM
Effect of Vibration Intervention on Balance, Core Stability and Muscle Strength in Martial Arts Athletes
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 (No relevant relationships reported)

Objective: To compare the effects of vibration training(V)and control training(C)on balance, core stability and muscle strength in young martial arts athletes. **Methods:** Fourteen athletes were recruited and randomly assigned to two groups:vibration group(V, n=7)and control group(C, n=7). Before and after the 12 weeks training, The SMART Balance Master system was used to measure scores in the limits of stability(LS): reaction time(RT), movement velocity(MVL), end point excursion(EPE), maximum excursion(MXE), and directional control(DCL). The core stability is evaluated by the performance of grade 8 abdominal bridge. Core muscle strength are indirectly evaluated by integrating electromyography (iEMG). Student t-tests were used for data analysis. **Results :** MVL(1.37 deg/sec, $P < 0.01$),EPE(10.86%, $P < 0.01$),MXE(7.00%, $P < 0.05$),DCL(2.86%, $P < 0.05$)in group V were significantly higher after the Vibration Intervention . EPE (8.86%, $P < 0.01$),MXE(4.43%, $P < 0.01$)in group C were higher after the control training . The percentage range was higher in group V(8.29%)than C(4.50%). No significant differences were found in LS between the groups at 12 weeks of follow up. The full score of grade 8 abdominal bridge was obtained in the vibration group, and the overall Range was higher in group C than group V($P < 0.01$). The scoring of core stability also revealed no differences between the groups. In group V left rectus abdominis iEMG value(nearly 100% mV·s, $P < 0.01$), left rectus femoris(0.71 mV·s, $P < 0.05$) , left tibialis anterior (0.39 mV·s, $P < 0.05$)were higher after 12 weeks training .In group C left rectus femoris (0.42 mV·s, $P < 0.01$), left tibialis anterior (0.12 mV·s, $P < 0.05$) were higher after 12 weeks training. After 12 weeks training, the iEMG value of left tibialis anterior(0.63 mV·s, $P < 0.01$),right rectus abdominis (0.34 mV·s, $P < 0.05$) in group V were higher than C. There were no significant differences in the right erector spinae, left Rectus abdominis, left rectus femoris, left erector spinae and left gluteus maximus between group V and C. **Conclusion:** Vibration training improved balance, core stability and muscle strength of movements in young martial arts athletes.

3475 Board #163 June 1 8:00 AM - 9:30 AM
Quantifying Training Loads During High-Intensity Functional Training: Session-RPE Method
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High intensity functional training (HIFT), due to its constant variance and multi-modal approach presents a unique challenge in quantifying external loads. The session rate of perceived exertion (sRPE) method has been shown valid in determining training loads (TL) in a variety of sports. However, sRPE has yet to be psychometrically evaluated within HIFT. **PURPOSE:** To estimate the psychometric properties of the sRPE method within HIFT. **METHODS:** Twenty-five healthy, recreationally active men (n=13; age = 22.6 ± 3.5 years; body mass = 86.1 ± 13.9 kg; height = 182.8 ± 8.1 cm) and women (n=12; age = 21.0 ± 1.5 years; body mass = 70.5 ± 11.3 kg; height = 165.6 ± 5.7 cm) participated in six weeks (5 d·week⁻¹) of HIFT. Heart rate was continuously monitored throughout each training session and rate of perceived exertion was recorded immediately following daily workouts completion. Daily TL was quantified using sRPE and compared to two heart rate-based criterion methods (i.e., Edwards' TL and Banister's TRIMP). **RESULTS:** In training block 1 (i.e., weeks 1-3), sRPE significantly predicted both Edwards' TL (n = 271, $r = 0.81$, $p < 0.001$; $R^2 = 0.67$, 95% CI = 0.60–0.73) and TRIMP (n = 260, $r = 0.43$, $p < 0.001$; $R^2 = 0.18$, 95% CI = 0.10–0.27). In training block 2 (weeks 4-6), these associations remained significant but also improved in their predictive capability for both Edwards' TL (n = 268, $r = 0.88$, $p < 0.001$; $R^2 = 0.78$, 95% CI = 0.73–0.82) and TRIMP (n = 258, $r = 0.57$, $p < 0.001$; $R^2 = 0.33$, 95% CI = 0.23–0.42). However, reliability estimates (n = 554, ICC = 0.58, 95% CI = 0.52–0.63, $p < 0.001$; CoA = 52%) between perceived exertion and HR were generally poor. **CONCLUSION:** We observed the sRPE method was a valid tool across individual, group, and sex levels when compared to criterion heart rate-based measures. However, the utility of this strategy within HIFT is limited due to poor reliability in participants' abilities to correctly match their perceived exertion with the relative level of physiological effort (i.e., percentile of maximum heart rate). Over time, however, these participants demonstrated the ability to improve agreement between perceived and actual effort. Future investigations should continue to explore the potential utility of this monitoring strategy with HIFT interventions.

3476 Board #164 June 1 8:00 AM - 9:30 AM
Training Intensity Distribution In A Chinese Top-level Women's Single Sculls Rower Preparing For 2008 Olympic Games Season
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Purpose: This study was to report seasonal training intensity distribution characteristics in a Chinese top-level Women's Single rower during 2007-2008, while season preparing for 2008 Olympic Games. **Methods:** A Chinese top-level (33 y, height 177 cm, weight 71 kg) World Rowing Cup champion Women's Single Sculls rower participated in this case study. The season's training load included overall duration (calculated in hours and km), frequency (calculated by overall sessions), and training intensity (measured by blood lactate and estimated by heart rate). Her performances at World Cup and Olympic competitions during the seasons, and 2000m ergometer test were also collected and analyzed. **Results:** A training program of 46 weeks (33 weeks of pre-season and 13 weeks of in-season) was analyzed. 193 training days was performed during the season. Total training hours were 737 hours. Total training time consisted of 48.9% on-water rowing (362 hours), 9.18% ergometer rowing (68 hours), 15.2% condition training (112 hours), and 18.4% warm-up and recovery programs (136 hours). All training sessions were quantified using continuous heart rate monitoring, a subset of 117 training sessions was quantified using blood lactate measurements. Intensity distribution across rowing and ergometer training hours (n=489 hours) based on heart rate analysis and blood lactate analysis was 91.12% in zone 1 (74.5% ≤2.0 mM blood lactate, 16.8% between 2.1 and 3.5 mM blood lactate), and 4.13% in zone 2 (>3.5 and 5 mM blood lactate) and 4.75% in zone 3 (over 5mM blood lactate). 2000m ergometer trials performed in weeks 2, 12 and 24 was in times 6 minutes 57 seconds, 6 minutes 55 seconds and 6 minutes 46 seconds, respectively. Maximal power test was 309 W, 313 W and 334 W, respectively. Rowing performance improved 1.29% and 6.27% during the period. She finished the season in 3rd place in the World Cup and fourth place in the 2008 Olympic Games. **Conclusion:** Training-intensity distribution with an emphasis on low-intensity polarized training model led to the success in top Chinese top-level Women's Single Sculls rower in the 2007-08 season. Possible mechanisms underlying the association between intensity distribution and performance success require further investigation.

3477 Board #165 June 1 8:00 AM - 9:30 AM
Impact of Workload on Time-Loss Incidence Rates in Elite Rugby Union Players.
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 (No relevant relationships reported)

Rugby Union has one of the highest reported time-loss incidence rates of all professional team sports. However, the relationship between workload and time-loss incidence rate has not been well studied. **PURPOSE:** To investigate the impact of workload on time-loss incidence rates in elite Rugby Union players and compare different methods of workload quantification. **METHODS:** Sixty elite Rugby Union players were followed over one season (46 weeks) of competition. Workload was measured for all training and matches using subjective (RPE load; RPE x session duration) and objective (GPS; total distance and high-speed running (HSR) distance) methods and quantified using both the acute:chronic workload ratio (ACWR) and exponentially weighted moving average (EWMA). Chi-square analysis was used to examine the influence of workload on time-loss incidence rate. **RESULTS:** Of the 240 time-loss incidences that occurred across the season, 125 were contact injuries (106 during matches and 19 during training), 76 were non-contact injuries (25 during matches and 51 during training) and 39 were illnesses. Chi-square analysis showed that time-loss incidence rates were affected by ACWR RPE load ($X^2_{(5)} = 12.3$, $p = 0.031$), EWMA RPE load ($X^2_{(5)} = 30.8$, $p < 0.01$), EWMA total distance ($X^2_{(5)} = 23.9$, $p < 0.01$) and EWMA HSR distance ($X^2_{(7)} = 18.0$, $p = 0.012$), yet were unaffected by ACWR total distance ($p = 0.067$) and ACWR HSR distance ($p = 0.894$). EWMA RPE load and EWMA total distance exhibited an optimum range of 0.8-1.2 where actual time-loss incidence rate was lower than expected. Whereas for EWMA HSR distance values <1.0 led to a lower than expected time-loss incidence rate. ACWR RPE load had an optimum range of 0.6-1.2, whilst ACWR total distance and ACWR HSR distance did not affect time-loss incidence rates. **CONCLUSION:** This is the first study to compare different methods of workload quantification in elite Rugby Union and demonstrate that the EWMA method is better at explaining the variance in time-loss incidence risk compared to the ACWR method. When using the EWMA approach, an optimum range of 0.8-1.2 for RPE load and total distance and <1.0 for HSR distance demonstrated

a reduced time-loss incidence rate. These findings suggest that the EWMA of each individual player should be monitored to minimise time-loss incidence risk in elite Rugby Union.

- 3478** Board #166 June 1 8:00 AM - 9:30 AM
The Influence Of Combine Preparation Training Duration On NFL Combine Or Pro Day Performance
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For collegiate football players, an outstanding performance at the NFL scouting combine or an athlete's college pro-day may increase the likelihood of being drafted or signed to an NFL team. In recent years, it has become common for players to decline playing in bowl games to allow for additional preparation for combine and pro-day performance. **PURPOSE:** To determine if the duration of combine preparation training influences NFL Combine or Pro Day performance. **METHODS:** 23 college football players (22.6±0.51 y, 108.8±18.2 kg 1.88±0.07 m) completed a preparation training program leading up to the 2018 NFL combine and college pro-days. Prior to training, all players were assessed in the 40yd dash, 225 bench press test, 3-cone drill, pro-agility test, broad jump and vertical jump. Post-training values were obtained from the players combine or pro-day performances and athlete data were then allocated to two groups: (1) athletes who completed 9-10 weeks of training (n=11) and (2) athletes who completed 6-8 weeks of the same training program (n=12). Combine training consisted of 4 resistance training sessions per week with position and test specific training occurring 6 days a week for the duration of the program. An analysis of variance with repeated measures was used to assess differences in training outcomes for each variable. **RESULTS:** Significant ($p < 0.05$) main effects for time were observed for improvements in 40-yard dash times ($p = 0.046$), 3-cone drill time ($p = 0.002$), along with 225 bench press repetitions, vertical jump height, broad jump distance, and pro-agility drill time ($p < 0.001$). There were no significant group by time interactions for any of the physical performance tests. Out of the 23 participants, 3 players were drafted and were on active rosters for the 2018 NFL season, one participant was drafted and signed a practice squad contract, while 5 other participants signed undrafted free agent contracts with various NFL teams. **CONCLUSION:** It appears that length of combine preparation did not produce significant differences in pro day performance between the two groups. Therefore, NFL hopefuls can improve their combine performance even with a short duration combine training program.

- 3479** Board #167 June 1 8:00 AM - 9:30 AM
Table Tennis Training Results with Robot: Spin Rate and Hitting Speed in Forehand Loop-Drives
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PURPOSE: Limited studies have addressed spin rate (SR) and hitting speed (HS) in forehand loop-drive (FLD) among recreational table tennis players. This study examined how the use of a table tennis robot would improve SR and HS of the FLD among recreational table tennis players during a self-regulated training program. **METHODS:** Thirteen middle-aged (46.2 ± 18.3 yr., 8 males) players with 4.8 ± 4.1 yr. of recreational table tennis experience participated in an eight-week table tennis program that met twice a week with the purpose of increasing SR and HS in FLD. A pretest and posttest were conducted to assess average SR and HS from five consecutive FLDs performed by each participant against consistent backspin balls served by a table tennis robot. SR was assessed with high-speed video recordings at 480fs⁻¹, and HS was assessed at 60 fs⁻¹. Each training session included a 20-min practice of FLD against balls served by the robot. The ball, after its bounce on the table, arrived to the participants at the speed of approximately 2.9 ms⁻¹ with a SR of approximately 21 rs⁻¹, the same condition as that in the pretest/posttest. In training sessions, participants also studied written and visual instructional materials, and utilized self-regulated feedback (feedback from coaches was available only when requested). In addition, progress results of SR and HS were assessed and provided to each participant every two weeks. Differences in SR and HS between pretest and posttest were examined with paired-samples t test. **RESULTS:** Participants showed significant improvements during the training program in both SR and HS measurements ($p < .05$). SR demonstrated an 45.9% improvement from 41.6 ± 30.5 rs⁻¹ to 60.7 ± 31.6 rs⁻¹, and HS resulted in a 13.3% improvement from 8.57 ± 0.98 ms⁻¹ to 9.71 ± 1.22 ms⁻¹. **CONCLUSION:** The eight-week training with a robot significantly improved SR and HS in FLD for recreational table tennis players. The use of the robot and the biomechanical feedback for self-regulated training seem to be successful tools in developing SR and HS in

recreational table tennis setting, where working with a personal coach is often limited. The effective use of technology helps the middle-aged population to meet ACSM's recommendation for neuromotor exercise training.

- 3480** Board #168 June 1 8:00 AM - 9:30 AM
The Effects of Suspension Training in Lower Body Strength and Balance in Sedentary
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ABSTRACT

Purpose: The aim of the study was to investigate the effects of suspension training in lower body muscle strength and balance in sedentary.

Methods: A total of 60 healthy, sedentary volunteer aged 30-45 years participated in this study. Participants were randomly divided into two groups that were suspension strength group (40,67±3 yrs) (SSG), and traditional strength group (TSG) (39,10±3,3 yrs). In SSG were applied suspension exercises 8 weeks, twice in a week, 40-45 min. In TSG were applied traditional strength exercises 8 weeks, twice in a week, 40-45 min. In both groups volunteers' anthropometric, hand grip strength, push-up, static squat, crunch, plank and balance performances were measured before and after 8 weeks training programs.

Results: As a result of the findings in this research which was made to determine the effects of suspension exercises on muscle strength development in sedentary individuals, suspension strength training studies differ from traditional strength training. At the end of eight-week strength training; all parameters in the suspension strength group and only squat (54,27±22,67 vs. 61,60±22,39, $p < 0.05$), crunches (21,00±4,01 vs. 24,23±6,05 $p < 0.05$), plank (54,73±19,47 vs. 58,53±23,76 $p < 0.05$), flexibility (25,10±9,38 vs. 27,33±9,11 $p < 0.05$) and balance (5,13±1,90 vs. 3,33±1,44 $p < 0.05$) parameters were found significantly in traditional strength group.

Conclusion: As a result, strength training (push-up, squat, crunches and plank) applied on unstable surfaces showed more improvement than traditional strength training. It is also thought that the suspension strength exercise method may be an alternative to force exercises and may be more useful for strength development.

Key words: Traditional Strength, Fitness, TRX

- 3481** Board #169 June 1 8:00 AM - 9:30 AM
Effects of Suspension Training and Unstable Surface on the Lower Limb

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Unstable surfaces have been used to enhance the muscle activity (MA) in different strength and conditioning exercises. Some evidence supports that the unstable surface increases the motor unit recruitment and improves the neuromuscular coordination in order to maintain balance. Thus, an emerging trend is the utilization of suspension devices to increase the amount of instability.

Purpose: To examine the MA of the lower limb when perform a Bulgarian squat, suspended lunge and suspended lunge-Bosu.

Methods: Seventeen physically active university students (age = 24±3.31y, height = 1.78±0.06 m, weight= 74.99±9.39 kg) were recruited to perform a Bulgarian squat, suspended lunge and a suspended lunge-Bosu. The MA was assessed using sEMG on the front leg (FL) to measure the rectus femoris_FL (RF_FL), biceps femoris (BF), gluteus medius (Gmed), vastus medialis (VM), vastus lateralis (VL) and the RF of the rear leg (RF_RL). The activity of all analyzed muscle was expressed as percentage of maximum voluntary isometric contraction (% MVIC). A one-way repeated-measures ANOVA was carried out to determine the effect of exercise condition on MA.

Results: A main effect was found for exercise condition on muscle activation for RF_FL [$F_{(2,32)} = 7.678$ $p = 0.002$], BF [$F_{(2,32)} = 4.076$ $p = 0.026$], Gmed [$F_{(2,32)} = 33.878$ $p = 0.000$], VL [$F_{(2,32)} = 3.508$ $p = 0.042$] and RF_RL [$F_{(2,32)} = 5.704$ $p = 0.008$], except for VM [$F_{(2,32)} = 2.346$ $p = 0.112$]. The suspended lunge-Bosu showed a higher activation for RF_FL, Gmed, and VL (44.25%±4.78; 66.56%±4.84; 75.58%±4.48, respectively) respect Bulgarian squat (RF_FL: 33.13%±3.87 $p = 0.024$; Gmed: 47.97%±4.41 $p = 0.000$) and suspended lunge (RF_FL: 33.86%±3.82 $p = 0.006$; Gmed: 47.89%±3.21 $p = 0.000$; VL: 63.87%±4.69 $p = 0.041$). However, the suspended lunge-Bosu reached a lower activity for RF_RL (25.98%±2.60) in comparison with Bulgarian squat (RF_RL: 35.69%±4.19 $p = 0.025$).

Conclusions: These findings suggested that leaning the RL on the suspension device did not provoke the sufficient stimuli to increase the muscle demands of the FL, but adding the unstable device on the FL in a suspended lunge could be a challenge to

increase the MA. Funding for this project was provided by Secretaria d'Universitats i Recerca del Departament d'Empresa i Coneixement de la Generalitat de Catalunya i als Fons Socials Europeus.

3482 Board #170 June 1 8:00 AM - 9:30 AM
Developing Muscular Power vs. Muscular Endurance: Results from Two Different Push-ups Training Programs

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 (No relevant relationships reported)

PURPOSE: While development of muscular power (MP) vs. muscular strength (MS) requires the use of different repetitions, weights, and movement velocity, push-ups involve overcoming constant resistance (body) weight and might be able to develop both MP and ME, especially among beginning trainees. This study examined whether two different push-ups training programs, one focusing on MP and the other on ME, would influence the development of MP and ME of the upper body differently among novice trainees.

METHODS: A six-week push-ups training with three sessions each week was administered to 46 college students (mean age: 21.36 ± 1.67). Participants had limited experience in resistance training, and were randomly assigned to the MP group (MPG) or the ME group (MEG), with each group having 14 males and 9 females. In each training session, the MPG performed six sets of ballistic plyometric push-ups with low (4-6 for females, 4-8 for males) repetitions at maximum velocity, and the MEG did six sets of regular push-ups with high (10-20 for females, 15-25 for males) repetitions. Two push-ups tests were administered before (pretest) and after (posttest) the six-week training: (a) four consecutive ballistic push-ups for average flight height (T1), calculated from the flight time provided by a contact mat, and (b) regular push-ups for maximum repetitions (T2). The test results were compared within and between groups. **RESULTS:** Paired-samples t-tests indicated significant within-group improvements in both push-ups tests ($p < 0.05$) in both groups. The MPG improved in T1 from 6.53 ± 1.76 to 7.59 ± 1.74 in., and in T2 from 26.63 ± 13.31 to 30.08 ± 8.93 reps. The MEG improved in T1 from 6.64 ± 3.63 to 7.33 ± 2.86 in. and in T2 from 23.4 ± 13.31 to 26.9 ± 11.10 reps. As for between-group comparisons, MANCOVA showed no significant differences ($p > 0.05$) in adjusted means in either push-ups test after controlling for pre-test differences: MP 7.48 ± 1.74 vs. ME 7.06 ± 2.86 in. (T1), and 29.01 ± 8.93 vs. 27.39 ± 11.10 reps. (T2).

CONCLUSION: While the two push-ups training programs each has a different focus (MP or ME), they have roughly the same results in developing both MP and ME. This may be related to the constant resistance (bodyweight) in push-ups, as well as the transfer effect between MP and ME in early stage of resistance training among novice trainees.

3483 Board #171 June 1 8:00 AM - 9:30 AM
Actinin 3 Genotypes and Altitude Training

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Certain genotypes determine adaptation to certain exercise and can be used to monitor adaptability to training. **PURPOSE:** To gauge cardiovascular response by using oxygen saturation and heart rate change to determine adaptation to altitude training in athletes with 577RR/577RX and the 577XX genotypes. **METHODS:** Athletes who were previously genotyped for the actinin 3 genes were recruited for the study. Forty athletes consented to participate and were divided in two groups. One group participated primarily in running events of distance > 1000 m (group M, $n=5$) and the other participated in running events ≤ 400 m (Group S, $n=35$). Each group was subjected to running up a steep slope of 5000M twice weekly for 12 weeks. Oxygen saturation was recorded using a pulse oximeter for each participant before the start of 12 weeks and each four weeks up to 12 weeks. Blood pressure and heart rate were recorded before the start of the 12 week trail and each 4 weeks up to 12 weeks. **RESULTS:** Thirty five athletes had the 577RR or the weaker 577RX variant of the actinin 3 gene. Five had the 577XX genotype. Those with the 577RR and 577RX genotypes had no significant increase in their SpO₂ values over 12 weeks ($P=0.1$). Their heart rate and blood pressure did not significantly decrease over 12 weeks ($p>0.5$). Group M athletes had significant increase in SpO₂ values, heart rate and pulse rate also significantly decreased over 12 weeks ($p<0.001$). **CONCLUSION:** Those with the 577XX genotype adapted better to altitude training than those with the 577RR and 577RX genotypes

3484 Board #172 June 1 8:00 AM - 9:30 AM

Effect of Progressive Unilateral Eccentric versus Concentric Training on Muscle Damage of the Contralateral Limb

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Muscle damage of the elbow flexors (EF) induced by maximal eccentric exercise (100%EC) is significantly less following the second bout of the same exercise performed at 1-28 days after the first bout by not only the ipsilateral EF but also the contralateral EF (contralateral repeated bout effect: CL-RBE; Chen et al. MSSE 2016). However, it is not known whether the magnitude of the CL-RBE of the opposite limb would be differently conferred if one limb received progressive unilateral eccentric training (PET) compared with progressive unilateral concentric training (PCT). **PURPOSE:** This study tested the hypothesis that a greater CL-RBE would be conferred upon the EF by PET than by PCT. **METHODS:** Untrained young men were placed into PET, PCT and control (CON) groups ($n=8$ /group). Both the PET and PCT groups performed 5 sets of 6 contractions of the EF of one arm once a week for 5 weeks, in which the load was increased from 10 to 30, 50, 80 and 100% of maximal voluntary isometric contraction (MVC), followed 1 week later by 5 sets of 6 100%EC of the opposite EF. The CON group performed 100%EC with one EF, and repeated the 100%EC with the opposite EF 1 week later. MVC, range of motion, upper arm circumference, muscle soreness (SOR) and plasma creatine kinase activity were measured before to 3 days after each PET and PCT, as well as before and for 5 days after 100%EC. Changes in these variables after 100%EC were compared between groups by a mixed-design two-way ANOVA. **RESULTS:** The magnitude of increases in MVC for the trained (22%) and untrained arms (10%) after PET was greater ($P<0.05$) than after PCT (11%, 5%). Changes in all variables after 100%EC were smaller ($P<0.05$) for the PET group (e.g. MVC: -9% at 4 days post) compared with 100%EC for the PCT group (-23%) and the first 100%EC of the CON group (-27%), without significant difference between the PCT and CON groups. Changes for the PET group (e.g. peak SOR: 12 mm) were smaller ($P<0.05$) than those after 100%EC for the PCT group (34 mm) and after the second 100%EC for the CON group (25 mm), and changes in all variables after the second 100%EC for the CON group were smaller ($P<0.05$) than for the PCT group. **CONCLUSIONS:** These results supported the hypothesis and showed that the CL-RBE conferred after PET would be greater than that conferred after PCT. Supported by MOST, TAIWAN (MOST105-2410-H-003-052-MY3).

3485 Board #173 June 1 8:00 AM - 9:30 AM
Comparison of Eccentric Utilization Ratio and Reactive Strength Index between Football Linemen and Backs

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Explosive generation of force is a fundamental component of many sports. Various jumping indices have become major indicators of player potential or for judging training improvement. However, there is limited information concerning these indices for college football players. **PURPOSE:** To compare two forms of reactive strength index (RSI) between college football linemen and backs. **METHODS:** Linemen ($n=12$) and backs ($n=16$) were tested for static jump (SJ) and drop vertical jump (DVJ) on a force plate to determine flight time (Ft), ground contact time (GCT), and peak takeoff force (PTF). Peak landing force (PLF) was determined during DVJ. Each player performed 2 trials of each jump with a 1-min rest between. RSI was calculated as a ratio of DVJ to GCT (RSI-1) and Ft/GCT (RSI-2). A modified elastic utilization ratio (EURmod) was calculated as DVJ/SJ. **RESULTS:** Linemen were significantly heavier (127.9 ± 7.8 kg) than backs (92.0 ± 7.8 cm) but the two were not statistically different in age (20.2 ± 1.3 vs 19.8 ± 1.6 yrs, respectively) or height (186.5 ± 6.0 vs 183.6 ± 6.0 cm, respectively). Reliabilities for GCT (ICC = 0.870), SJ Ft (ICC = 0.952), DVJ Ft (ICC = 0.959), DVJ (ICC = 0.958), and SJ (ICC = 0.949) were high. GCT was not significantly different between backs (0.275 ± 0.055 s) and Linemen (0.288 ± 0.039 s). RSI-1 and RSI-2 were greater in backs (1.26 ± 0.37 and 1.95 ± 0.42 , respectively) than in linemen (0.77 ± 0.18 and 1.47 ± 0.23 , respectively) with large effect sizes (ES = 2.78 and 2.11, respectively). RSI-1 (1.05 ± 0.38) was statically greater than RSI-2 (1.74 ± 0.42), although they were highly correlated ($r = 0.95$). EURmod was significantly higher in backs (0.91 ± 0.13) than in linemen (0.75 ± 0.14) with a large ES = 1.69). PLF/kg was not significantly different between linemen (47.2 ± 7.5 N/kg) and backs (49.5 ± 8.3 N/kg) but PTF/kg was significantly greater in backs

(40.8 ± 6.4 N/kg) than in linemen (34.7 ± 3.5 N/kg). Discriminant analysis indicated that JH/kg could correctly classify 94% of backs and 100% of linemen to the correct position.

CONCLUSIONS: Various ratios indicating the ability of players to handle their body weight during explosive movements may be useful in classifying playing position and evaluating training improvement.

3486 Board #174 June 1 8:00 AM - 9:30 AM
Minimalist Style Military Boot Does Not Improve Walking Economy Under Load In Trained Males

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MINIMALIST STYLE MILITARY BOOT DOES NOT IMPROVE WALKING ECONOMY UNDER LOAD IN TRAINED MALES

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Footwear may be a simple external factor to improve rucking economy (RE) for soldiers that must carry heavy external loads, but it is also possible that with no flight phase, RE may not be enhanced by footwear style. This study compared RE with an ~500 g minimalist style boot (MIN) versus an ~800 g traditional style boot (TRD) while wearing a 16 kg external load consisting of a 7.5 kg weighted compression vest and ruck sack with 8.5 kg of weight. Male participants (n = 14) completed two testing sessions for this study. In session 1 participants completed a VO₂ peak test (46.6 ± 7.3 ml/kg/min) under load while wearing their normal athletic shoes. The second session consisted of two 5-min walking treadmill sessions under load. Treadmill speed was based on the highest speed stage that allowed the participant to walk for the full stage during the VO₂ peak test. RE was evaluated using indirect calorimetry (TrueOne2400, Parvo Medics Inc. Provo, Utah) and calculated by averaging the 60-s average values of minutes 3-4 and 4-5. Steady state was confirmed by a difference < 0.1 L/min between minutes 4 and 5. MIN and TRD were worn in a counter-balanced crossover order. There was a 10-min rest period between rucking bouts. RER did not differ between treatments (MIN = 0.86 ± 0.48; TRD = 0.86 ± 0.51; p = 0.96). A two-tailed t-test with an was ran for all data (α = 0.05). Although MIN (1.79 ± 0.23 L/min) tended (p = 0.13) to improve RE versus TRD (1.85 ± 0.30 L/min), breathing RPE was the only measure that reached significance (p = 0.045) between MIN (2.0 ± 0.9) versus TRD (2.4 ± 1.2). Altering boot type does not improve RE.

3487 Board #175 June 1 8:00 AM - 9:30 AM
Cortisol and Testosterone Awakening Response During Training in Elite Military Men

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(No relevant relationships reported)

Elite military training is highly stressful on the body and challenges the individual operator to maintain allostasis (i.e., the ability to adapt and recover from repetitive stressors). It is well understood that increased allostatic load, above that of allostasis, may lead to hormonal imbalances in the hypothalamic-pituitary adrenal (HPA) and gonadal (HPG) axes. However, it is not well understood if elite military training elevates allostatic load enough to disrupt the HPA and HPG axes. **PURPOSE:** To determine the cortisol awakening response (CAR)—an outcome metric of the HPA axis—and the testosterone awakening response (TAR)—an outcome metric of the HPG axis—over the course of a 9-month unit level training (ULT) cycle. **METHODS:** Active duty, elite, male operators (n = 37; age: 28.6 ± 3.8 yrs; height: 178.0 ± 5.3 cm; weight: 87.0 ± 8.6 kg) participated in this study. Operators were stratified into 3 groups based on age (20-26, 27-29, and 30-41 yrs). Daily self-administered saliva samples were completed by each operator at the time of Wake, Wake + 30 min, and Wake + 60 min, pre- and post-ULT cycle. All CAR and TAR data were calculated as area under the curve from the ground (AUC_G). Differences and interactions between age groups and days were examined using a 3 (age) × 2 (day) mixed effects model. **RESULTS:** There was a significant interaction between age groups and days for CAR (p < .0001) and TAR (p < .0001) AUC_G. Simple effects comparing differences in the CAR AUC_G from operators aged 27-29 yrs exhibited a 22.8% decrease in CAR following ULT (AUC_G = 17.5 ± 8.3 vs. 13.6 ± 7.5, p = .01). Examination of the individual main effects revealed significant differences comparing age groups in TAR (p = .006). Adjusted contrast analysis revealed operators aged 20-26 yrs had a heightened TAR during both pre- and post-ULT time points when compared with those aged 27-29

yrs (AUC_G: pre = 12059.8 ± 3819.0 vs. 8439.4 ± 3801.5; post = 11834.1 ± 5588.5 vs. 7754.2 ± 2606.3, p < .0001) and 30-41 yrs (AUC_G: pre = 12059.8 ± 3819.0 vs. 8298.1 ± 3440.0; post = 11834.1 ± 5588.4 vs. 8640.4 ± 5087.7, p < .0001). **CONCLUSION:** Results indicate the middle-aged group (27-29 yrs) has a decrease in CAR over the 9-month ULT cycle compared with the younger and older age groups. Additionally, the youngest operators, aged 20-26 yrs, have the highest TAR, regardless of time point.

3488 Board #176 June 1 8:00 AM - 9:30 AM
The Effectiveness Of Neuromuscular Training Versus Traditional Training On Dynamic Balance In Athletes: A Meta-analysis

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Neuromuscular training has been viewed as an effective approach to improving dynamic balance through enhancement of unconscious motor responses in athletes. However, it is still unclear whether neuromuscular training is better than traditional training to improve the dynamic balance ability. **Purpose** The primary purpose of the present paper was to determine whether or not neuromuscular training is better than traditional training in improving dynamic balance through a systematic review and meta-analysis of the available research articles. **Methods** The meta-analysis was conducted and reported according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA). Relevant articles were searched independently by two researchers through PubMed, web of science, Google scholar, CNKI, which was completed before September 2018. The randomized controlled trials involving the effects of neuromuscular training and traditional training on athletes' dynamic balance were included. **Results** 6 RCT studies with 162 athletes met inclusion criteria for this review and were included. On average sessions went for 45 ± 20mins; 3 ± 2 times a week for 6 ± 2 weeks. Compared with traditional training, there was a significantly improve in Star excursion balance test (SEBT), the anterior (MD = 6.92 cm, 95%CI: 3.22 to 10.63), anteromedial (MD = 3.64 cm, 95%CI: 0.86 to 6.43), lateral (MD = 6.3 cm, 95%CI: 3.21 to 9.48), posterior (MD = 10.19 cm, 95%CI: 7.29 to 13.10, posteromedial (MD = 9.69 cm, 95%CI: 7.2 to 12.19) and posterolateral (MD = 5.75 cm, 95%CI: 1.81 to 9.69) scores of SEBT, respectively. No significantly differences in anterolateral (MD = 11.68, 95%CI: -0.03 to 23.38), medial (MD = -0.51 cm, 95%CI: -7.20 to 6.17) of SEBT between neuromuscular training and traditional training were found in the available research articles. **Conclusions** Neuromuscular training could be an effective training method for improving the dynamic balance of athletes in different sports and could be applied to athletes' training programs. More attention is needed in future research on validating the effectiveness of neuromuscular training between different sports programs through large randomized controlled trials and exploring the underlying physiological mechanisms.

3489 Board #177 June 1 8:00 AM - 9:30 AM
The Impact of Isometric Handgrip Training on Cardiovascular Stress Reactivity: Does Baseline Psychological Stress Matter?

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Cardiovascular stress reactivity (CSR) is associated with cardiovascular risk factors such as hypertension and carotid intima media thickness. It may also be influenced by baseline perceived psychological stress. Isometric handgrip training (IHGT) has been shown to reduce CSR in hypertensive adults, however, the impact of IHGT on CSR in normotensive adults is unknown.

PURPOSE: To examine the effect of IHGT on CSR in young, healthy males and to assess the potential influence of variability in baseline perceived stress across the intervention.

METHODS: Young, healthy male subjects were randomly assigned to a control (n=11, 22±4 yrs) or IHGT group (n=11, 23±4 yrs). The Perceived Stress Scale (PSS) was administered and mean arterial pressure (MAP) was assessed during the Trier Social Stress Task. CSR was calculated as the difference in MAP from baseline to peak during stress. A single training session consisted of 4 alternating right and left 2 min isometric handgrip contractions (30% maximal voluntary contraction) and this was performed 5 days/week for 5 weeks. All measurements were performed before and after the intervention.

RESULTS: There was a significant reduction in CSR post-intervention (19±10 vs. 23±11 mmHg, p<0.02) however, this was not significantly different between groups (p=0.45). PSS score did not change with the intervention (14±7 vs. 13±6 p=0.56) or differ between groups (p=0.7). Overall, CSR did not correlate with PSS scores (r² = -0.03, p>0.2) and addition of the PSS score to CSR analysis did not alter the findings. However, there was a significant negative correlation between CSR and PSS scores of

less than 15 ($r^2 = -0.3$, $p < 0.001$). Addition of PSS score to CSR analysis in only these participants did not show a training reduction of CSR compared to the control group (28 ± 3 vs. 19 ± 3 mmHg; 20 ± 3 vs. 18 ± 3 mmHg, $p = 0.172$).

CONCLUSION: In contrast to some findings with aerobic training, IHGT did not lower CSR in young, healthy males. Lower responses overall post intervention suggest that some habituation to the TSST occurred. Although considering PSS score did not alter current findings, CSR decreased with increasing reported stress up to a moderate reported stress level (PSS score of 15). This suggests that considering baseline levels of stress may be helpful in interpreting CSR changes with exercise interventions.

3490 Board #178 June 1 8:00 AM - 9:30 AM
Pushing A Sled: Assessing Its Impact On Gait Temporospatial Parameters In Young Healthy Adults
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Resistance exercise (RE) has been demonstrated as a superior modality for increasing muscle strength, muscle endurance, power, and motor performance. The sled used in this study is a novel device that provides a proportional increase in resistance with increased speed.

PURPOSE: To examine the impact of resistance on gait temporospatial parameters using a sled in healthy young adults while walking and running.

METHODS: Fifteen young adults (ages 21-35) were recruited to participate in this study. Mobility Lab sensors (accelerometers and gyroscopes) were placed on each subject at the chest, waist, and both wrists and ankles. Each participant performed three trials of 40 feet for the following conditions: self-paced walking (W), self-paced walking while pushing the sled (WP), and maximal speed running while pushing the sled (RP).

RESULTS: A repeated measures MANOVA was conducted to compare gait temporospatial parameters across conditions. Results indicate significant differences ($P < 0.005$) between all conditions for stride length, cadence, double support time, swing %, and stance %. Stride length decreased across all three conditions: W (85 ± 3.0), WP (68 ± 4.1), and RP (56 ± 7.0). Cadence decreased while WP (92 ± 10.1), yet increased during RP (169 ± 14.9), compared to W (109 ± 6.7). During resistance conditions (WP and RP) participants demonstrated greater gait cycle percentage in stance phase [(WP, stance phase: 66 ± 1.6 , swing phase: 34 ± 1.6) and (RP, stance phase: 57 ± 2.7 , swing phase: 42 ± 2.7)] when compared to W (stance phase: 37 ± 2.1 , swing phase: 37 ± 2.2).

CONCLUSIONS: Longer stance phase with a proportional increase in resistance could be utilized as a combined resistance and gait training tool as supposed to only gait training. This resistance as an intervention might be a viable option to improve the push off of patients with limitations such as neurological disorders. Future studies should focus on neuromuscular activation of the lower extremity, specifically the muscles involved in the gait cycle stance phase when walking or running with resistance.

3491 Board #179 June 1 8:00 AM - 9:30 AM
The Specificity of Muscular Coordination between Front Crawl Swimming and Dry-land Resistance Training Exercises.
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PURPOSE

Specificity is an integral component in understanding the mechanism of transfer of dry-land resistance training exercises (RT) to front crawl swimming (FC). The specificity of intra and inter muscular coordination is deemed to be important, with neuromuscular adaptations at the forefront namely motor unit recruitment, synchronisation and co-contraction. Limited research has investigated the muscular coordination between FC and RT. Therefore, the aim of this investigation is to explore the muscular coordination between RT and FC.

METHODS

Fourteen male international and national level swimmers were recruited. EMG and 2D kinematic data were collected whilst FC, bench press (BP) and pull-up (PU) were performed. A standardised warm up was conducted followed by 3 x 35 m FC bouts, 1 x 70 % and 2 x 100 % of maximal exertion, with 5 minutes' recovery between bouts. The BP and PU were performed using the same protocol, with participants performing 3 x 5 RM. EMG data were filtered using a 4th order Butterworth filter and normalised to peak EMG. The EMG data were presented using a 50 % threshold of peak EMG and

demonstrated temporal overlaps (TO) for each muscle. 2D data were collected during the propulsive (PRO) phase of FC and eccentric (ECC) and concentric (CONC) phase of BP and PU.

RESULTS

The individual results show little TO between FC and BP and FC and PU. Furthermore, FC and BP had significantly ($P < 0.05$) greater TO compared to FC and PU. The ratio of the ECC and CONC phase during the 5RM, BP and PU, show significant ($P < 0.001$) differences compared to the recovery (REC) and PRO phase of FC. Additionally, duration of time under tension during the CONC phase, of BP ($P < 0.01$) and PU ($P < 0.001$), was significantly higher than during the PRO phase of FC.

CONCLUSION

The EMG data shows different individual responses and little specificity between FC and BP and FC and PU. The targeted prime movers show little TO between FC and RT. These findings may question the validity of this method for assessing specificity, as it does not account for their dynamic nature. The lack of specificity between RT and FC shows further differences as the ratio and duration of time under tension of the RT compared to FC show significant differences. Velocity based training may be a viable method to target specific movement velocities and increase specificity.

3492 Board #180 June 1 8:00 AM - 9:30 AM
Effects Of Lower-leg Kinesio Taping On Ankle Strength, Foot Pressure And Balance
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The use of kinesio tape among health care professional has grown recently in efforts to efficiently prevent and treat joint injuries. However, limited evidence exists regarding the efficacy of this technique in enhancing joint stability and neuromuscular control.

PURPOSE: To compare of the effect of lower-leg kinesio taping and traditional taping method on ankle strength, foot pressure and static and dynamic balance.

METHODS: In a double-blinded, randomized, crossover trial, and twenty healthy adults were applied lower-leg kinesio taping and traditional taping method for 1-week. The two taping methods were separated by a 2-week. All subjects were evaluated for isokinetic strength (plantar flexion, dorsiflexion, inversion and eversion of $30^\circ/\text{sec}$ and $60^\circ/\text{sec}$), foot pressure during gait and static and dynamic balance.

RESULTS: Results showed that backward, leftward and rightward of dynamic balance were significantly increased in lower-leg kinesio-taping compared to CON ($p < 0.05$, respectively). Leftward and rightward of dynamic balance were significantly increased in traditional taping compared to CON ($p < 0.05$, respectively). However, no significant difference in the ankle strength, foot pressure and static balance were observed between the taping methods.

CONCLUSIONS: Both taping methods applications are recommended for increasing dynamic balance ability. Further research might investigate how this affects participants with a history of injury.

3493 Board #181 June 1 8:00 AM - 9:30 AM
Effects Of Whole-body Electrostimulation On Concurrent Training Related To Explosive Strength, Anaerobic Power And $\dot{V}O_{2\text{max}}$.
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 (No relevant relationships reported)

Training programs typically involve the concurrent use of strength and endurance training sessions. Moreover, whole-body electrostimulation has also been used by athletes in the context of training programs to develop strength and physical performance. We postulate that the addition of whole-body electrostimulation (WB-ES) to concurrent training may improve explosive strength, anaerobic power and aerobic performance.

PURPOSE: To identify which of two concurrent training protocols-consecutive (weightlifting + HIIT) or simultaneous (WB-ES + HIIT)-is more effective in enhancing explosive strength, anaerobic power and aerobic performance in recreationally trained subjects. **METHODS:** Twenty-two recreationally trained subjects (Age 20.08 ± 2.08 yr, Weight 72.49 ± 5.20 kg, BMI 22.23 ± 2.47 kg/m²) were randomized into 3 groups: Concurrent Consecutive (CC), Concurrent Simultaneous (CS) or Control Group (CG), who carried out 5 weeks of training, 2 days per week. The CC group performed a circuit strength training of 4 exercises (bench press, front pull down, back squat and femoral curl); 4 x 8 reps 60-65% 1RM, followed by HIIT (4 x 4 min 90-95% maximal aerobic power with 3 min of recovery) on a cycle ergometer. Conversely, the CS group

completed the same HIIT training combined with a strength program with WB-ES (WiemsPro, USA). Participants were evaluated in three moments; PRE, POST, and after a detraining (DET). Testing included Wingate test for anaerobic power, CMJ for explosive strength and an incremental maximal test for $\dot{V}O_{2\max}$. Analysis was performed using two-way ANOVA with repeated measures. **RESULTS:** CS and CG increased mean power in Wingate test between all measurements (CC 471 ± 87 W vs 562 ± 77 W vs 553 ± 70 W; CS 457 ± 74 W vs 566 ± 112 W vs 563 ± 105 W $p < 0.01$). CMJ increased in CC in POST (29.75 ± 3.87 cm vs 33.42 ± 4.11 cm $p < 0.001$) and DES (29.75 ± 3.87 cm vs 33.68 ± 4.48 cm $p < 0.05$). However, CS group only improve CMJ after DET with respect to PRE measurement (28.40 ± 3.78 cm vs 30.94 ± 3.82 cm $p < 0.05$). No differences were found in $\dot{V}O_{2\max}$. **CONCLUSIONS:** Concurrent consecutive training is more effective at improving lower-limb explosive strength, however both concurrent training protocols are effective at improving anaerobic power even though concurrent simultaneous protocols take half the time to complete. Supported by CTS036 GR18

3494 Board #182 June 1 8:00 AM - 9:30 AM
Improving Shoulder Internal Rotation Motion of In-season Throwing Athletes: A Randomized Controlled Trial

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 (No relevant relationships reported)

PURPOSE: Throwing athletes commonly experience loss of shoulder internal rotation (IR). This adaptation, when combined with compromised resting posture, has the potential to increase risk of rotator cuff and biceps tendinopathy, labral tears, and elbow injuries. This study investigated the effectiveness of two methods prescribed to restore IR: the Sleeper Stretch (SS), which aims to stretch the capsule, and the Balloon Blow (BB) which aims to optimize breathing, posture, and scapular stability. Because the BB is less stressful to the shoulder joint, it may be a superior alternative. We hypothesized that when using the BB, IR would be increased either as effectively, or more so, than the SS.

METHODS: Healthy in-season baseball and softball players were randomly assigned an intervention (BB or SS) to the dominant arm 2x/day for 5 consecutive days. After a 2-week period of no intervention, both groups crossed over and performed the alternate intervention. IR was passively measured in supine at baseline, immediately after a throwing session on day 1, after intervention on day 1, and prior to practice on days 2-5. On the last day of the study, each subject was asked if he/she had a preference for either exercise. Statistical analysis for comparisons of differences in IR among intervention type (SS and BB) were performed using an analysis of covariance (ANCOVA) for the 6 instances as listed above. Statistical significance was set *a priori* at $\alpha \leq 0.05$.

RESULTS: 13 softball players (17.49 ± 0.63 yrs.; BMI 28.4 ± 5.6) and 10 baseball players (17.07 ± 0.56 yrs.; BMI 24.6 ± 4.7) participated in the study. Both interventions increased IR over the course of the 5 days, but there was no significant difference ($p = 0.66$) between SS and BB. When performing SS, the mean IR was 45.7 ± 11.38 degrees immediately after the throwing session and incrementally improved to 53.06 ± 10.95 degrees on day 5. When performing BB, the similar incremental increase was from 47.39 ± 12.15 degrees to 53.56 ± 8.61 degrees. There was no statistically significant difference in preference between the SS (51.1%) and the BB (48.9%).

CONCLUSIONS: The BB and the SS were both observed to be effective at increasing IR ROM in healthy in-season baseball and softball players over 5 days, yet neither proved to be superior with regard to degree of improvement nor speed of attaining increased IR.

3495 Board #183 June 1 8:00 AM - 9:30 AM
The Influence Of Previous Training Intensity On The Rating Of Perceived Exertion

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A discrepancy between coach' intended session-intensity, and the intensity as experienced by the athlete has been found in many sport settings. To avoid deconditioning as well as non-functional overreaching, it is important that athletes execute and perceive the training as prescribed by the coach. **PURPOSE:** The aim of this study is to find an explanation for the difference between intended and perceived RPE (dRPE). **METHOD:** Thirteen athletes completed 1392 training sessions. Athletes and coach rated each session on BORG-CR10 scale (RPE). dRPE was calculated as athlete's RPE minus coach' RPE. Linear regression was used to analyze the relation between dRPE and the average RPE from, respectively, the previous 1, 2, 3, and 7 days. **RESULTS:** A weak correlation was found between the coach intended RPE and athlete executed RPE ($r = 0.302$; $P < 0.01$). Mean dRPE was 0.51 (sd = 2.07). Easy

sessions (RPE < 4.8) were underestimated by the coach, and harder sessions (RPE > 4.8) were overestimated by the coach. A significant linear regression was found between dRPE and all 4 predictor variables. **CONCLUSION:** This study demonstrates evidence for dRPE to be influenced by the intensity of training sessions during the previous days. Intended intensity has shown to be overestimated when previous days were of low intensity and underestimated when previous days had a severe intensity. This information might help the coach to adjust the program and avoid these problems in advance.

3496 Board #184 June 1 8:00 AM - 9:30 AM
The Effects of 12-week Yoga Practice on Flexibility and Dynamic Balance of Female College Students

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The effects of 12-week yoga practice on flexibility and dynamic balance of female college students

INTRODUCTION: In recent years the practice of yoga has gained popularity as a means to improve health, sports performance and psychological wellbeing.

PURPOSE: The aim of this study was to evaluate the effects of a 12-week yoga intervention on flexibility and dynamic balance of female college students.

METHODS: A one-group pretest-posttest design was employed. Seventy females (20.8 ± 1.9 years; 1.62 ± 0.15 m; 54.2 ± 9.64 kg; BMI 21.2 ± 3.18 kg·m⁻²) attended yoga practice for a total of 12 weeks, consisting of one 90-min session per week. All participants have no previous experience on the Star Excursion Balance Test (SEBT) and yoga practice. Lumbar and hamstring flexibility and dynamic balance were assessed using the sit and reach test and SEBT before and after 12-week intervention. Participants performed the anterior (ANT), posterolateral (PL), and posteromedial (PM) reach directions of both legs in the SEBT.

RESULTS: A statistically significant increase in post-intervention normalized reach distances from 4.5% to 9.9% was seen in all directions of both legs. Results of paired sample t-test also displayed a significant normalized reach distance difference before and after the intervention. Left leg: (ANT: $76.8 \pm 9.5\%$ versus $67.0 \pm 13.1\%$; $t(69) = 5.78$, $P < 0.01$; PL: $88.0 \pm 11.8\%$ versus $81.4 \pm 17.3\%$; $t(69) = 3.29$, $P < 0.05$; PM: $91.2 \pm 10.9\%$ versus $86.7 \pm 17.0\%$ $t(69) = 2.23$, $P < 0.01$); Right leg: (ANT: $75.2 \pm 10.8\%$ versus $68.0 \pm 16.6\%$; $t(69) = 3.25$, $P < 0.01$; PL: $88.6 \pm 10.5\%$ versus $83.7 \pm 17.4\%$; $t(69) = 3.17$, $P < 0.01$; PM: $92.3 \pm 11.1\%$ versus $85.9 \pm 17.2\%$; $t(69) = 2.54$, $P < 0.05$). The increase in flexibility was observed after the intervention (39.3 ± 5.8 cm versus 37.8 ± 6.5 cm; $t(69) = 4.64$, $P < 0.01$).

CONCLUSIONS: The dynamic balance ability and flexibility of the female college students were significantly enhanced after 12-week yoga intervention.

3497 Board #185 June 1 8:00 AM - 9:30 AM
Original Mat Pilates in Classic Ballet: A Case Study

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Abstract

Dance is an art form in which it is necessary to develop various physical abilities because for a ballet dancer to achieve high performance it is necessary to acquire technical, athletic and aesthetic capacities so that the movements flow in a controlled way and without apparent effort. To generate positive effects on the performance, it is necessary to complement the training program with a method that maintains the technical ballet characteristics and principles. One type of training is the Mat Pilates method.

PURPOSE: To verify the effect of a training periodization with the original Mat Pilates on the performance of muscle strength and flexibility in a ballerina.

METHODS: A female ballet dancer (age: 19 yrs; height: 1.54 m; body mass: 56 kg; BMI: 23.6 kg/m²), without lesions, were submitted to the Mat Pilates method during 8 weeks, with a duration of 1 hour per training session, performed 2 times a week with a 48-hour interval between the sessions. The pre- and post-intervention tests were: strength and resistance abdominal test, isometric test of the column extensor, sit and reach, My Jump, and hip flexion with extended knee.

RESULTS: The highest post-intervention response value was for the abdominal resistance test, possibly because the exercises of the Mat Pilates contemplate this musculature. However, the jump test showed a negative post-intervention response (Table 1).

Table 1. Results of the pre- and post-intervention tests.

	Pré-test	Post-test	% Post-test	Result (%)	Absolute Difference
Seat and Reach	30	40	133.3	33.3	10
Abdominal	20	30	150.0	50.0	10
Lumbar hyperextension	4	5	125.0	25.0	1
hip flexion (right)	90	110	122.2	22.2	20
hip flexion (left)	100	130	130.0	30.0	30
Jump height (cm)	17.12	19.0	110.9	10.9	1.9
Flight time (ms)	351.33	393.0	111.9	11.9	41.7
Velocity (m/s)	0.86	1.0	111.6	11.6	0.1
Force (N)	1527.30	1345.4	88.1	-11.9	-181.93
Power (W)	1322.60	1298.7	98.2	-1.8	-23.86

CONCLUSIONS: The original Mat Pilates Method applied in the present study potentiated the increase in the flexibility, abdominal and lumbar resistance and strength levels, but did not influence the performance of the vertical jump. New studies are suggested with a greater number of participants, with Pilates exercises in machines, in both sexes, in different age groups and with subjects of other sports and artistic modalities.

3498 Board #186 June 1 8:00 AM - 9:30 AM
Relationship Between Cumulative Training Loads and Treatments of Division II Swimmers

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Coaches are responsible for designing training sessions to optimize athlete progression while decreasing the incidence of treatments and fatigue by monitoring training loads. Training loads (TL) consist of the external load (work done by the athlete) and internal load (athlete's perceived intensity of that work). Multiple methods are used to monitor both external and internal TL's such as the utilization of heart rate, lactate concentration, rate of perceived exertion (RPE) and session duration (Gabbett et al, 2004). Among NCAA Division II athletics, monitoring team training loads necessitates a cost-effective method, like that of RPE and session duration. Purpose: To determine the relationship between cumulative training load, and number of visits to the Athletic Trainer for treatments, in a Division II women's swimming team. Methods: For one season, twenty-four collegiate female swimmers (mean \pm SD, age 20.2 ± 1.23 years; height 169.03 ± 6.18 cm; mass 68.7 ± 8.87 kg) were surveyed after each practice and competition, and asked to report the date, the duration of training in minutes and the RPE for that session. TL was calculated as the product of the RPE and training session duration and reported as arbitrary units (au). All treatments (visits to the athletic trainer) were recorded by the athletic trainer, ranging from a cosmetic treatment (ice pack) to a soft tissue injury. TL's were averaged daily across the whole team, and a weekly cumulative TL was compared to total treatments for that week. The relationship between TL's and number of treatments was examined using a Pearson correlation. Results: On average the athletes recorded weekly a cumulative TL < 4000 au. A weak negative correlation was found between TL's and treatments, possibly contributing to TL's decreasing as athletes underwent more treatments ($r = -.229$). Over the course of 14 weeks the swimmers had a total of 152 treatments, 91 of which occurred following a 3 week period where TL's were consistently high (>4000 au). A 72.5% increase in number of treatments occurred after a 3 week period of high TL's. Conclusion: A latent increase in treatments after consecutive high TL's (>4000 au) is expected based on the cumulative load theory and may explain the negative correlation between TL and treatments over the entire season.

3499 Board #187 June 1 8:00 AM - 9:30 AM

The Effect Of Core Strength Training On Dynamic Balance And Agility In Collegiate Korfball Players

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PURPOSE: The purpose of this study was to investigate the effect of core strength training (CST) on core endurance, dynamic balance and agility in collegiate korfball players.

METHODS: Twenty-two college students (age = 20.9 ± 1.4 years; height = 179.8 ± 8.9 cm, weight = 72.4 ± 12.2 kg) korfball players were randomly divided into two groups as training group (TG, N=11) and control group (CG, N=11). The TG completed CST twice a week, for 8 weeks. The CG trained according to the original plan. Star Excursion Balance Test (SEBT), Illinois Agility Test, and the core endurance tests were used to evaluate all subjects. Paired sample T-test and factor analysis were used as data analysis.

RESULTS: There were significant increases in core endurance tests ($t = -7.5$, $p < 0.05$) and directions of SEBT ($t = -3.1$, $p < 0.05$) after the experiment in the TG. However, no significant change was observed for agility ($t = -0.9$, $p > 0.05$). In addition, there were significant increases in core endurance tests ($t = -4.7$, $p < 0.05$), no changes in the directions of SEBT ($t = 0.8$, $p > 0.05$) and agility ($t = 1.3$, $p > 0.05$).

CONCLUSIONS: The core strength training could improve core endurance and directions of the SEBT in collegiate korfball players, but not in agility. Consequently, if the goal of training is to enhance agility, then CST has limited. (This study was supported by Fundamental Research Funds for the Central Universities at SWU Grant 1309232)

3500 Board #188 June 1 8:00 AM - 9:30 AM

Studies On The Effect Of Single Scull Training On The Skill Improvement In Sweep Rowers

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In recent years some sweep rowers use single scull boat to train their rowing skill, especially during winter times. However, there is no report about the scull training efficiency in improving the sweep skill. **PURPOSE:** To evaluate the effect of single scull training on the skill training efficiency of sweep rowers.

METHODS: Thirty-five national level male sweep rowers (22.31 ± 2.42 yr., height: 196.33 ± 3.76 cm, mass: 96.05 ± 4.77 kg) volunteered attending the test, who were randomly divided into experimental group ($n = 18$) and control group ($n = 17$). All subjects performed rowing skill training 5 times a week, 90 minutes each, for 4 weeks. Two groups trained same except that the subjects in experimental group used single scull boat and the subjects in control group used sweep boat. The key parameters of rowing skill were measured before and after 4 weeks training by bio-row system including catch, release, total angle, catch slip, release slip, maximal force, average force, leg speed and power. Separate two-way ANOVA with repeated measures was performed to compare groups (experimental, control) and times (before, after) for each of the parameters. Tukey's HSD tests were conducted for post-hoc comparisons. The alpha level was set at < 0.05 .

RESULTS: 1. There were significant group by time interactions for release ($F_{(1,32)} = 6.23$, $p < .05$), catch slip ($F_{(1,32)} = 33.18$, $p < .001$) and leg speed ($F_{(1,32)} = 7.95$, $p < .005$). 2. The main effect for time was significant for catch slip ($F_{(1,33)} = 53.86$, $p < .001$), average force ($F_{(1,33)} = 37.64$, $p < .001$), leg speed ($F_{(1,33)} = 22.63$, $p < .001$) and power ($F_{(1,33)} = 9.25$, $p < .01$). The main effect for group was significant for catch ($F_{(1,33)} = 3.50$, $p < .05$), release ($F_{(1,33)} = 4.61$, $p < .05$), release slip ($F_{(1,33)} = 8.15$, $p < .01$). 3. The release of experimental group significantly increased larger than that of control group (8.25 ± 2.06 vs. 1.28 ± 2.10), so that with release slip (7.88 ± 2.51 vs. 1.39 ± 2.67).

CONCLUSIONS: Single scull training dose have effect in improving release and release slip skill for sweep rowers.

3501 Board #189 June 1 8:00 AM - 9:30 AM
Results of a Six Week Training Protocol for Dancers to Achieve Pointe (Toe Shoe) Readiness

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PURPOSE: It is estimated that 2 million children study dance each year in USA public schools alone, and that more than 35% of all adolescent girls participate in some form of dance training. Their most common injury is ankle sprain, with recurrence as high as 80%. This study aimed to test the efficacy of a six-week, pre-pointe (toe shoe) progressive training program that, if effective, would subsequently be put into a 3-year prospective epidemiologic study examining the intervention's effect on ankle sprain rate. **METHODS:** 16 pre-pointe students, (average age 11 yrs), at a professional ballet school assented, (along with parent/guardian consent), to participate. Three motor control-based concepts were incorporated into a 50 minute progressive exercise class taught twice per week for 6-weeks. The motor control principles underlying all of the exercises were: 1.) identification and maintenance of trunk-pelvic neutral; 2.) appropriate weight shift; 3.) dissociation of the limbs from the trunk. Tests of lower extremity and trunk strength were assessed using hand-held dynamometry and Kendall methods. Four functional tasks, (single leg eyes-closed balance; topple; airplane and sauté tests), were assessed along with one IMU-based jump task. Jump height and GRF were estimated using an inertial sensor (BTS G-Sensor 2, Brooklyn, NY). The sensor, worn in a pouch on a velcro belt wrapped around the dancer's trunk at umbilicus level, contained a triaxial accelerometer, gyroscope and magnetometer and connected wirelessly via Bluetooth® to a computer. Based on the accelerations measured by the sensor and the weight of the subject, several parameters were estimated. **RESULTS:** Paired t-tests revealed changes from the pretest to posttest assessment day: hip abduction ($p=0.009$) and trunk strength ($p=0.045$), balance ($p<0.001$), topple ($p=0.006$), airplane ($p=0.005$), all improved significantly; sauté showed a trend to improve ($p=0.084$). No G-Sensor jump parameters showed improvement. **CONCLUSIONS:** Significant improvements in strength, balance, and alignment were demonstrated by this cohort. Jump performance did not show improvement, but was an unfamiliar task to the subjects at the beginning of the training; it will be monitored intermittently as training continues.

3502 Board #190 June 1 8:00 AM - 9:30 AM
Effect Of 3d Multiple Object Tracking Training On Collegiate Ice Hockey And Lacrosse Game Performance

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3D multiple object tracking (3D MOT) aids in improving working memory and spatial awareness by stressing foveal and peripheral vision while demanding multi-faceted attentional focus. 3D MOT also improves cognitive processing which may improve the ability to rapidly extract data from the environment thereby enhancing decision making capabilities. These attributes have the potential to enhance sports performance. **PURPOSE:** The purpose of this study was to determine if 3D MOT training increases in-game performance during a competitive season. **METHODS:** 79 athletes from four NCAA DIII collegiate athletic teams (ice hockey $n=34$; lacrosse $n=45$) participated. Athletes were assigned to either a 3D MOT ($n=38$) training intervention or control (C) group ($n=41$). Athletes completed 24 sessions of 3D MOT training, 2-4 times per week over 12 weeks during the respective competitive seasons. At the conclusion of the seasons, independent samples t-tests were used to compare performance measures (game statistics) between 3D MOT and C groups for ice hockey (men's and women's combined), men's lacrosse, and women's lacrosse. **RESULTS:** There were no significant differences in performance measures between 3D MOT and C groups for ice hockey ($p>0.05$). For men's lacrosse, faceoff winning percentage was significantly different ($p=0.000$) with the C group having a greater faceoff winning percentage versus the 3D MOT group (30% vs. 0%). For all other performance measures there were no significant differences ($p>0.05$) between groups. For women's lacrosse, there were significant differences for assists ($p=0.045$), points ($p=0.034$), shots ($p=0.035$), and free-position shots ($p=0.014$) with the 3D MOT group having lower values versus C. **CONCLUSIONS:** Athletic performance is multifactorial in uncontrolled environments such as competitive ice hockey and lacrosse, which may suggest that performance benefits of 3D MOT training may be overshadowed by the complexities of game play. The significant differences found between groups may be due to player skill differences versus a 3D MOT effect. Further research is warranted to determine the effectiveness of 3D MOT training and its impact on sport performance.

3503 Board #191 June 1 8:00 AM - 9:30 AM
Pelvic and Core Strength Training Improves Pelvic Posture, Hamstrings-to-Quadriceps Ratio, and Vertical Jump Performance

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Poor pelvic posture demonstrated through anterior pelvic tilt have been known to produce musculoskeletal imbalances involving muscular weakness of the abdominal and pelvic regions. While stretching and massage techniques have been reported to be effective in alleviating anterior pelvic tilt, it remains unclear if similar improvements can be elicited by pelvic and core strength training. **PURPOSE:** To examine the effect of an 8-week pelvic and core strengthening program on anterior pelvic tilt (APT), hamstrings-to-quadriceps (H:Q) strength ratio, and vertical jump performance in healthy individuals. **METHODS:** Nine healthy males (age=27.11±12.15 years; mass=82.78±8.84 kg; height=178.76±8.07 cm) performed resistance training (2x/week; 30-40 min) involving a combination of abdominal and hip extensors strengthening exercises for 8 weeks. APT (°), vertical jump height (m), vertical jump power (W), and H:Q ratio at 60, 180, and 300 °/s were assessed prior to and following the 8-week pelvic and core strengthening program. Paired samples t-tests were used to evaluate pre- to post-training changes in APT, vertical jump height and power, and H:Q ratio. Effect sizes (*ES*) were calculated for all analyses and *ES* magnitudes of < 0.50, 0.50-1.0, and > 1.0, were interpreted as small, medium, and large effects, respectively. **RESULTS:** APT was significantly decreased, and vertical jump height and the H:Q ratio at the angular velocity of 300 °/s were significantly increased, following 8 weeks of pelvic and core strength training (all $p < 0.05$, Table 1). **CONCLUSION:** Resistance training emphasizing pelvic and core strengthening was effective in reducing APT, improve vertical jump performance and H:Q ratio. Our findings have potential implications for clinicians prescribing resistance exercises to improve pelvic posture in patient populations with musculoskeletal imbalances, and for injury prevention and maintenance of postural equilibrium in healthy individuals.

Table 1. Pre- versus post-training responses (mean±SD) following pelvic and core strength training.

	Pre-training	Post-training	%Δ	<i>P</i>	<i>ES</i>
APT (°)	14.9±3.2	8.6±3.5*	42	0.0005	1.95
Vertical jump power (kW)	4.45±8.76	4.56±1.02	2	0.18	0.12
Vertical jump height (m)	0.457±0.099	0.493±0.090*	8	0.004	0.36
H:Q ratio @ 60 °/s	0.49±0.07	0.56±0.12	14	0.06	0.92
H:Q ratio @ 180 °/s	0.50±0.15	0.57±0.12	15	0.06	0.49
H:Q ratio @ 300 °/s	0.51±0.13	0.60±0.13*	18	0.04	0.70

*Significantly different compared to pre-training ($P<0.05$).
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3504 Board #192 June 1 8:00 AM - 9:30 AM
Impact of 4-week Brain Endurance Training (BET) on Cognitive and Physical Performance in Professional Football Players

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PURPOSE: It has been hypothesized that acute negative effect of mental fatigue (MF) could potentially become a training stimulus for the brain (Brain endurance training [BET]) to adapt and improve its ability to better sustain or attenuate MF states during sport competitions. The aim of this study was to test the efficacy of BET to reduce fatigue during a battery of cognitive and physical tests in players from a professional football team. We hypothesized that combination of BET and standard physical training during a 4-week period would increase cognitive capacity and physical football performance by increasing resilience to fatigue, more than standard football training alone. **METHODS:** 24 professional football players were randomly assigned to 2 different training groups: BET and Control. Both groups completed 20 supervised physical training sessions. Immediately after each session BET group completed on average 400 min (20 min/session) of cognitive training. Control group, instead, was asked to listen to neutral music for the same amount of time. Endurance performance (30-15 Intermittent Fitness Test), Sprint and Decision Making (RSA Random Test), Reactive Agility alongside with cognitive performance (STROOP Task) were measured at baseline (pre-test) and after 4 weeks of training (post-test). Data were

analysed using mixed model ANOVAs. **RESULTS:** STROOP task showed reaction time in both groups decreased at post-test. However, BET decreased significantly more compared to control group ($p < 0.02$) despite no significant differences in accuracy. BET group completed the reactive agility test significantly faster than the control group ($p < 0.05$) and with lesser fouls ($p < 0.03$). During the RSA Random Test no significant differences were found between the groups for linear acceleration phase (first 10 m). However, BET group completed significantly faster ($p < 0.05$) the decisional phase (second 10 m). Distance covered during the 30-15 test showed there was no difference in the performance of the BET group. However, control group showed a significant decrease ($p < 0.05$) in performance. **CONCLUSION:** The results of this study provide evidence that the combination of BET and standard football training is more effective than standard training alone in boosting cognitive and physical performance in elite football players.

3505 Board #193 June 1 8:00 AM - 9:30 AM
Effect of Wheelchair Tai Chi Ball Exercise on Physical & Mental Health among Elderly

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 (No relevant relationships reported)

Mind-body exercise and strength training are crucial for elderly with disability. In this project, we developed an innovative exercise of Wheelchair Tai Chi Ball 12 forms (WTCB12), which combines mind-body exercise with strength training for elderly with disability. **PURPOSE:** To examine the effect of a 3-month WTCB12 intervention on physical and mental health and functional abilities among elderly.

METHODS: Twenty-six participants from a local senior living facility participated in the WTCB12 intervention with 13 in each group. Nine completed the study in WTCB group (age: 86.55 ± 3.39 yrs; height: 1.69 ± 0.17 m; mass: 75.54 ± 20.28) and ten completed in the control group (age: 81.78 ± 14.39 yrs; height: 1.64 ± 0.07 m; mass: 68.31 ± 15.17 kg). The weights of the WTCB ranged from 1 pound to 2 pounds selected by the participants based on their physical conditions. The WTCB group practiced WTCB12 twice a week, one hour each time. The control group did their daily routine without WTCB intervention. The following variables were measured: Pain Self-Efficacy Questionnaire (PSEQ), heart rate (HR), blood pressures, range of motion (ROM) and muscle strengths of the dominant arm at the shoulder, elbow and wrist joints, and SF-36v2 for physical and mental health. The Independent t test and paired t test were employed to examine the differences between and within the two groups in the pretest and posttest.

RESULTS: The results indicated that the PSEQ was significantly improved in WTCB group after WTCB12 intervention (Pre-test: 41.44 ± 13.89 vs Posttest: 50.11 ± 8.94 , $p < .05$), but no significant improvement in the control group. The HR, blood pressures, ROM and SF-36v2 physical and mental health were not significantly different between two groups, however, the WTCB group had significant greater muscle strengths at the shoulder extension, abduction and adduction, elbow flexion and extension and wrist flexion and extension in the posttest than the control had since the WTCB group's joint muscle strengths maintained and the control group's muscle strengths at these joints decreased.

CONCLUSIONS: WTCB12 exercise may help with pain management, maintain upper extremity muscle strength and is a feasible exercise for elderly with disability. Supported by Paralyzed Veterans of America Education Foundation Grant #819

3506 Board #194 June 1 8:00 AM - 9:30 AM
Health And Fitness Benefits Using A Heart Rate Intensity-based Commercial Fitness Exercise Regimen

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 (No relevant relationships reported)

PURPOSE: Inactivity leads to morbidity and mortality, while engaging fitness approaches improve health outcomes.

METHODS: The current study examined an 8-week commercial group exercise regimen for comprehensive health and fitness indices. Study duration gauged the time frame by which high intensity interval training (HIIT) elicits improved health and fitness. Aerobic fitness, body composition, resting metabolic rate, blood cholesterol and glucose, in addition to resting blood pressure were quantified. Exercise training utilized multimodal HIIT-based exercises and work intensity was gauged by real-time heart rate feedback.

RESULTS: Program adherence was 100% with 23 participants. Pre-Post analyses indicate aerobic fitness ($O_{2max} +4 \text{ ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$), body composition (%fat -1.1%), resting metabolic rate (+107 Kcal), resting blood pressure (-8.1mmHg systolic, -2.5mmHg diastolic), and circulating triglycerides (-21%) were altered.

CONCLUSIONS: This study is the first study to quantify comprehensive improvements in aerobic fitness, body composition, resting metabolic rate, resting blood pressure, and triglycerides after a brief 8-week HIIT regimen. The implications of franchised group exercise with wearable technology serves as an unexplored scientific approach to understand novel exercise prescriptions on health-fitness outcomes. Future research should investigate sociological aspects of program adherence, while biological applications should be examine the adaptive stimuli of HIIT training on health and fitness improvements.

3507 Board #195 June 1 8:00 AM - 9:30 AM
Comparison of Two Training Programs for Improvement of Muscular Strength Quantified via Pull-Ups

Ciara-Lyn Lee¹, Eric C. Bredahl¹, Michael T. Lane², Jacob A. Siedlik¹. ¹Creighton University, Omaha, NE. ²Eastern Kentucky University, Richmond, KY. (Sponsor: Joan Eckerson, FACSM)
 (No relevant relationships reported)

The requirement to integrate women into combat-arms military occupational specialties represents an opportunity to refocus training protocols for optimized performance in specific components of military physical and combat fitness tests. The United States Marine Corps will incorporate new standards in 2019 which include requiring more pull-ups for female Marines. The pull-up requirement is often difficult for Marine recruits to achieve and the overabundance of training protocols potentially confuses recruits and minimizes potential gains in event specific muscular strength.

PURPOSE: To quantify changes in completed pull-ups between two training protocols to determine an optimal program for improved performance in college-aged females.

METHODS: Twenty-nine female subjects volunteered to participate and were randomized to either a control group or one of two training programs (Control [$n = 3$]; Free Weights [$n = 14$]; Machines [$n = 12$]). The two training programs consisted of pre-programmed workouts 3 d-wk⁻¹ focused on upper body and core exercises. There was at least 1 d of recovery between workouts. Subjects were monitored for the first 2 wk of training to ensure compliance and proper technique. Maximum number of pull-ups were assessed at baseline, 3 wk, and 6 wk. Data were analyzed using a 3x3 repeated measures ANOVA. **RESULTS:** There were no significant differences in age, height, or weight between the groups (Mean \pm SD; age = 20 ± 1 yr; Height = 164 ± 6 cm; Weight = 64.2 ± 9.9 kg). Over the 6 wk period a total of 5 subjects withdrew from the study (Control [$n = 3$]; Free Weights [$n = 11$]; Machines [$n = 10$]). No significant interaction effect was observed between programs ($p = .7$); and there was no main effect for time ($p = .1$). **CONCLUSION:** Overall the training protocols improved pull-up performance with 4 of the free weight participants and 3 of the machine-based participants improving from zero to one or more pull-ups. Results are limited due to the dropout rate of ~17% over the training period which is not unexpected given the duration of this study. Future research should focus on improved adherence, and subject monitoring, to optimize performance in the pull-up event.

3508 Board #196 June 1 8:00 AM - 9:30 AM
Effect Of Suspension Training On Functional Movement Screen (FMS) and Mobility, Activation, Posture, and Symmetry (MAPS)

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 (No relevant relationships reported)

INTRODUCTION: Although suspension training is used in various exercise routines, there has been insufficient research to determine the effect of suspension training on functional movement. **PURPOSE:** 1) to examine the effect of suspension training on functional movement, assessed via the FMS and MAPS and 2) to identify the correlation between the FMS and MAPS. **METHODS:** Twenty-seven participants (19 females; 8 males; Age = 26.0 ± 11.1 yrs; Height = 167.9 ± 9.1 cm; Body Mass = 69.6 ± 14.1 kg) completed 28 exercise sessions over a 14-week course. Throughout each 40-minute exercise session, six body positions were utilized on the suspension training straps which included push, pull, rotational, squat, and lunge movements; participants also engaged in functional training utilizing stability balls and resistance bands. Pre- and post-fitness assessments included the FMS, MAPS, body composition, muscular endurance, muscular strength, and flexibility. Dependent t-tests were used to determine if there were mean changes in functional movement status. Due to multiple comparisons, Bonferroni correction was used, therefore, alpha level was set at .007.

RESULTS: There were significant positive changes in FMS (14.6 ± 2.7 to 15.9 ± 2.1 , $p < 0.001$) and MAPS (52.9 ± 10.3 to 56.3 ± 9.7 , $p < 0.001$) values, as well as mean quantity of push-ups (24.9 ± 11.5 to 29.4 ± 13.9 , $p = 0.004$) and handgrip dynamometer (78.0 ± 21.7 kg to 85.6 ± 24.0 kg, $p = 0.006$). There were no significant changes in

mean body mass, fat mass, lean mass, percent body fat, and sit-and-reach values. Pearson correlation was used to determine the relationship between FMS and MAPS both at pre- and post-testing. At both time points, pre- and post-testing, the correlations were significant ($r = .52$ and $.43$, respectively). **CONCLUSIONS:** Participation in suspension training produced significant improvements in overall functional movement, muscular strength, and endurance. Although there were significant positive changes in both FMS and MAPS from pre- to post-assessment, a weak correlation existed between the FMS and MAPS assessments.

3509 Board #197 June 1 8:00 AM - 9:30 AM

Biomechanical Analysis of Collegiate Baseball: Training Implications for Enhancement of Pitching Endurance

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(No relevant relationships reported)

Endurance is critical to a starting pitcher's success. However, the repetition of pitching stress can decrease performance and increase risk of injury in later innings. Improving arm endurance likely enhances late-game performance. **PURPOSE:** To evaluate predictors of mechanical endurance in collegiate pitchers. **METHODS:** 10 Division-I pitchers were tested using Proteus technology (Boston Biomotion, Inc.). They completed 6 sets of 5 pitches; each set changed in resistance, ranging from ½ to 5 lbs. Endurance was a calculation of the ability to preserve power in each set on a continuous scale of 0.00 (0% preservation) to 1.00 (100% preservation). Mean endurance was the mean value of all 6 sets. Proteus also assessed biceps curls, triceps extensions, internal and external rotation, and horizontal adduction and abduction. Pitchers were tested during the 2017 season and data were compared to in-game performances. Linear regressions tested the relationships between endurance, performance on other tests, and in-game statistics. **RESULTS:** Pitchers were 72.0 ± 2.7 inches in height, had a mean fastball velocity of 84.6 ± 3.9 mph, a mean earned run average (ERA) of 5.8 ± 2.8 , and a mean endurance of $97.7 \pm 1.9\%$. Endurance was unrelated to class year ($p=0.857$) and was not related to anthropometric measurements, including height ($p=0.460$), weight ($p=0.188$), arm length ($p=0.350$), and leg length ($p=0.464$). Maximum squat strength ($p=0.917$), fastball velocity ($p=0.832$), and three-dimensional measurement of pitch range of motion ($p=0.730$) were also unrelated to pitch endurance. Biceps curl endurance ($p=0.035$) and triceps extension explosiveness ($p=0.089$) of the dominant arm correlated with pitching endurance. These relationships lost significance on non-dominant arm for curls ($p=0.241$) and extensions ($p=0.187$). Given a larger sample, other associations may be found; of interest, there may be relationships between endurance and innings per appearance ($\beta = 0.353$, $R^2=0.196$; $p=0.232$) and ERA ($\beta = -0.559$, $R^2=0.149$; $p=0.305$). Post-hoc power analyses revealed samples of 30 and 38 respectively to reach significance (power=0.80; $p=0.05$). **CONCLUSIONS:** Fatigue results from repetitive overhead throwing, elevating risk of overuse injuries. Use of Proteus may provide modes of exercise unrecognized by traditional baseball training.

3510 Board #198 June 1 8:00 AM - 9:30 AM

Automated Impact Corroboration From Game Video In Ice-hockey Using Computer Vision Approaches

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(No relevant relationships reported)

Purpose

Video corroboration of on ice impacts identified by wearable sensors (WS) is a time-consuming task. To automate this, we attempted a computer vision approach to recorded game video to corroborate impacts identified using WS among national ice-hockey team members.

Methods

23 U.S. National U18 Hockey team members consented to procedures approved by EMU HSRC. Impacts were previously validated from data collected at 100 Hz (Impact Processor, Zephyr MD) from 8 players with the top activity levels determined by WS in 4 games. Game video was manually synchronized, and timestamps were used to extract frames from the video that allowed for visually identifying and labeling impacts. A convolutional neural network (YOLO) was used to detect impacts in video and generate a training dataset from 1060 images from 3 game videos that included 86 impacts.

Video and timestamps were used for training instead of still frames. Denoising filters were used to account for time shift errors due to manual labeling and anomalous detections appearing and disappearing in up to half a second of video. Thus, we

removed any impacts detected by video for less than 30 or 60 continuous frames (0.5 or 1.0 second, respectively). An smaller version of the model (YOLO-tiny) was also tested on a Note 8 (Samsung) smart phone to determine applicability to real-time game setting.

Results

The trained YOLO network was applied to the 4th game video that had 32 validated sensor identified impacts. The model successfully detected all 32 impacts but generated 1000 false positives. With a 60 frame filter, the model detected 20 of the 32 events, but false positives were reduced to 211. With a 30 frame filter, the model detected all 32 impacts but false positives increased to 391. Interestingly, the mobile model and 30 frame filter detected all 32 impacts with 222 false positives, of which, 99 were classified as "Pass Bys" or players that occluded each other on the video but did not make physical contact.

Conclusion

These results demonstrate that computer vision techniques can be used to identify validated impacts with high success, but with many false positives. The high false positive rate presents a challenge, but since a large proportion of false positives were simple pass-bys, using a real-time sensor fusion approach with WS, the false positives may be reduced substantially.

3511 Board #199 June 1 8:00 AM - 9:30 AM

Relationship Between the Perceived Training Loads of Division II Swimmers and Coaches

Bianca Lagamon, Angel Quintero, Derrick Gardner, Vanessa Yingling, FACSM, James Mouat IV. *California State University, East Bay, Hayward, CA.* (Sponsor: Vanessa Yingling, FACSM)

(No relevant relationships reported)

Monitoring training loads provides coaches the opportunity to create effective programs for their athletes to prepare for competition and make adjustments to manage fatigue, reduce the risk of soft-tissue injuries and non-functional overreaching. An athlete's training load is a combination of the external load (work completed by the athlete) and internal load (physiological or psychological stress from that work). The individuality of perceived training loads is an important consideration for a coach as the athlete's perception may be different from the intended demands from the coach. The difference in perceived training loads between the coach and athlete can increase the risk of undertraining or overtraining. **PURPOSE:** To compare the perceived training loads between a coach and athletes on a Division II women's swimming team. **METHODS:** Twenty-four athletes participated (age 20.2 ± 1.2 years; height 169.03 ± 6.2 cm; mass 68.7 ± 8.9 kg). The expected training loads of the coach and perceived training loads of the athletes were monitored for one season. A survey link was sent to the coach and players to report the date, the duration of training in minutes and the rate of perceived exertion (RPE) for each practice and competition. Training load (TL) was calculated as the product of the RPE and training session duration in minutes and labeled arbitrary unit (AU). The relationship between the coach's expected training loads and the athletes' perceived training loads were examined using paired t-test and Pearson correlation. **RESULTS:** The swimmers average TL over the 54 sessions was 554.5 ± 237.1 au which showed no significant difference from the coach's average perceived TL, 555.6 ± 246.5 au ($p=0.85$). A strong correlation was found between the TL of the coach and the average TL of the 24 athletes ($r=0.87$, $CI=0.79-0.92$, $p<0.0001$). **CONCLUSION:** On average, the athletes perceived the training sessions to be harder than what the coach expected. Differences in training expectations and perception could be due to fitness levels among athletes, sleep (quantity and quality), academic stress or illness. However, the differences in TL expectation and perception could result in fatigue, injury and/or suboptimal training adaptation. Monitoring planned and perceived training load is critical to optimize performance and reduce injury.

3512 Board #200 June 1 8:00 AM - 9:30 AM

Relationships Between Isometric and Dynamic Strength in Recreationally Active Women

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(No relevant relationships reported)

Women entering training for physically demanding occupations typically perform strength orientated tasks less well than their male counterparts. However, they are not often strength-trained and appropriate training may reduce these differences. Force-time assessment of the isometric mid-thigh pull (IMTP) has been used to monitor strength adaptations in athletes as they relate to dynamic task performance. The ratio between peak countermovement jump (CMJ) concentric force and IMTP peak force (Dynamic Strength Index [DSI]) has also been used to guide prescription of maximal or ballistic strength training. **PURPOSE:** To examine the efficacy of IMTP and DSI to monitor and prescribe strength training in untrained women. **METHOD:** Following familiarization, 26 civilian women volunteers (mean \pm SD, age: 24 ± 3 y, height: 1.64 ± 0.05 m, body mass: 65.4 ± 11.8 kg) completed five tests in this order: bench press one-repetition maximum (1RM); CMJ; IMTP; seated medicine ball throw (MBT); dominant handgrip strength. Force plates sampling at 1000 Hz recorded IMTP and

CMJ performance, and 1RMs were predicted from submaximal load-velocity profiles. Relationships were assessed between IMTP and dynamic tests (Pearson's r), and performance compared between Low (<0.60 , $n = 8$) and High (>0.80 , $n = 10$) DSI participants (Bonferroni adjusted independent t-tests or Mann-Whitney U test), with effect sizes calculated (Hedges g). **RESULTS:** Absolute peak IMTP force (minus body weight) correlated moderately with handgrip strength ($r = 0.66$), MBT ($r = 0.70$) and 1RM ($r = 0.57$), and relative IMTP peak force (per kg body mass) with CMJ height ($r = 0.48$). The 1RM (Low vs High DSI: 45.0 ± 11.0 vs 31.5 ± 6.5 kg, g 1.6), absolute IMTP (1386 ± 276 vs 709 ± 166 N, g 2.9), relative IMTP (20.7 ± 2.8 vs 11.0 ± 1.9 N·kg⁻¹, g 4.9), MBT (3.3 ± 0.3 vs 2.7 ± 0.3 m, g 2.4) and handgrip (34.5 ± 1.8 vs 26.2 ± 3.9 kg, g 3.1) were greater in Low DSI participants ($p < 0.01$), with no difference in CMJ height (0.23 ± 0.03 vs 0.19 ± 0.05 m, g 0.51). **CONCLUSION:** Moderate relationships between IMTP force and dynamic performance are consistent with current athletic literature, thus absolute and relative force are both recommended to monitor strength training adaptations in untrained women. Similar ballistic (CMJ) performance between Low and High DSI individuals support its use to prescribe training modality.

G-39 Free Communication/Poster - Anterior Cruciate Ligament

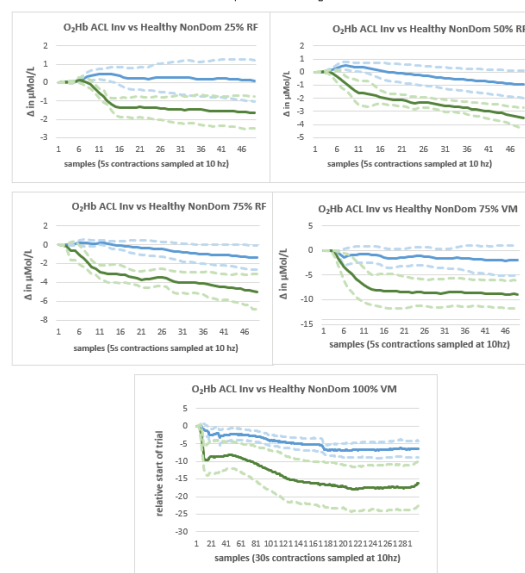
Saturday, June 1, 2019, 7:30 AM - 11:00 AM
Room: CC-Hall WA2

3513 Board #201 June 1 9:30 AM - 11:00 AM Quadriceps Oxygen Consumption During Exercise in Patients with ACL-Reconstruction

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(No relevant relationships reported)

PURPOSE: Patients with ACL reconstructed knees (ACLR) commonly experience persistent muscle weakness. Altered oxygen consumption (OC) during voluntary rehabilitation exercises of the quadriceps may be a contributing factor. The purpose was to compare quadriceps muscle OC during knee extension exercises in patients with ACLR versus healthy controls. **METHODS:** 10 patients with primary, unilateral ACLR (7M/3F, 22.9 ± 3.5 y, 170.81 ± 7.93 cm, 73.7 ± 15.1 kg) and 10 matched controls (7M/3F, 22.9 ± 3.5 y, 170.4 ± 10.7 cm, 68.86 ± 9.51 kg) participated. Each participant completed a single data collection session consisting of 5-second isometric contractions at 25, 50 & 75% of the volitional maximum followed by a 30s maximal isometric knee extension contraction. We continuously recorded measures of oxygenated hemoglobin (O₂Hb) on the reconstructed thigh (versus the non-dominant thigh of healthy controls) using three wearable, wireless near-infrared spectroscopy units placed superficial to the vastus medialis, lateralis and rectus femoris muscles. Relative changes in OC were ensemble averaged and plotted for each contraction intensity with associated 90% confidence intervals. Statistically significant differences were defined as portions of the exercise trials where confidence intervals of the O₂Hb graph did not overlap. Effect sizes were calculated for statistically significance. **RESULTS:** We observed significantly lower relative change in O₂Hb for ACLR compared to healthy controls in the rectus femoris at 25% ($2.1[1.5-2.7]$), 50% ($2.8[2.6-2.9]$), 75% $2.0[1.9-2.2]$ and for the vastus medialis at 75% ($1.5[1.4-1.5]$) and 100% ($2.6[2.5-2.7]$) (Figure 1). No other statistically significant differences were observed. **CONCLUSION:** Differences exist in quadriceps muscle OC between patients with ACLR during the same exercises versus healthy controls. However, not all portions of the quadriceps are affected uniformly across contraction intensities.

Figure 1: O₂Hb in ACLR thighs compared to a healthy matched thighs at different exercise intensities for rectus femoris (RF) and vastus medialis (VM). Blue solid lines represent ACLR, green lines represent Healthy and dotted lines represent 90% confidence intervals over the course of knee extension isometric contraction trials. Data presented as changes relative to the start of the trial.



3514 Board #202 June 1 9:30 AM - 11:00 AM Comparison of Knee Functional Outcomes after Anterior Cruciate Ligament Reconstruction between Older and Younger Patients

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(No relevant relationships reported)

Anterior cruciate ligament (ACL) reconstruction is frequently performed to restore knee stability and function following ACL injury. Traditionally, ACL injury people older than 40 years received non-operative treatments because of not performing high demanding activities and possible inferior surgical outcomes. According to increasing sports activities, there are more chance to injury and surgical reconstruction in patients older than 50 years. However, a few numerous research with knee function and stability outcomes had been reported following ACL reconstruction in age over 50 years old.

PURPOSE: The aim of this study was to evaluate muscle strength, ligament stability, and functional outcomes in comparing older (>50 years) and younger (<40 years) patients at 1 year after ACL surgery. **METHODS:** A retrospective analysis of prospectively collected data was performed in 40 younger (29.0 ± 5.1 yr) and older (52.5 ± 2.1 yr) ACL reconstruction patients each. All patients were evaluated for isokinetic extensor and flexor muscle strength, laxity, and functional scores at 1 year after operation. The highest peak torque at each velocity was compared with the uninjured side by isokinetic device. The knee laxity was assessed by the KT-2000 arthrometer. The comparing injured and uninjured knee side-to-side difference was measured at anterior maximum manual tension. Knee functional score were evaluated using the validated International Knee Documentation Committee (IKDC) and Lysholm scores. **RESULTS:** There was no statistically significant difference in extensor strength deficits between older and younger groups at $60^\circ/s$ and $180^\circ/s$ ($p = 0.495$, $p = 0.419$, respectively). In addition, there was no differences in knee flexor strength deficits between the groups ($p = 0.417$, $p = 0.449$, respectively). There was also no statistically significant difference in ligamentous laxity ($p = 0.06$) and Lysholm scores ($p = 0.126$). However, IKDC scores in the younger group showed significantly greater improvement than those in the older group ($p = 0.009$). **CONCLUSION:** Older patients with ACL reconstruction surgery would have similar results for knee strength and ligament laxity. This study showed that ACL reconstruction is more effectiveness and safety for restoration of knee strength and stability in older than 50 years patient group.

3515 Board #203 June 1 9:30 AM - 11:00 AM
Associations Between Muscle Morphology Measured with Ultrasonography and Self-Reported Function Following Anterior Cruciate Ligament Reconstruction

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 (No relevant relationships reported)

Deficits in quadriceps function are common in patients who sustain an anterior cruciate ligament (ACL) injury and undergo subsequent ACL reconstruction (ACLR). Quadriceps atrophy is among the notable changes in muscle tissue after ACLR. The relationship between muscle morphology and self-reported function should be established so treatment options can be targeted to improve function after ACLR. **PURPOSE:** (1) To evaluate rectus femoris (RF) cross-sectional area (CSA) and intramuscular fat percent (PF) in the injured and uninjured limb from 9 weeks post ACLR to return to activity (RTA) and (2) identify associations between injured limb quadriceps CSA, PF and self-reported function. **METHODS:** 28 individuals with primary unilateral ACLR (Age=16.6±2.7; Weight=71.8±17.7; 64% female; 18 bone-patellar tendon-bone; 2 quadriceps tendon; 5 hamstring tendon) were recruited for this study. RF was imaged at 15cm proximal of superior border of the patella. Quadriceps CSA and PF of the injured and uninjured limb were used for analysis. Self-reported function was evaluated using the International Knee Documentation Committee score (IKDC). Paired-samples t-tests were used to compare inter-limb differences in CSA and PF and changes from 9 weeks to RTA. Partial correlations adjusting for sex were used to analyze the relationship between RF morphology and IKDC scores. **RESULTS:** Injured limbs had smaller RF CSA at each time point (4.5±1.6cm² vs 5.2±1.9cm², p<.01 and 5.2±1.9cm² vs 5.6±2.1 cm², respectively) compared to the uninjured limb. Injured limb CSA increased at RTA (4.5±1.6cm² vs 5.2±1.9cm², p<.01) while the uninjured limb did not (p=0.12). No differences in PF were found between limbs (p=0.18, and p=0.43, respectively) or time point (p=0.67, and p=0.92, respectively). After adjusting for sex, larger injured limb CSA was associated with higher IKDC scores at 9 weeks and trended toward significance at RTA (r=0.32, p=0.05, and r=0.26, p=0.09, respectively). Injured limb PF was negatively associated with IKDC scores at both time points (r=-0.55, p<.01, and r=-0.39, p=0.02, respectively). **CONCLUSIONS:** Inter-limb differences in RF muscle CSA are not ameliorated at RTA. RF CSA and PF are associated with self-reported function in individuals with ACLR and should be treatment targets to improve patient function following injury.

3516 Board #204 June 1 9:30 AM - 11:00 AM
Evaluating Collagen Matrix Degradation after ACL Reconstruction using Quantitative MRI

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 (No relevant relationships reported)

Logan K. Faux-Dugan¹, Jack R. Williams², Kelsey Neal², Ashutosh Khandha², PhD, Thomas S. Buchanan², PhD, FACSM. ¹Delaware State University, Dover, DE, ²University of Delaware, Newark, DE
 Forty percent of individuals who undergo anterior cruciate ligament (ACL) reconstruction develop knee osteoarthritis (OA) within eight years of the procedure. T2 magnetic resonance imaging (MRI) can be used to assess the cartilage's collagen matrix health. Higher T2 times, when compared to healthy cartilage, are indicative of cartilage matrix degradation. When the ACL is injured, a bruise develops on the central and posterior regions of the tibial plateau. It is not known if this bruising has a long-term effect on the cartilage health in this region. **PURPOSE:** To determine if T2 values at the site of initial ACL injury (central and posterior regions of tibial cartilage) are higher in the involved vs. uninvolved limb, three months post ACL reconstruction. **METHODS:** Ten participants (8 men/2 women, age = 22 ± 5 years) underwent T2 MRI testing and analysis. Menisci boundaries were used to establish regions of interest (ROI). These ROI were further divided into deep and superficial sub-layers. The average T2 value for each ROI was calculated and each was compared in the involved vs. uninvolved limb using a paired t-test ($\alpha = 0.05$). **RESULTS:** For the tibial central deep region, the inter-limb difference (involved vs. uninvolved) approached significance (36±4 SD vs. 33±6 SD; p = 0.06, (Cohen's d = .59)), with higher T2 values in the involved limb cartilage. No statistically significant results were found for the other ROI. **CONCLUSION:** While not statistically significant, higher T2 values within the involved limb's central tibial cartilage indicate that bone bruising may result in collagen matrix degradation three months post ACL reconstruction. Future studies should include follow-up time points and a larger sample size. Supported by NIH R25-NS095371 and NIH R01-HD087459.

3517 Board #205 June 1 9:30 AM - 11:00 AM
Skeletal Muscle Mass and Circumference Discrepancies Between Injured and Un-Injured Limbs Post-ACL Reconstruction

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 (No relevant relationships reported)

Lower extremity injuries are common in sport. Anterior cruciate ligament (ACL) injuries often result in muscle atrophy in the thigh and calf muscles of the injured leg. Evaluating muscle atrophy via circumferences to document asymmetry has been recommended and is often used clinically (1). Previous studies have shown a small loss of skeletal muscle mass (SMM) may cause a greater loss in muscular strength (1), thus investigating muscle mass and girth may be beneficial in evaluating return to play post-ACL injury.

PURPOSE: The purpose of this study was to examine SMM and circumference discrepancies between injured and uninjured limbs post- ACL reconstruction. **METHODS:** Participants (n = 7, 4 F, 3 M; 21.9 ± 4.3 y; 5.24 ± 4.74 y post injury) were tested using bioelectrical impedance analysis (BIA). Fat mass, fat-free mass, body fat percentage, and SMM (kg) for extremities and torso were obtained. Circumference measurements were taken on the injured (I) and un-injured (NI) limbs at the mid-patella, and superiorly and inferiorly of the patellar poles at 10, 15, and 20 centimeters, using a standard, non-elastic tape measure. **RESULTS:** There was no significant difference between SMM (I :14.54 ± 3.80 kg; NI:14.48 ± 3.48 kg; t(6) = 0.46, p = .660). Roughly half of participants had greater SMM in the injured leg versus un-injured leg. There were no significant differences in circumference measurements between the limbs. **CONCLUSIONS:** There was evidence of decreased SMM in some participants following ACL injury. It is possible that continued study with more participants may find difference in muscle mass following injury. SMM and circumferences provide useful information concerning muscular atrophy and discrepancies between limbs. SMM obtained via BIA may be utilized as a cost-effective measure indicative of knee stability and limb strength for return to play protocol (1). Future research should include measurements made pre and post injury/surgery to understand muscle mass progression following injury. 1-Ross, C. M., & Worrell, T. W. (1998). Thigh and calf girth following knee injury and surgery. *Journal of Orthopaedic & Sports Physical Therapy*, 27(1), 9-15.

3518 Board #206 June 1 9:30 AM - 11:00 AM
Patient Reported Outcomes after Anterior Cruciate Ligament Reconstruction Predict Isometric Quadriceps Torque

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Individuals who have undergone anterior cruciate ligament reconstruction (ACLR) have reduced muscle function that has been shown to persist for many years post-surgery. The ability to predict future levels of neuromuscular function with the use of early-on inflammatory markers may assist clinicians to better target common muscle function deficits seen after ACLR. **PURPOSE:** The purpose of this study is to determine if levels of inflammation and patient reported outcomes one month post-surgery predict muscle function at six months post-surgery. **METHODS:** Nineteen patients who underwent ACLR (82.8±20.3kgs, 1.7±0.1m, 18.4±2.8yrs, 8M, 11F) completed this study. One month post-surgery (1.1±0.3 months) individuals completed the Knee Osteoarthritis Outcomes Score (KOOS), and visual analog scale (VAS) for pain. Patients were also aspirated one month post-ACLR and commercially available ELISA kits were used to determine concentrations of interleukin-1 β (IL-1 β) in the synovial fluid. At six months (6.1±0.3months) patients completed maximal isometric contractions of the involved limb at 60 degrees of knee flexion. Rate of torque development (RTD) was calculated as the slope of the time-torque curve taken from onset of torque to peak torque. Multiple linear regressions were run to determine if levels of IL-1 β , KOOS scores, and VAS scores, while controlling for height and weight, one month post-ACLR would better predict peak torque or RTD six months post-ACLR. Models were compared and the highest adjusted R² was identified as the best model. An alpha value of 0.05 was used. **RESULTS:** Levels of IL-1 β , and patient reported outcomes one month post-surgery did not significantly contribute to the variance of RTD (86.8±68.0Nm/kg) six months post-surgery in the involved limb. Height, mass, KOOS-pain (73.3±19.2), KOOS-sport (41.9±40.2), and VAS (30.6±28.8) were included in the final model predicting 50.6% of the variance of peak isometric torque (151.3±49.1Nm; p=0.038). IL-1 β (-4.75±1.3pg/mL) did not significantly contribute to predicting the variance of peak torque. **CONCLUSION:** Although levels

of inflammation one month after surgery may not explain muscle function six months after surgery, patient reported outcomes for pain and sport performance can, suggesting early clinical use to help drive targeted rehabilitation.

3519 Board #207 June 1 9:30 AM - 11:00 AM

Differences in T1 ρ Relaxation Time in the Vastus Lateralis after an Anterior Cruciate Ligament Tear

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(No relevant relationships reported)

Anterior cruciate ligament (ACL) injury results in quadriceps atrophy and fibrotic changes in the extracellular matrix of the muscle that may not resolve. To date, assessments have used a muscle biopsy; however, this is an invasive procedure and impractical on a wide scale. Magnetic resonance imaging (MRI) techniques, such as T1 ρ , hold promise to measure fibrotic changes. This technique has been used to study cartilage degeneration and liver fibrosis, but has not been widely applied to muscle. Whether T1 ρ relaxation time is different between the quadriceps of the injured and non-injured limbs, as well as its relationship to quadriceps strength, is not established.

PURPOSE: To investigate the variance in T1 ρ relaxation times in the vastus lateralis (VL) between the injured and non-injured limb following an ACL tear and possible correspondence to quadriceps strength.

METHODS: 17 ACL deficient patients (8M, 9F, 21 \pm 4.52 y, BMI 25.95 \pm 3.83, days since injury 26 \pm 17.26) underwent an MRI. T1 ρ acquisition included a single 6 mm thick slice at the location of the largest cross-sectional area of the VL with 8 echoes collected within spin lock times of 0-70 ms (spin lock amplitude 300Hz, matrix 256x256, 2 excitations with 4 shots per slice). Data was fitted to a mono exponential decay curve using custom MATLAB code. Quadriceps strength was assessed via maximal voluntary isometric contractions on a dynamometer. Paired t-tests and Pearson product moment correlation coefficients were used to analyze the data.

RESULTS: T1 ρ times were significantly longer in the involved limb compared to the non-involved limb (involved: 0.0296 \pm 0.0032 s; non-involved: 0.0280 \pm 0.0031 s; 5.7% difference; $p=0.04$). Peak isometric torque was significantly less in the involved limb as to the non-involved limb (involved: 1.91 \pm 0.71 Nm/kg; non-involved: 2.65 \pm 0.52 Nm/kg; 27.7% difference; $p<0.001$); however, was not significantly correlated with longer T1 ρ time ($r=0.07$; $p=0.70$).

CONCLUSION: T1 ρ was significantly longer soon after injury, indicating that this tool is sensitive to measure early changes in muscle organization. Contrary to our hypothesis, a relationship to quadriceps strength was not found. Potentially, T1 ρ measures a different factor than peak strength and additional variables of muscle function should be evaluated.

NIH R01AR071398

G-40 Free Communication/Poster - Blood Flow Restriction

Saturday, June 1, 2019, 7:30 AM - 11:00 AM
Room: CC-Hall WA2

3520 Board #208 June 1 9:30 AM - 11:00 AM

Acute Muscular Responses to Practical vs. Traditional Blood Flow Restriction Resistance Exercise

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(No relevant relationships reported)

PURPOSE: To compare the impact of blood flow restriction (BFR) resistance exercise on changes in muscular force output (MVC), muscle thickness (MTH) and total exercise volume (TEV) when using elastic knee wraps (practical) or nylon cuffs (traditional) inflated to 40 and 80% of arterial occlusion pressure (AOP).

METHODS: Participants (male=7, female=2) were 22 (4) years and had a body mass index of 25.4 (1.5) kg/m². A randomized cross-over study design used unilateral knee extension exercise (4 sets to failure) with six different conditions at three separate visits. Low-load (LL, 30% 1-RM) exercise was performed with four conditions: elastic knee wraps (Valeo®) stretched two inches from resting length (K2) and to a value that was 85% of thigh circumference (K85), and nylon cuffs inflated to 40% (BFR40) and 80% (BFR80) of AOP. LL (30% of 1-RM) and high-load (HL, 70% of 1-RM) exercise

without restriction were also performed. MVC and MTH were measured pre and post exercise. TEV was also calculated for each condition. Two-way [Condition x Time] repeated measures ANOVA and one-way repeated measures ANOVA were used to analyze the data. Data reported as mean (standard deviation). Statistical significance was set at $p<0.05$.

RESULTS: MVC decreased from pre to post-exercise for all conditions [Δ HL: -90 (81) N, Δ LL: -126 (57) N, Δ BFR40: -168 (89) N, Δ BFR80: -240 (134) N, Δ K2: -178 (91) N, Δ K85: -197 (57) N, $p<0.05$]. The changes in MVC were significantly different in K85 vs. HL ($p<0.001$) and K85 vs. LL ($p=0.013$). HL and BFR80 MVC at 15 minutes post-exercise were not different from pre-values (Δ HL: -53 (68) N, $p=0.095$; Δ BFR80: -67 (77) N, $p=0.138$) but LL, BFR40, K2 and K85 were still significantly below pre-values ($p<0.05$). MTH changes were similar from pre to post-exercise [Δ HL: 0.22 (0.22) cm, Δ LL: 0.26 (0.1) cm, Δ BFR40: 0.26 (0.14) cm, Δ BFR80: 0.28 (0.19) cm, Δ K2: 0.26 (0.21) cm, Δ K85: 0.25 (0.13) cm, $p=0.892$]. HL TEV was higher [889.6 (227.7) kg] compared to all the other conditions ($p<0.05$) while the LL [686.1 (173.1) kg] was higher than the BFR40 [576.8 (160.7) $p=0.026$], BFR80 [434.9 (142.3) kg, $p<0.001$] and K85 [520.2 (139.2) kg, $p=0.023$] conditions.

CONCLUSIONS: Exercising to fatigue with elastic knee wraps could be used to produce similar acute changes in MVC, MTH and TEV compared to known BFR pressures.

3521 Board #209 June 1 9:30 AM - 11:00 AM

Blood Flow Restriction Does Not Augment Low Force Contractions Taken to or Near Task Failure

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(No relevant relationships reported)

Low load [30% of one repetition maximum (1RM)] exercise performed to volitional failure appears to result in similar skeletal muscle adaptations as low load exercise with the addition of blood flow restriction (BFR). However, there may be a point where the training load becomes too low (<20% 1RM) to stimulate an anabolic response without the addition of BFR. **PURPOSE:** To examine the skeletal muscle adaptations to very low load exercise with and without BFR in the upper body. **METHODS:** Changes in muscle thickness (MT), one repetition maximum strength (1RM), isometric strength, isokinetic strength and endurance were examined following 8-weeks of training with a traditional high load [70% 1RM, (70/0)], low load (15% 1RM), low load with moderate BFR (15% 1RM+40%BFR), or low load with greater BFR (15% 1RM+80%BFR). Results are displayed as mean (95% CI). **RESULTS:** 40 untrained men and women completed the study. For 1RM strength, there was a condition x time interaction ($p=0.003$). 1RM strength changes were greater in the 70/0 condition [2.09 (95% CI=1.35-2.83) kg] compared to all low load conditions. For isometric and isokinetic strength, there were no changes. For endurance, there was a main effect for time [mean pre to post change = 7.9 (4.3, 11.6) repetitions, $p<0.001$]. At the 50% MT site there was a condition x time interaction ($p=0.004$). The mean change in MT in the 70/0 condition [0.16 (0.10-0.22) cm] was greater than all low load conditions. For the 60% MT site there was a condition x time interaction ($p=0.014$). The mean change in MT for the 70/0 condition [0.15 (0.08-0.22) cm] was greater than all low load conditions. For the 70% MT site there was a main effect of time ($p=0.001$). Muscle thickness increased from pre-testing to the midpoint [mean change = 0.06 (0.01- 0.10) cm] and remained elevated above baseline at post-testing [mean change = 0.09 (0.5 - 0.14) cm]. **CONCLUSIONS:** All groups increased muscle size; however, this response was lower in all very low training conditions compared to high load training. 1RM strength increased in the 70/0 condition only, with no other changes in strength observed. These results suggest that loads as low as 15% 1RM do not provide adaptations comparable to high load resistance training. Further, BFR cannot be used to compensate for an insufficient external load regarding muscle size and strength adaptations.

3522 Board #210 June 1 9:30 AM - 11:00 AM
Nitric Oxide-dependent Myogenic Satellite Cell Activation In Human Skeletal Muscle Following Blood-flow Restricted Exercise

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(No relevant relationships reported)

PURPOSE: Skeletal muscle contractions performed under concurrent blood-flow restriction (BFR) have been shown to elicit myogenic satellite cell (MSC) proliferation and differentiation, however, the upstream signaling events governing MSC activation with BFR exercise remains unknown. A potential important upstream regulator of MSC activation initiated by BFR exercise may be nitric oxide (NO). Thus, the aim of the present study was to investigate the effect of endogenous nitric oxide (NO) synthesis on MSC activation in human skeletal muscle in response to BFR exercise.

METHODS: Eight male subjects (20.9 ± 2.7 (SD) years) performed five sets of low-load knee extensor exercise (20% 1RM) with concurrent BFR applied with a pressure cuff (100 mmHg) positioned at the proximal thigh. Concurrently, local arterial infusion of the NO synthase (NOS) inhibitor, NG-monomethyl-L-arginine (L-NMMA) or Placebo was applied in a within-subject cross-over design. Arterio-venous blood samples were obtained before and after exercise (30min) for assessment of leg blood-flow and oxygen extraction. Muscle biopsies were obtained at Baseline as well as 1, 3, 24 and 48h post exercise (Post1-48) for assessment of myogenic satellite cell (Pax7⁺) content using immuno-fluorescence techniques. **RESULTS:** Resting leg blood-flow decreased 37 % (0.57 ± 0.14 L/min to 0.36 ± 0.12 L/min) and oxygen extraction increased 98 % (26.8 ± 9.2 to 53.1 ± 7.9 %) with NOS inhibition ($P < 0.001$), while remaining unchanged in the Placebo condition. MSC counts increased (47-94 %) with Placebo infusion from baseline (9.7 ± 3.3 MSC per 100 myofiber) to Post1 (15.0 ± 4.1), Post3 (15.3 ± 4.2) and Post24 (18.8 ± 7.0) and Post48 (14.2 ± 5.3) ($P < 0.05$ - 0.001), while remaining unchanged with NOS inhibition.

CONCLUSIONS: This study is the first to show that inhibition of endogenous NO synthesis leads to blunted MSC activation in response to muscle contractions performed during conditions of partial blood-flow restriction in human skeletal muscle. In conclusion, the present data suggest that NO is a key signaling molecule activating MSC in human skeletal muscle in vivo.

3523 Board #211 June 1 9:30 AM - 11:00 AM
Endurance is Augmented By Greater Blood Flow Restriction Pressures: Muscle Size and Strength Are Not

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(No relevant relationships reported)

Purpose: The importance of training to failure, especially when using low-loads (i.e., 30% 1RM) is well established. However, it remains unknown if lifting 15% 1RM can disrupt muscular blood flow enough to induce failure and stimulate adaptation. This study was designed to compare muscular adaptations between training with 15% 1RM and 70% 1RM, to determine if blood flow restriction (BFR) could augment the response to 15% 1RM, and if the effect of BFR is pressure dependent [40% versus 80% arterial occlusion pressure (AOP)].

Methods: 40 untrained participants performed 4 sets of unilateral knee extension 2x/week for 8 weeks, with two conditions, one per leg. Conditions (label) were: 15% 1RM 0% AOP (15/0), 15% 1RM 40% AOP (15/40), 15% 1RM 80% AOP (15/80), 70% 1RM 0% AOP (70/0). Sets were stopped at 90 repetitions or volitional failure, as determined by an inability to maintain metronome cadence (2 s/contraction) or full repetitions. Inter-set rest was 30 s for 15/0, 15/40, 15/80 and 90 s for 70/0. A 10 cm wide nylon cuff was used for BFR.

Results: Data presented as [mean change (95% CI)]. There were condition x time interactions for 1RM ($p < 0.001$) and endurance ($p = 0.028$). 70/0 increased 1RM [3.15 ($2.04, 4.25$) kg]; 15/0 [-0.06 ($-1.13, 1.01$)], 15/40 [0.066 ($-1.06, 1.20$)], and 15/80 [0.68 ($-0.41, 1.79$)] did not. Increased endurance was greatest for 15/80 [6.2 ($4.3, 8.0$)] compared to 15/0 [4.2 ($2.4, 6.0$)], 15/40 [4.7 ($2.8, 6.5$)], and 70/0 [4.0 ($2.2, 5.9$)]. There were main effects of time for isometric MVC [10.51 ($3.87, 17.16$) Nm, $p = .002$] and

isokinetic MVC at 180°/s [change = 8.61 ($5.54, 11.68$) Nm, $p < .001$]. Isokinetic MVC at 60°/s did not change [2.45 ($-1.84, 6.74$) Nm, $p = .261$]. There were no condition x time interactions for muscle thickness sites (all $p \geq .313$), which increased over time (all $p < .001$). There were main effects of condition for each site (70/0 was greater, all $p < .001$) except 30% lateral ($p = .059$).

Conclusion: Most muscle strength and size changes appear similar despite large discrepancies in training load and restriction pressure. While the change in 1RM with high-load may be due to motor learning or practicing, the greater endurance adaptation favoring high restriction pressures should be explored further regarding underlying mechanisms. These results are relevant to mechanistic exploration, therapeutic purposes, and program design.

3524 Board #212 June 1 9:30 AM - 11:00 AM
The Acute Muscle Swelling Response: The Influence Of Sex And Cuff Size

Vickie Wong, Raksha N. Chatakondi, Takashi Abe, Zachary W. Bell, Robert W. Spitz, Scott J. Dankel, Jeremy P. Loenneke. *The University of Mississippi, University, MS.*

(No relevant relationships reported)

Muscle cell swelling is a purported mechanism for the muscle hypertrophy following blood flow restriction (BFR) training. There are numerous cuff widths used in literature in BFR. It is presently unknown if cuff width impacts the swelling response and whether this differs between sexes. **PURPOSE:** To examine whether the acute muscle swelling response differs based on cuff size and sex. **METHODS:** Forty-nine (25 men, 24 women) participants completed two conditions in a random order (one each arm). Participants completed four sets of unilateral elbow flexion exercise to failure using 30% of their one repetition maximum with BFR applied with either a narrow (5cm) or a wide (12 cm) cuff inflated to 40% of the arterial occlusion pressure. Muscle thickness and echo intensity were measured before and after each exercise bout in the supine position. A repeated measures analysis with a between subject factor of sex was used to assess changes between conditions. Default priors were used for fixed effects ($r = 0.5$) and random effects ($r = 1$). Bayes Factors (BF10) were used to quantify evidence for the null and alternative hypothesis. Data are presented as mean (SD) unless otherwise stated. **RESULTS:** For muscle swelling, there was evidence for an interaction. Men had greater swelling than women [Men: 0.57 (0.18) vs. Women: 0.39 (0.15) cm] with the narrow cuff [median δ (95% credible interval) .903 (.324, 1.52); BF10: 38.57]; but there was no evidence of a difference within the wide cuff [median δ (95% credible interval) .348 (-.170, .902); BF10: .690]. There was some evidence that men had greater swelling with the narrow [0.57 (0.18) cm] cuff compared to the wide [0.49 (0.14) cm] cuff [median δ (95% credible interval) .602 (.071, 1.174); BF10: 2.61]. However, there was no evidence (BF10: .439) for this in women [Narrow: 0.39 (.15) vs. Wide: 0.43 (.12) cm]. For changes in echo intensity, there was no evidence for an interaction or an effect of cuff [Narrow: 1.2 (8) vs. Wide: $-.5$ (7) AU, BF10: .41]. There was evidence for the null with sex (BF10: .322). **CONCLUSIONS:** Acute muscle swelling occurs in both men and women, even when using a wide cuff. There is evidence, however, that the change in swelling is greater in men, particularly with the narrow cuff. Whether these acute changes translate to differences in chronic adaptations is currently unknown.

3525 Board #213 June 1 9:30 AM - 11:00 AM
Time Course of Blood Flow Restricted Resistance Training Adaptations in Older Adults

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(No relevant relationships reported)

Blood flow restricted (BFR) resistance training leads to increased muscle mass and strength but the time course of adaptations may be different as they are often to a lesser magnitude than high-load (HL) training. **PURPOSE:** To evaluate the impact of resistance training loads and repetitions on older adults' muscle mass and strength following BFR or HL training. **METHODS:** Twenty-one older adults (67-90 years) were randomly assigned to HL ($n = 11$) or BFR ($n = 10$) training on the knee extensors and flexors twice per week for 12 weeks. Muscle strength was measured with 10-repetition maximum (10-RM) and muscle mass was assessed via magnetic resonance imaging and quantified as cross-sectional area (CSA). The measurements were performed before and after 12 weeks of training. **RESULTS:** After 12 weeks of resistance training, the HL and BFR interventions increased 10-RM knee flexion strength by $36.9 \pm 25.4\%$ and $18.9 \pm 25.5\%$, respectively, but there was not a significant time x group interaction ($P = .16$). CSA of the knee flexors increased an average of $4.8 \pm 5.9\%$ among the HL and BFR training interventions (time main effect $P < .01$) but was not different between the training groups (time x group interaction $P = .89$). There were similar rates of progression of knee flexion training load and repetitions (time x group interactions of each variable $P > .05$) as the groups combined averaged an increase of $.28 \pm .1$ kg·session⁻¹ and $.97 \pm .8$ repetitions·session⁻¹ of training (time main effects $P < .05$). Participants in the HL training group experienced greater improvements

in knee extension 10-RM strength than the BFR group ($60.7 \pm 36.0\%$ vs $35.3 \pm 25.5\%$; $P=.03$). The growth in quadriceps CSA was significant (time main effect $P<.01$) and to similar magnitudes (time \times group interaction $P=.62$) following HL training ($6.5 \pm 3.1\%$) and BFR training ($7.8 \pm 8.2\%$). The HL group experienced a faster progression of load when compared to BFR training ($.46 \pm .30$ kg \cdot session $^{-1}$ vs $.15 \pm .10$ kg \cdot session $^{-1}$; $P=.006$). The BFR training group progressed at a rate of $1.8 \pm .63$ repetitions \cdot session $^{-1}$ while the HL group progressed at $1.1 \pm .21$ repetitions \cdot session $^{-1}$ ($P=.003$).

CONCLUSIONS: HL resistance training may result in better strength gains than BFR resistance training because of distinctive rates of progressive overload.

Supported by NIH grant 1R15 A6040700-01A1

3526 Board #214 June 1 9:30 AM - 11:00 AM Blood Flow Restricted Exercise and Reduced Oxygen Tension Decrease Mitochondrial ROS Emission in Human Muscle

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(No relevant relationships reported)

Low volume blood flow restricted (BFR) training has been proposed to induce comparable adaptations to traditional resistance training, however the underlying mechanisms remain unknown. Despite the absence of direct support, a suggested mechanism of BFR is an increase in reactive oxygen species (ROS). **PURPOSE:** We aimed to determine if the rate of mitochondrial ROS emission was altered following an acute bout of occluded (BFR) or non-occluded resistance training (RT), and to mechanistically investigate the role of skeletal muscle O_2 partial pressure (pO_2) in this response.

METHODS: Ten males (25 ± 1 yrs) performed 3 sets of single leg squats to failure at 30% 1RM, with either BFR (60-70% occlusion), or without occlusion (RT), while skeletal muscle tissue oxygenation was estimated using near-infrared spectroscopy. Muscle biopsies were obtained at rest and 2-hours post-exercise to determine mitochondrial respiration and ROS emission in permeabilized muscle fibers. In a separate cohort, muscle biopsies were obtained from six males (25 ± 2 yrs) to examine the effects of pO_2 on *in vitro* mitochondrial bioenergetics.

RESULTS: Resistance exercise, with or without BFR, did not alter maximal respiratory capacity or mitochondrial sensitivity to ADP. While maximal mitochondrial ROS emission was unchanged following RT, BFR decreased this response compared to rest (66.6 vs. 86.2 pmol \min^{-1} mg dry wt $^{-1}$, $p<.05$). Skeletal muscle oxygenation was lower in the BFR compared to RT leg, both during (41.4% vs. 46.1% saturation respectively, $p<.01$) and between (50.3% vs. 61.1% saturation respectively, $p<.01$) exercise sets. Further evaluation of mitochondrial bioenergetics *in vitro* revealed that mild O_2 restriction ($50\mu M$) dramatically attenuated maximal mitochondrial ROS emission (~ 4 -fold), and fraction electron leak to ROS (~ 3 -fold) compared to room air ($200\mu M$). This effect was especially evident in the presence of non-saturating ADP, as submaximal ROS emission was almost completely suppressed during O_2 restriction, without a reduction in submaximal respiration.

CONCLUSIONS: These data indicate that a reduction in skeletal muscle pO_2 attenuates the propensity of mitochondria to produce ROS, a mechanism which may contribute to the acute responses to BFR training. This research is supported by NSERC funding.

3527 Board #215 June 1 9:30 AM - 11:00 AM B.F.R. For Proximal Benefit: Blood Flow Restriction Therapy For The Shoulder?

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(No relevant relationships reported)

Blood flow restriction (BFR) therapy has been observed to improve post-operative recovery in the limbs when combined with low intensity resistance exercise (LIX). Little data exists regarding use of BFR for proximal benefit of the upper limbs (shoulders). **PURPOSE:** (1) Determine if rotator cuff (RC) exercises combined with BFR (BFR-Rx) promote greater increases in strength, muscular endurance, and lean mass compared to exercise alone (NoBFR-Rx); (2) Determine if BFR applied to the arm during acute LIX increases activation of RC muscles. **METHODS:** Eighteen healthy adults (\bar{X} 11, 32 ± 5 yr, 92.3 ± 15.2 kg | \bar{X} 7, 34 ± 7 yr, 81.9 ± 6.3 kg) were recruited and randomized into 2 groups (BFR-Rx, NoBFR-Rx). Each performed 8wks of LIX

(2/wk) using 4 RC exercises: cable external rotation (ER), cable internal rotation (IR), dumbbell scaption, and side-lying dumbbell ER; 20% 1RM; 1set/30reps followed by 3sets/15reps (30s rest between sets, 2min rest between exercises, ~ 1 lb resistance each week all repetitions achieved). For the BFR-Rx group, BFR was applied to using an tourniquet system (Delfi®) that maintained 50% limb occlusion pressure during each exercise with pressure released between exercises. A group \times time ANCOVA (co-varied on baseline) followed by a tukey's post hoc test was used to detect absolute & relative changes in strength (pre/post training), lean mass (pre/post training; DEXA, GE®), and achieved weekly exercise volume (sets \times reps \times resistance). A two-tailed paired samples t-test was used to detect differences in RC muscle activation (EMG, Delsys®) recorded during acute ER and IR fatigue tests in all subjects. Type I error was set at $\alpha=0.05$.

CONCLUSIONS: Combined BFR-Rx using RC exercises may yield greater increases in shoulder/arm lean mass, strength, and muscular endurance compared to exercise alone. These findings may be partially due to a greater activation of shoulder musculature while using BFR. Data collection is ongoing and will be completed prior to conference.

LEAN MASS						
ARMS			SHOULDERS			
	%Δ	Δ	%Δ	Δ		
BFR-Rx	8.15% ± 2.85*†	0.51 ± 0.22 kg*†	28.10% ± 11.04*†	0.36 ± 0.14 kg*		
NoBFR-Rx	-0.43% ± 1.42	-0.01 ± 0.05 kg	11.23% ± 6.31*	0.13 ± 0.08 kg*		
STRENGTH (%Δ From Pre-Training)						
DOMINANT	FLEXION	SCAPTION	ER 0°	IR 0°	ER 90°	IR 90°
BFR-Rx	4.48%* ± 2.54	5.25%* ± 1.80	7.21%* ± 2.02	23.25%* ± 7.66	2.77% ± 4.50	19.83%*† ± 8.15
NoBFR-Rx	-2.15% ± 5.05	0.70% ± 3.01	2.97% ± 7.62	8.23% ± 9.76	-3.55% ± 5.58	2.11% ± 5.55
NON-DOMINANT	FLEXION	SCAPTION	ER 0°	IR 0°	ER 90°	IR 90°
BFR-Rx	2.69% ± 2.10	7.41%* ± 2.11	1.01% ± 0.22	14.50%* ± 8.01	6.58% ± 8.69	17.35%* ± 13.74
NoBFR-Rx	4.59% ± 4.30	2.09% ± 3.89	7.32% ± 7.46	16.01%* ± 4.00	1.82% ± 8.50	21.07%* ± 10.37
ACHIEVED EXERCISE VOLUME - SUM OF ALL LIFTS (%Δ From Training Week 1)						
	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
BFR-Rx	9.57%* ± 2.60	18.37%* ± 2.61	25.26%* ± 1.45	32.97%* ± 1.86	35.38%* ± 4.45	43.51%*† ± 4.48
NoBFR-Rx	5.62% ± 2.10	10.73%* ± 4.61	22.26%* ± 8.18	20.63%* ± 7.44	23.14%* ± 4.68	30.25%* ± 3.41
MEAN EMG ACTIVATION & 20% 1RM (mV Normalized To Un-occluded Control Contractions)						
ALL SUBJECTS	Cable ER (20 Contractions)			Cable IR (30 Contractions)		
	Infraspinatus	Teres Minor		Infraspinatus	Teres Minor	
With BFR	1.14 ± 0.02	1.40 ± 0.04†		1.04 ± 0.03	1.16 ± 0.03†	
Without BFR	1.16 ± 0.04	1.19 ± 0.02		1.03 ± 0.04	1.05 ± 0.10	

Data are presented as means \pm SD. * = significant difference from baseline. † = significant difference between groups at the same measurement time-point. Type I error set at $\alpha=0.05$.

3528 Board #216 June 1 9:30 AM - 11:00 AM The Perceived Tightness Scale Does Not Provide Reliable Estimates Of Blood Flow Restriction Pressure

Zachary W. Bell, Scott J. Dankel, Robert W. Spitz, Raksha N. Chatakondi, Takashi Abe, Jeremy P. Loenneke. *The University of Mississippi, University, MS.*
(No relevant relationships reported)

When completing blood flow restriction, use of a perceived tightness scale is recommended as a method for setting sub-occlusive pressures. However, whether or not participants can consistently rate a similar pressure using this scale is unknown.

PURPOSE: To determine the reliability of a perceived pressure when asking participants to rate a 7 out of 10, considered a moderate pressure with no pain, during blood flow restriction. **METHODS:** Participants (12 men, 12 women) were tested over 3 visits, involving measurements for arterial occlusion and the relative pressure at which participants deemed a 7 out of 10. Participants arrived to the lab and proceeded to lie supine for a 10-minute rest period. Measurements were completed in one limb for the upper and lower body. A repeated measures analysis with a between subject factor of sex was used to compare relative arterial occlusion pressures across days and sex with a default prior of 0.5 for the fixed effects and 1 for the random effects. An independent samples t-test was used to determine if there were sex differences in %CV with a default prior of 0.707. A Bayes factor (BF_{10}) of 3 and 0.33 was considered evidence for the alternative and null hypotheses, respectively. **RESULTS:** The %CV for the measurement in the upper body was 12%, with no effect of sex (men: 12.3% vs. women 12.2%; BF_{10} : .403; median δ (95% credible interval): .016 (-.741, .752)). The %CV for relative arterial occlusion pressure in the lower body also did not differ between sexes (men: 13.7% vs. women 10.3%; BF_{10} : .509; median δ (95% credible interval): .266 (-.396, .999)). Participants rated a 7/10 pressure above the arterial occlusion pressure for the upper body and below for the lower body. At the group level, participants rated a 7 out of 10 at a higher relative pressure on day 1 compared to days 2 (BF_{10} : 4.482, median δ (95% credible interval): -.694 (-1.307, -.130)) and 3

(BF₁₀: 10.2, median δ (95% credible interval): -.838 (-1.468, -.189)) for the lower body but no differences in the upper body. There was no effect of sex. **CONCLUSIONS:** The use of a perceived tightness scale does not appear to provide a reliable method for the prescription of blood flow restriction pressure. Future work should consider alternative methods or modifications to the scale for improving reliability when setting sub-occlusive pressures.

G-41 Free Communication/Poster - Nutrition and Metabolic Health

Saturday, June 1, 2019, 7:30 AM - 11:00 AM
Room: CC-Hall WA2

3529 Board #217 June 1 9:30 AM - 11:00 AM The effect of Metabolic Syndrome on Exercise Performance in American Football Players From a Mexican University

Dulce E. Morales Elizondo, FACSM, Pedro G. Morales-Corral, FACSM, Rosalinda Sepulveda, Hector E. Pérez, Elfega Sámano-Pérez, Francisco J. Barrera-Flores, Emanuel Rizo-Belloso. *UANL, San Nicolás de los Garza, Mexico.*
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(No relevant relationships reported)

PURPOSE: To demonstrate the effect that the presence of the metabolic syndrome (MetSyn) has on the physical performance on American Football Players of a college team in México

METHODS: Seventy six players were included in the study, thirteen had MetSyn (21.7±1.5 yrs) and sixty three were not diagnosed with MetSyn (21.8±1.5 yrs). In order to establish a statistical significance between the physical performance and MetSyn, the data was analyzed in two different ways: With MetSyn (WMS) or absence of MetSyn (AMS) and by groups of similarity of Body Mass and type of execution in the field **Group 1** Offensive and Linemen (OL and DL) and Tight ends (TE).

Group 2 Running Backs (RB), Linebackers (LB) and Quarterbacks (QB). **Group 3** Wide Receivers (WR), Kickers (K), Strong Safeties (SS) and Cornerbacks (CB). The physical performance tests that were measured were: Maximum strength, explosive strength, Isometric hand strength, muscular resistance, power of upper and lower body, lumbar flexibility, agility, speed and cardiovascular resistance

RESULTS: The physical performance tests between WMS revealed better performance in maximum upper body strength 293.46(56.54) against the ABS group 246(36.45), explosive strength with Snatch 165(135-205) against 155(105-205) and Jerk 228.08(31.46) against 204.29(34.70) tests, as well as muscular resistance test 9.5(1-25) against 3(0-26) repetitions. Lower athletic performance was shown in the WMS group in the speed 5.6(5.23-7.12) sec against 5.21(4.75-8.22), agility 8.84(7.1-9.79) seconds against 5.21(4.75-8.22) and cardiovascular resistance 13.32(10-18) against 11.16(9.06-17.11) min.

CONCLUSIONS: The weight and BMI and the body fat percentage were variables that presented significance difference in the WMS group, coinciding with the authors who affirm that the weight and the percentage of fat have an influence on the physical performance. The physical performance tests in the WMS group revealed better performance in maximum chest force, explosive strength with Snatch and Jerk tests, as well as muscular resistance suggesting a possible favorable relationship to presence MetSyn. We observed a lower athletic performance in the tests of speed, agility and cardiovascular resistance in the players with the presence of MetSyn negatively relating the MetSyn with these motor skills.

3530 Board #218 June 1 9:30 AM - 11:00 AM Inhibition Of miR-16 In Vitro Decreases Glucose Uptake And Insulin Signaling

Seongkyun Lim, David E. Lee, Megan E. Rosa-Caldwell, Jacob L. Brown, Tyrone A. Washington, Nicholas P. Greene. *University of Arkansas, Fayetteville, AR.* (Sponsor: Matthew S. Ganio, FACSM)

(No relevant relationships reported)

Type 2 Diabetes Mellitus (T2DM) is a fast-growing epidemic and skeletal muscle insulin resistance may be the onset point in the development of T2DM. Recent data have suggested that microRNAs (miR) may play an important role in T2DM glucose intolerance. Specifically, reduced miR-16 content in muscle has been noted in human and rodent models of T2DM. However, regulation of miR-16 and its relation to muscle insulin resistance is largely unexplored. **PURPOSE:** To investigate how miR-16 content affects insulin resistance and glucose regulation in myotubes during insulin resistant states. **METHODS:** This study was performed in three experiments. Experiment (Ex) 1: To test if miR-16 is necessary for muscle insulin sensitivity, C2C12

myoblasts were cultured to become myotubes. Cells were transfected with a plasmid to inhibit function of miR-16. Ex 2: To test if miR-16 is sufficient to improve insulin resistance, myotubes were treated with a 1-oleoyl-2-acetyl-sn-glycerol (OAG), to simulate lipid overload-induced insulin resistance, cells were transfected with plasmid to overexpress functional miR-16. Ex 3: To test if Primary-miR16 (Pri-miR16) is differently expressed in insulin resistance state, Pri-miR16 level was measured by RT-PCR in both in vivo and in vitro models of insulin resistance. In experiment 1 and 2, glucose uptake and insulin signaling were measured by uptake of 2-NBDG (a fluorescent analog of glucose), and immunoblot of phosphorylation of AKT and IRS1. Data were analyzed by ANOVA or t-test as appropriate, significance was denoted at $p < 0.05$. **RESULTS:** Ex 1: Insulin-stimulated glucose uptake was ~25% lower in myotubes following miR16 inhibition ($p = 0.01$). Insulin signaling was lower in myotubes with miR16 inhibition (31%, $p = 0.002$). Ex 2: OAG-induced insulin resistant myotubes exhibited lower glucose uptake ($p = 0.01$; 12%). However, overexpression of miR16 did not improve OAG-induced insulin resistance ($p > 0.05$). Ex 3: Pri-miR16 level was not different between control and OAG. **CONCLUSION:** Reduction of miR-16 content seems to be necessary for glucose handling, however, miR-16 overload is not sufficient to rescue glucose regulation and synthesis of pri-miR16 was not a culprit for reduced miR16 during insulin resistance, therefore it may be due to either degradation or export of miR16 during the miRNA process.

3531 Board #219 June 1 9:30 AM - 11:00 AM Amelioration Of Diabetes-associated Muscle Atrophy By Transcutaneous Carbon Dioxide Exposure

Hiroyo Kondo¹, Hidemi Fujino², Tomohiro Matsumoto², Akihiko Ishihara, FACSM³. ¹Nagoya Womens University, Nagoya, Japan. ²Kobe University, Kobe, Japan. ³Kyoto University, Kyoto, Japan.

(No relevant relationships reported)

PURPOSE: Diabetes has been known to result in attenuated growth and atrophy in skeletal muscle. Recently, it has been reported the Carbon dioxide (CO₂) exposure leads to an increase of muscle mass in normal rats. Therefore, the aim of the present study was to investigate the effects of transcutaneous CO₂ exposure with the hydrogel (eCO₂GEL) on diabetic-associated muscle atrophy.

METHODS: Male Goto-Kakizaki (GK) rats were divided into control (GK) and CO₂ exposure (CO₂) groups and male Wistar rats used as a non-diabetic control. The hair on the lower limbs was shaved and the hydrogel (eCO₂GEL), which can increase the absorption of CO₂ from skin, was applied. The CO₂ adaptor was attached to the limbs and sealed, and CO₂ gas was administered into the adaptor for 30 min. The CO₂ exposure was performed everyday for 8 weeks.

RESULTS: The muscle weights of soleus and tibialis anterior in the GK group decreased compared with those of the control group. CO₂ exposure attenuated decreased muscle weights in diabetes-associated muscles ($P < 0.05$). In addition, the blood flow in skeletal muscle was increased by CO₂ exposure compared with non-CO₂ exposure condition ($P < 0.05$). Furthermore, the level of fasting blood glucose in the CO₂ exposure group was significantly decreased compared with the GK group ($P < 0.05$).

CONCLUSIONS: These results indicate that the transcutaneous CO₂ exposure may have a therapeutic potential for diabetic-associated muscle atrophy. This amelioration may associate with increased blood flow in skeletal muscle.

3532 Board #220 June 1 9:30 AM - 11:00 AM Exercise and High-Fat Diets Upregulate Endoplasmic Reticulum Membrane Protein Sensors and Muc2 in Female Mice

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Reported Relationships: P.J. Wisniewski: Other (please describe);

Supported by a Student Research Fellowship Award: Crohn's & Colitis Foundation (Ref. # 535042).

A dense dual layered mucus barrier, comprised of the muc2 mucin glycoprotein, protects the colon epithelium from luminal microbes and the external environment. The complexity and high secretory output of muc2 makes it prone to misfolding which activates the unfolded protein response (UPR) contributing to endoplasmic reticulum (ER) stress if unresolved. Interestingly, high fat diets have shown to induce colonic epithelial stress and inflammation which may be attenuated by exercise. **PURPOSE:** We aimed to examine impact of a high-fat diet (HFD) and exercise on the gene expression of factors involved in the UPR and ER stress in male and female mice colon. **METHODS:** 56 (n=7/group) 6-week old C57BL/6N male and female mice were weighed and randomly assigned to one of 4 groups: (1) control-diet sedentary (CDS, 10% fat diet, Research Diets); (2) very high-fat diet sedentary (VHFS, 60% fat, Research Diets); (3) control-diet exercise (CDX); and (4) very high-fat diet exercise (VHFX) for 12 weeks. Mice had *ad libitum* access to food and water. Exercised mice

had free access to a running wheel in their cages. Food intake was monitored every other day and body weights once per week. After 12 weeks animals were sacrificed. Total RNA was extracted from colon tissue fixed in RNAlater and converted into cDNA using the RNeasy Mini and First Strand kits. qRT-PCR was performed using a custom RT2-profiler PCR array (Qiagen). Ct values were normalized to GAPDH and a one-way ANOVA with LSD post-tests was used to analyze group means of Δ Ct values for each sex. A difference of mean with a p value of ≤ 0.05 was considered statistically significant. mRNA expression was expressed relative to CDS groups using the $\Delta\Delta$ Ct method. **RESULTS:** For females, Atf6 and Ire1 β expression was increased in VHFX mice (0.9 and 1.1-fold times) compared to VHFS (0.6-fold times; $p = 0.001$ and $p = .008$). Muc2 expression was significantly increased in CDX mice (2.3-fold times) compared to VHFS (0.7-fold times; $p = 0.02$). In males, no significant differences in the expression of any factor was observed. **CONCLUSION:** High-fat diets coupled with exercise increase the expression of endoplasmic reticulum membrane protein sensors involved in the unfolded protein response in females. Exercise increases muc2 expression in females.

3533 Board #221 June 1 9:30 AM - 11:00 AM
Hypocaloric High Fat and High Carbohydrate Diets on Visceral Adipose Tissue and Body Composition
 Jarrett Walbolt, Yunsuk Koh. *Baylor University, Waco, TX.*
(No relevant relationships reported)

Introduction: Excess visceral adipose tissue (VAT) is strongly associated with increased cardiometabolic risks. High-fat (HF) diets are a popular method for improving body composition. **Purpose:** To determine the role of HF diets in body composition and VAT. **Methods:** In a randomized, cross-over design, 12 healthy, sedentary individuals were assigned either to a HF or HC diet trial with a 20% reduction in total caloric intake from their typical diet. Participants maintained their 1st assigned diet for 2 weeks followed by a 1-week washout period where they consumed their typical diet. After the 1-week washout period, participants began the opposite diet trial (either HF or HC) for 2 weeks. The HF diet consisted of 70% fat and 30% carbohydrate and protein, with a limit of 50 grams of carbohydrate. The HC diet consisted of 70% carbohydrate and 30% fat and protein. Body composition including VAT in mass and volume were determined using dual-energy x-ray absorptiometry. **Results:** Total body mass decreased up to 1.5 kg from the pre-intervention (78.07 \pm 17.36 kg) following either the HF (76.63 \pm 15.99 kg) or HC (76.24 \pm 15.71 kg) trial, yet it was not statistically significant. VAT in mass and volume decreased following either the HF or HC diet from the pre-intervention (429.57 \pm 225.43g and 464.42 \pm 244.02cm³). However, the magnitude of change in VATmass and VATvolume was greater in the HF diet (374 \pm 159.59g and 404.14 \pm 172.54cm³) than the HC diet (388.71 \pm 184.73g and 420.42 \pm 199.93cm³) although it was not statistically significant. Notably, percent body fat decreased only following the HF diet (pre-intervention: 29.70 \pm 9.75, HF: 27.65 \pm 10.55, and HC: 29.15 \pm 11.43%). **Conclusion:** Although a short-term hypocaloric diet with either HF or HC did not yield a significant change in body composition, there was a strong trend showing that hypocaloric diets, whether HF or HC, can lower total body weight. HF diets though may be more effective than HC at decreasing body fat percentage and VAT. Our study only looked at changes after two-week dietary interventions in healthy sedentary individuals. Thus, future studies examining long term effects of HF diets in a variety of subject populations, including obese people, may provide more accurate information regarding a role of HF diets in body composition and visceral adipose tissue.

3534 Board #222 June 1 9:30 AM - 11:00 AM
Exploring The Utility Of Muac In Classifying Adult Metabolic Syndrome Risk Using Nhanes 2015-2016
 Hayley G. Boucher, Brian Miller, Laura Richardson, Judith A. Juvancic-Heltzel. *The University of Akron, Akron, OH.* (Sponsor: Dr. Ronald Otterstetter, FACSM)
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(No relevant relationships reported)

Metabolic syndrome (MetS) is a constellation of cardiometabolic risk factors (visceral adiposity, dyslipidemia, hyperglycemia, and hypertension) that, when presented in tandem, exponentially increases the risk of heart disease and insulin resistance. Finding a simple and validated screening method is critical to proactively intervene and attenuate the development of these cardiometabolic diseases, thereby improving healthcare outcomes such as quality of life and associated costs. The utility of mid-upper arm circumference as a metric of MetS risk has not been widely investigated. There is paucity in the literature exploring the relation between mid-upper arm circumference (MUAC) and MetS.

PURPOSE: This study defined and attempted to validate a risk criterion for MetS using MUAC as a valid alternative criterion for MetS classification risk. **METHODS:** The target sample was derived from National Health & Nutrition Examination Survey (NHANES) 2015-2016 data that included adults over the age of 18 ($N = 9,971$). MetS was defined using the NCEP ATP III 2005 MetS diagnosis criteria. A recursive partitioning methodology (RPM), using the Classification & Regression Tree

Algorithm, was employed to create binary MUAC criterion by sex, using 75% of the total sample. Validation of the criteria was performed with the remaining 25% of the total sample, selected at random.

RESULTS: Seventeen percent (17%) of the total sample presented with the MetS. The RPM resulted in sex specific MetS criteria with the MUAC criterion being >32 cm ($p = 0.024$) and >29 cm ($p = 0.024$) for males and females, respectively. Specifically, those presenting with the risk criteria were 9.84, for males, and 9.23, for females, times more likely to present with MetS than without the MUAC criterion. The overall classification accuracy for both the training and validation models were 83% with no statistical difference between models ($p = 0.983$). **CONCLUSIONS:** MUAC shows promise in being an effective screening method for MetS in guiding further diagnostic tests to prevent associated cardiometabolic morbidity and mortality.

3535 Board #223 June 1 9:30 AM - 11:00 AM
Patterns of Interrupting Prolonged Sitting and Postprandial Triglycerides in East-Asian Young Men with Central Obesity
 Waris Wongpipit, Jane J. Yu, Stephen H.S. Wong, FACSM. *The Chinese University of Hong Kong, Hong Kong, Hong Kong.*
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(No relevant relationships reported)

Prolonged sitting is related to an increased risk of morbidity and mortality. In the literature, frequent interruptions to prolonged sitting, e.g., every 30 min of sitting, have been found to be beneficial for cardiometabolic health. Interrupting prolonged sitting less frequently, however, may be preferred due to practical issues.

PURPOSE: To examine the acute effect of different frequency of interrupting prolonged sitting on postprandial triglycerides (TG) in young men with central obesity compared with prolonged sitting.

METHODS: Twenty-one East-Asian men with central obesity (mean age: 23.24 \pm 3.65 years; body mass index: 29.78 \pm 3.17 kg·m⁻²; waist circumference: 98.71 \pm 7.08 cm) completed three randomized 7-h laboratory-based trials including 1) a prolonged sitting trial (SIT), 2) 3-min walking every 30 min (3-min) at 3.2 km·h⁻¹, and 3) 6-min walking every 60 min (6-min) at 3.2 km·h⁻¹ separated by 7-14 days washout period. Standardized mixed meals (50% carbohydrate, 30% Fat, and 15% Protein) were provided at 0 and 3 h. Blood samples were collected at -1, 0, 0.5, 1, 2, 3, 3.5, 4, 5, and 6 h. TG concentrations were changed to total area under the curve (tAUC) using the Trapezoidal method. One-way (trial) and two-way (trial \times time) ANOVAs with repeated measures were used to compare tAUC value and TG concentrations, respectively.

RESULTS: Regarding the tAUC, the main effect of trial ($F_{2,40} = 4.210$, $P = 0.022$, $\eta^2 = 0.174$) was significant with 6-min trial (10.58 \pm 3.62 mmol·L⁻¹ per 7 h; $P = 0.020$) being lower than SIT trial (11.83 \pm 3.52 mmol·L⁻¹ per 7 h). There were no differences on the 7-h tAUC for TG concentrations between 3-min (11.52 \pm 3.47 mmol·L⁻¹ per 7 h; $P > 0.05$) and SIT trials as well as between 3-min and 6-min trials (both P s > 0.05). Regarding TG concentrations, the main effect of trial ($F_{2,40} = 4.448$, $P = 0.018$, $\eta^2 = 0.182$) was significant with 6-min trial being lower than SIT trial ($P = 0.013$). The main effect of time was also significant ($F_{9,180} = 66.589$, $P < 0.001$, $\eta^2 = 0.769$) with the TG concentrations significantly increased from 1 h to 6 h (all P s < 0.05) compared with the baseline (the average of TG concentrations between -1 and 0 h).

CONCLUSIONS: Interrupting prolonged sitting with 6-min trial elicits a superior benefit on reducing postprandial TG than SIT trial in East-Asian young men with central obesity.

3536 Board #224 June 1 9:30 AM - 11:00 AM
The Relationship Between a High Sugar-Low Fiber Dietary Food Intake and Obesity in a Clinical Setting
 Emma R. Lucas, Nicholas V. Neuwald, Arlette C. Perry, FACSM, Wesley N. Smith. *University of Miami, Coral Gables, FL.* (Sponsor: Arlette Perry, FACSM)
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(No relevant relationships reported)

Diets high in simple sugars and processed foods, and low in whole, fibrous plant foods have been linked to insulin resistance and weight gain. To prevent obesity and cardiometabolic disease, it is recommended that Americans limit intake of sugary beverages, fruit juices, added sugars, and processed carbohydrates, in favor of more fibrous foods such as whole fruits and vegetables, nuts, beans, whole grains, and seeds.

PURPOSE: To examine the relationship between frequency of foods consumed high in sugar and low in fiber (HSLF) with BMI. We hypothesized that a HSLF diet would be significantly higher among obese individuals (BMI ≥ 30) than non-obese (BMI < 30). **METHODS:** A total of 2,703 adults (1,521 females and 1,182 males) from a HealthSnap wellness assessment used in physicians' offices across the country were evaluated for anthropometric measurements and nutritional behaviors. HSLF consumption was evaluated from patients' self-reported intake of soda, juices, energy drinks, and other high sugar foods versus selection of whole grains, whole plant foods, nuts, beans, and seeds. To identify the association between HSLF and obesity, a

Chi-squared analysis (χ^2) was performed using quintiles of HSLF for obese and non-obese subjects. A relative risk (RR) was evaluated across data quintiles. **RESULTS:** A significant association between obesity and HSLF was observed (χ^2 [12, n = 2703] = 178.73, $p < 0.001$). Patients with HSLF in the highest 20%, Q5, had a 242% higher RR of obesity than those in the lowest 20%, Q1 (RR: 2.42, 95% CI: 1.95-3.03, $p < 0.001$). **CONCLUSION:** A diet encompassing foods high in sugar and low in fiber is associated with obesity. This supports the promotion of whole foods, high in fiber while limiting intake of foods high in sugar, as a simple recommendation to protect against obesity in a clinical setting.

3537 Board #225 June 1 9:30 AM - 11:00 AM
Acute Exercise Intervention Combined with Metformin's Influences on Glucose Homeostasis in T2D Mice

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(No relevant relationships reported)

Purpose: The aim of our investigation was to determine the effects of different ways of acute exercise intervention combined with high dose of metformin on glucose homeostasis and its relative molecular mechanisms in type 2 diabetic mice.

Methods: 4-week high fat diet (HFD) and one-time Streptozocin (100mg/kg) intraperitoneal injection were used for building T2D mice. 24 mice were divided into normal control (NC), normal acute resistance training (NCR) and normal acute endurance training (NCE) group, all n=8, fed in normal chow. Finally 48 mice were developing T2D and divided into diabetic control (DC), diabetic acute resistance training (DCR), diabetic acute endurance training (DCE), high dose of metformin (200mg/kg) control (HMC), metformin combined with acute resistance training (HMR) and metformin combined with acute endurance continuous training (HME) group, all n=8.

Results: The two ways also enhanced blood glucose and lipid metabolism in T2D mice. Compared to HMC group, hepatic G6Pase mRNA expression in HMR and HME group was significantly escalated and hepatic FBP1 mRNA expression of both groups were significantly declined. Compared to HMC group, hepatic GLUT2 and Gck mRNA expression in HMR and HME group showed opposite trends, one was down and the other was up. Compared to HMC group, hepatic PEPCK mRNA expression in HMR group mice was notably raised and hepatic AMPK α , PGC-1 α and CREB mRNA expression in HMR and HME group mice were notably increased and only hepatic AMPK α mRNA expression in HMR group was significantly increased.

Conclusions: Acute resistance training (ART) and acute endurance training (AET) combined with metformin can effectively improve glucose homeostasis in T2D mice. And the two ways can improve blood glucose and lipid metabolism in T2D mice. ART combined with metformin was better to improve glucose homeostasis and inhibit hepatic gluconeogenesis relative mRNA expression in T2D mice probably via the signaling pathway of AMPK α -PGC-1 α -CREB.

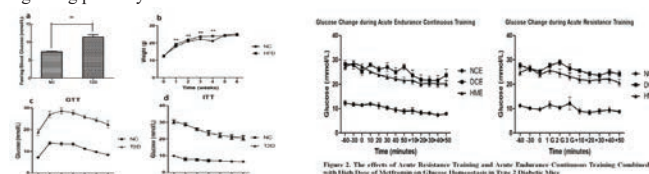


Figure 1: Bar graphs showing Glucose AUC and Insulin AUC for T2D mice under various conditions. The graphs show that combined treatment with metformin and exercise (HMR, HME) significantly reduces both Glucose AUC and Insulin AUC compared to the HMC control group.

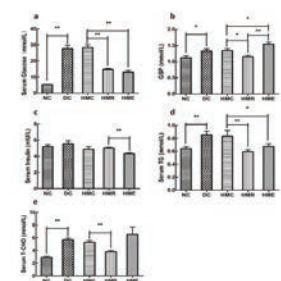


Figure 2: Line graphs showing the effects of acute resistance training (ART) and acute endurance training (AET) on glucose and insulin levels over time. The graphs show that both ART and AET groups maintain lower glucose and insulin levels during the test compared to the control groups.

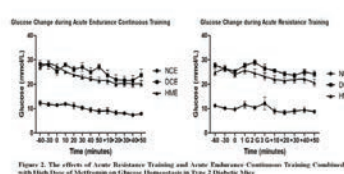


Figure 3: Line graphs showing the effects of acute resistance training (ART) and acute endurance training (AET) on glucose and insulin levels over time. The graphs show that both ART and AET groups maintain lower glucose and insulin levels during the test compared to the control groups.

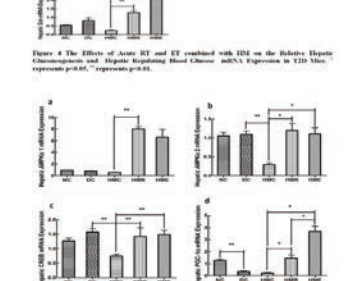


Figure 4: Bar graphs showing the effects of acute resistance training (ART) and acute endurance training (AET) on glucose and insulin levels over time. The graphs show that both ART and AET groups maintain lower glucose and insulin levels during the test compared to the control groups.

3538 Board #226 June 1 9:30 AM - 11:00 AM
Effect Of Combined Training On Metabolic Control In Type 2 Diabetes Overweight Patients.

Menaka N. Kalupahana¹, Katya Vargas-Ortiz¹, Claudia Luevano Contreras¹, Lorena Ibarra Reynoso¹, Arturo Figueroa, FACSM², Efraín Orozco Nieto³, Antonio E. Rivera⁴, Maciste H. Macías Cervantes⁵. ¹Universidad De Guanajuato, Leon, Mexico. ²Texas Tech University, Lubbock, TX. ³Clinica MIRA, Leon, Mexico. ⁴COMUDE, Leon, Mexico. ⁵Instituto de Investigaciones MÃ©dicas UG, LeÃ³n, Mexico. (Sponsor: Arturo Figueroa, FACSM)

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 (No relevant relationships reported)

PURPOSE: Aerobic exercise is accepted as therapy for control of glucose levels and body fat in type 2 diabetes (T2D). High-intensity interval training (HIIT) is new aerobic training method with benefits for T2D patients. There are few documented studies of traditional exercise plus HIIT effect on resting energy expenditure (REE) in T2D. The purpose was to compare the effect of traditional training (aerobic constant intensity+resistance) with new training (HITT + aerobic constant intensity + resistance) on REE and metabolic control in patients with T2D.

METHODS: Forty two sedentary people (Age = 50.7 \pm 6.1 years) with T2D were randomized to one of three groups for 16-week training program with dietary recommendation: new training (NT; n = 14) (85-100% HRmax 10 intervals of 1 minute; resistance: 12 repetition maximum (12RM); dietary recommendation), traditional (TT; n = 14) (65% -75% HRmax, resistance: 12RM, dietary recommendation) and control (C; n = 14 dietary recommendation). Body composition was measured by bio-electrical impedance (INBODY S10), REE was evaluated by indirect calorimetry (COSMED, FITMATE model). Maximum oxygen uptake (VO_{2max}), HRmax and Power (Watts/Kg body weight) were recorded during incremental exercise test (Monark 828 e). Glycosylated hemoglobin (HbA1c) and lipid profile were measures in fasting blood (12 hrs). Measurements were evaluated at baseline and 16 weeks.

RESULTS: The decrease in HbA1c was greater in NT compared to C (-23.1% \pm 10.2 vs -8.6% \pm 10.2; $p = 0.005$). BMI decreased in the NT compared to C group (-3.1% \pm 2.4 vs -0.1% \pm 3.0; $p = 0.03$) and power increased in NT compared to C (27.9% \pm 25.3 vs 6.3% \pm 20.5; $p = 0.05$). VO_{2peak} was increased in NT compared to C (19.8% \pm 18.1 vs 2.8% \pm 13.3; $p = 0.02$).

CONCLUSIONS: Our results indicate that NT improves aerobic fitness, BMI, and glucose control in patients with T2D compared to C, despite no changes in the REE among groups.

3539 Board #227 June 1 9:30 AM - 11:00 AM
Lactate Response During Graded Exercise Test In Individuals With Prediabetes After Aerobic Exercise Training

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PURPOSE: Prediabetes (PD) is a metabolic disorder that precedes type 2 diabetes. The lactate concentration at rest, the response of lactate during graded exercise test, and the effect of aerobic training (AT) on lactate adaptation in subjects with prediabetes is little known. **The aim** of this study was to measure the lactate response adaptation to AT in individuals with prediabetes.

METHODS: Twenty-one subjects participated (age 39 \pm 6 y; BMI 29 \pm 5.4 kg/m²); after a glucose tolerance test, they were classified as normoglycemic (NG, n=11) and PD (n=10) group according to the criteria of the American Diabetes Association. All participants performed a graded exercise test in cycloergometer (MONARK 828), capillary lactate was measured every 5 min as well as the power output at a lactate concentration of 4mmol/l. The maximal heart rate (HR max) and peak oxygen consumption (VO_{2peak}) were also determined. Blood biomarkers, anthropometric measurements, and physical capacity were evaluated before and after AT.

RESULTS: Participants in both groups showed no change in blood glucose and lipid profile. VO_{2peak} increased similarly ($p < 0.01$) in both groups (NG: 33.5 \pm 5.3 vs 37.9 \pm 6.5 ml/kg/min; PD: 33.5 \pm 4.1 vs 36.8 \pm 3.8 ml/kg/min). The lactate at rest was similar in both groups before intervention and did not change significantly after AT (NG: 1.39 \pm 0.5 vs 1.17 \pm 0.4 mmol/L; PD: 1.76 \pm 1.8 vs 1.59 \pm 0.8 mmol/L). However, after AT, it was observed that the workload needed to reach the lactate threshold (4 mmol/L) increased significantly in each group (NG: 89.9 \pm 16 vs 120 \pm 22 W, $p < 0.05$; PD: 87.6 \pm 16 vs 101 \pm 15 W, $p < 0.01$), without a difference between groups.

CONCLUSIONS: Nine weeks of AT resulted in increased exercise capacity in both NG and PD, which indicates that patients with PD manage to respond and adapt to an exercise program and increase their aerobic capacity.

3540 Board #228 June 1 9:30 AM - 11:00 AM
Effect Of Exercise Intervention On Expression And Translocation Of FAT/CD36 In Aging Mice

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The international trend of rehabilitation medicine is leaning towards the prevention of metabolic disease these years. Especially in the prevention of insulin resistance, exercise therapy has become an effective means of rehabilitation. In view of the close association of fatty acid metabolism with insulin resistance, the potential role of Fatty Acids Translocase/CD36 (FAT/CD36) in treatment of aging-induced insulin resistance has been attracted more attentions. However, the regulative role of FAT/CD36 in exercise improving insulin sensitivity remains unclear. **PURPOSE:** To determine the regulative role of FAT/CD36 in exercise improving aging-induced muscle insulin resistance.

METHODS: Male C57BL/6J mice (8-week old) were randomly divided into two groups: (1) control group (CON; n = 6) and (2) endurance exercise group (EX; n = 6). The treatment was administered for one year. The mRNA levels of FAT/CD36 and other fatty acid transporters were determined by semi-quantitative reverse-transcription polymerase chain reaction (RT-PCR). The protein levels of FAT/CD36 and insulin signaling pathway related molecules were examined by western blot analysis. The localization of FAT/CD36 were detected by immunofluorescence. The differences in means were analyzed by t test. **RESULTS:** Compared with the aging CON group, the mRNA levels of FAT/CD36 (1.000 ± 0.156 vs. 0.543 ± 0.051 , $P < 0.05$) and CPT-1 β (1.033 ± 0.167 vs. 0.528 ± 0.055 , $P < 0.05$) in the EX group were significantly decreased, while other fatty acid transporters were not significantly changed (FATP4: 1.000 ± 0.153 vs. 0.832 ± 0.036 , $P > 0.05$) and (FABPpm: 1.000 ± 0.048 vs. 0.718 ± 0.095 , $P > 0.05$). When compared to the aging CON group, the protein levels of FAT/CD36 were also significantly decreased in the EX group (0.415 ± 0.053 vs. 0.337 ± 0.021 , $P < 0.05$), as well as the phosphorylation levels of AKT (0.177 ± 0.012 vs. 0.290 ± 0.034 , $P < 0.05$) and ERK (0.098 ± 0.014 vs. 0.322 ± 0.088 , $P < 0.05$) were significantly increased. The immunofluorescent pictures showed that FAT/CD36 were localized to the caveolae of plasma membrane, but not the mitochondrial membrane.

CONCLUSIONS: Exercise intervention protects against aging-induced insulin resistance by regulating FAT/CD36 expression and translocation.

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3541 Board #229 June 1 9:30 AM - 11:00 AM
An Attempt To Reverse Diabetic Cardiomyopathy By Aerobic Interval Training In High-fat Diet And Streptozotocin Induced Type 2 Diabetes Rat Models

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Purpose: Diabetes mellitus (DM) is an important risk factors of cardiovascular disease. Long-term hyperglycemia, hyperlipemia and insulin resistance may lead to diabetic cardiomyopathy (DCM). No rodent models fully captured the whole process of cardiac morphology and function changes during the course of DCM. Aerobic interval training (AIT) has been advised as a non-pharmacological strategy against DM patients. However, little is known whether impose AIT intervention at the onset of DM will reverse the process of DCM. In this study, we sought to evaluate the cardiac function during the development of DCM and explore whether AIT will reverse the process of DCM. **Methods:** 60 Wistar male rats were randomly divided into control group (CON), DCM group (DCM) and AIT intervention group (AIT). Rats in DCM group and AIT group used high fat diet and STZ to induce diabetes models. Rats in AIT group were subjected to 8 weeks AIT intervention. Fasting blood glucose (FBG), lipid profiles, insulin resistance (IR) and GLP-1 levels was measured. HE staining and echocardiography were used to identify cardiac morphology and function. α -MHC and β -MHC gene expression were detected by RT-PCR. GLP-1 and GLP-1R expression were detected by western blotting.

Results: Compared with CON, the heart function of DCM gradually changes from impaired diastolic function to impaired systolic function, with heart developed hypertrophy at onset and gradually cardiac walls became thinner with large LV volume. The FBG, TG and LDL-c levels in AIT was 16.8%, 45.6% and 74.7% lower than that in DCM ($P < 0.01$). AIT increased HDL-c level up to 60% than DCM ($P < 0.01$). AIT significantly decreased IR for 37.3% ($P < 0.01$). Histological analysis and echocardiography results revealed that AIT prevent the thinners of cardiac wall and improve systolic and diastolic function. There is a 81% increase of α -MHC mRNA expression and a 67% decrease of β -MHC mRNA expression in AIT group than in

DCM ($P < 0.01$), which represented that AIT prevent the heart transformation to embryo type. AIT protect DCM heart through improving serum GLP-1 level (80%, $P < 0.05$), heart GLP-1 expression (144%, $P < 0.01$) and GLP-1R expression (219%, $P < 0.01$).

Conclusions: AIT intervention may reverse the process of DCM by activating of GLP-1/GLP-1R signaling.

3542 Board #230 June 1 9:30 AM - 11:00 AM
Predictors of Clinical Measures of Insulin Resistance

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Approximately 30.3 million adults in the United States have diabetes. Diabetic complications include stroke, myocardial infarction, nerve damage, and renal failure, among others. In addition to being the seventh leading cause of death in the country, the medical costs due to diabetes is over \$325 billion annually. Clinical evaluation for type II diabetes can be assessed in a variety of ways: fasting blood glucose (FBG), hemoglobin A1c (HbA1c) percentage, and the homeostatic model assessment of insulin resistance (HOMA-IR). The **PURPOSE** of this study was to evaluate the relationships between these clinical indicators and body composition, physical activity level, and glucose response to mixed nutrient challenge in older adults.

METHODS: In 38 subjects (7 m /31 f) body composition (bioelectrical impedance); blood glucose (glucometer); insulin (enzyme-linked immunosorbent assay); and HbA1c (HbA1c Analyzer) were assessed. In a subset of 30 subjects, physical activity was assessed via accelerometry (Actical). Further, in a subset of 16 subjects, glucose area under the curve (gAUC) was calculated following mixed nutrient challenge (0.5 g dextrose/kg lean mass + 0.3 g protein/kg lean mass). Partial correlations (controlling for age and sex) were utilized to examine associations. Significance was set as $p < 0.05$. **RESULTS:** Subject characteristics included: age= 67.9 ± 6.6 y, BMI= 29.3 ± 7.5 kg/m², FBG= 104.0 ± 19.0 mg/dL, HOMA-IR= 2.61 ± 1.95 , and HbA1c= $5.42 \pm 0.25\%$. FBG was significantly correlated with body mass ($r = 0.62$), body fat percentage ($r = 0.33$); and gAUC ($r = 0.59$). HOMA-IR was significantly correlated with body mass ($r = 0.64$) and body fat percentage ($r = 0.51$). HbA1c was significantly correlated with gAUC ($r = 0.83$). There was a trend for a correlation between HbA1c and habitual, daily moderate-to-vigorous intensity physical activity ($r = -0.36$, $p = 0.06$). **CONCLUSION:** These preliminary data support previous findings that clinical indices of insulin sensitivity are associated with body composition. Interestingly, our data show blood glucose response to mixed nutrient intake, but not FBG, is predictive of HbA1c.

3543 Board #231 June 1 9:30 AM - 11:00 AM
A Family History Of Type 2 Diabetes Does Not Limit Exercise Induced Improvement In Aerobic Fitness And Mitochondrial Function In Normoglycemic Sedentary Men

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A family history of type 2 diabetes (FH+) is considered a risk factor for the development of type 2 diabetes (T2D). However, it is unclear whether exercise induced improvements in insulin sensitivity (IS), maximal aerobic fitness (VO_{2max}), and mitochondrial maximum ATP synthesis rate (ATP_{max}), are impacted by a FH+.

PURPOSE: The purpose of this study was to 1) determine if normoglycemic, sedentary healthy individuals with FH+ have a lower IS, VO_{2max} , and ATP_{max} compared to those without a family history of T2D (FH-) and 2) if exercise induced changes in IS, VO_{2max} , and ATP_{max} is impeded in those with a FH+.

METHODS: Fourteen normoglycemic sedentary males with (n=6; age= 27.33 ± 2.65 years; BMI= 26.48 ± 1.25 kg/m²) or without (n=8; age= 26.63 ± 1.44 years, BMI= 26.46 ± 0.57 kg/m²) FH were trained on a stationary bicycle for 30-55 minutes/session on alternate days of continuous and interval training for 13 days over 3 weeks. Non-exercising control (n=8; age= 25.75 ± 1.85 years; BMI= 24.38 ± 1.31 kg/m²) without a FH completed the same testing procedures at baseline and after 3 weeks. IS was assessed by hyperinsulinemic euglycemic clamp. ATP_{max} was measured by magnetic resonance spectroscopy, and VO_{2max} was measured by a standardized graded exercise test.

RESULTS: There were no differences in IS, ATP_{max} and VO_{2max} between groups at baseline (one-way ANOVA all $p > 0.05$). Three weeks of exercise increased VO_{2max} only in FH- (Mean \pm SEM; Control 33.25 ± 1.68 to 32.66 ± 1.92 mL/kg/min, $p = 0.73$; FH- 33.47 ± 1.85 to 35.24 ± 1.60 mL/kg/min, $p = 0.03$; FH+ 29.96 ± 2.09 to 31.49 ± 2.07 mL/kg/min, $p = 0.14$), increased ATP_{max} only in FH+ (Control 0.68 ± 0.04 to 0.69 ± 0.04 mM ATP/s, $p = 0.98$; FH- 0.70 ± 0.05 to 0.73 ± 0.03 mM ATP/s, $p = 0.81$; FH+ 0.61

± 0.04 to 0.74 ± 0.05 mM ATP/s, $p=0.02$) but did not change IS in any group (Control 8.24 ± 0.93 to 7.00 ± 0.92 mg/kg/min, $p=0.38$; FH- 7.84 ± 0.82 to 8.42 ± 1.11 mg/kg/min, $p=0.87$; FH+ 5.39 ± 0.48 to 6.62 ± 0.83 mg/kg/min, $p=0.51$).

CONCLUSION: Three weeks of combined endurance and interval exercise training improved ATP_{max} and VO_{2max} overall, but did not change IS in normoglycemic sedentary individuals. FH+ does not seem to be a limiting factor for achieving exercise stimulated improvement in whole body aerobic fitness and mitochondrial function in a normoglycemic healthy sedentary population.

3544 Board #232 June 1 9:30 AM - 11:00 AM
Hyperbaric Treatment With Normal Air Prevents The Progression Of Hyperglycemia In Type 2 Diabetes

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Previous study reported that hyperbaric treatment with 36% oxygen decreases glucose and insulin level in type 2 diabetes rats, and the improvement could be due to increased oxygen saturation and blood flow during hyperbaric treatment. However, the effects of simple hyperbaric treatment without high oxygen remain unknown. **PURPOSE:** To investigate the effects of hyperbaric treatment with normal air on hyperglycemia in type 2 diabetes, focusing on skeletal muscle hemodynamics.

METHODS: 24-week-old male Otsuka Long-Evans Tokushima fatty (OLETF) rats and Long-Evans Tokushima Otsuka (LETO) rats were used as diabetes model and non-diabetes model, respectively. All rats were assigned to hyperbaric treatment or non-treatment groups. The rats in the hyperbaric treatment group were exposed to hyperbaric chamber at 1.3 ATA with normal air for 8 hours a day for 16 weeks. The oxygen saturation and total-hemoglobin (Hb) changes in the calf muscle during hyperbaric treatment was measured by near-infrared spectroscopy. Oral glucose tolerance test was performed at 40-week-old.

RESULTS: Oxygen saturation and total-Hb were significantly increased during hyperbaric treatment from 73.3 to 76.7% and 25.0 to 26.3 $\times 10^9$ /mm³ in OLETF rats, 71.1 to 74.8% and 20.1 to 22.5 $\times 10^9$ /mm³ in LETO rats ($p<0.05$). The glucose and insulin levels were significantly higher in OLETF rats than LETO rats at both fasting and after glucose administration ($p<0.05$). Among OLETF rats, the glucose levels at 30, 60, 120 min after glucose administration were significantly lower in the hyperbaric treatment group than the non-treatment group (30 min: 325 ± 71 vs. 385 ± 48 , 60 min: 332 ± 67 vs. 421 ± 111 , 120 min: 216 ± 45 vs. 230 ± 20 mg/dL, $p<0.05$). Additionally, the fasting insulin level and the levels at 120 min after glucose administration were significantly lower in the hyperbaric treatment group than the non-treatment group (Fasting: 3.6 ± 1.1 vs. 4.3 ± 2.7 , 120 min: 4.4 ± 1.6 vs. 5.2 ± 3.9 ng/mL, $p<0.05$).

CONCLUSIONS: The present study demonstrated that hyperbaric treatment with normal air also prevents the progression of hyperglycemia in OLETF rats, and the treatment without high oxygen increases oxygen saturation and blood flow in the skeletal muscle.

3545 Board #233 June 1 9:30 AM - 11:00 AM
Hit Increases Substrate Oxidation In Obese Adolescents With And Without Insulin Resistance

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(No relevant relationships reported)

PURPOSE: To verify the effect of HIT on cardiorespiratory performance and substrate oxidation in obese adolescents with and without insulin resistance. **METHODS:** Clinical trial with 25 obese adolescents, allocated to two groups: with insulin resistance (IR, $n=12$, HOMA ≥ 3.16) and no insulin resistance (nIR, $n=13$), submitted before and after six sessions of HIT to cardiopulmonary test for determination of oxygen consumption (VO₂), heart rate (HR), and velocity (V) at peak intensities and the first ventilatory anaerobic threshold (LAV1), more indirect calorimetry protocol for determination of lipid oxidation rate (LIPox) and carbohydrate oxidation rate (CHOox). The training protocol included six HIT sessions with 48h intervals, consisting of six series at 100% of Vpeak and active recovery at 50% of Vpeak. Data were treated by Student t or Mann-Whitney tests (comparisons between groups) and Student t or Wilcoxon tests (pre and post-training comparisons); the influence of HIT was tested by Cohen's d. The level of significance was 5%. **RESULTS:** Significant increases in Vpeak, VO₂, V and HR at LAV1 were observed in post-training in both

groups ($p<0.05$; $d<0.02$). As a consequence, the groups presented alterations in oxidation substrates patterns, with increases of 56.13% and 20.21% of CHOox for nIR ($p=0.03$) and IR ($p=0.06$), respectively. **CONCLUSION:** Six HIT sessions were sufficient to alter parameters of cardiorespiratory and CHOox performance in obese adolescents resistant or not to insulin, suggesting its use in potential implications for the regulation of physical fitness and glycemia in these populations.

3546 Board #234 June 1 9:30 AM - 11:00 AM
Weight Loss Combined with Increased Water Consumption Improves Cognitive Performance in Overweight Older Adults

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(No relevant relationships reported)

Existing research has established links between cognition and hydration in athletes and young adults, and a higher BMI has been linked to deficits in inhibitory control and attention. We recently reported that hydration status was associated with cognitive performance in overweight older adults. However, there is little work exploring the influence of weight loss interventions that also increase water intake on cognition. **PURPOSE:** This study investigated the impact of a short-term weight loss intervention with and without increasing water intake on attention and inhibition in older overweight adults. **METHODS:** Older adults aged 50-69 ($n=23$, 67% female, BMI = 32 ± 4) were randomly assigned to one of two groups for 4 weeks: 1) hypocaloric diet + 16 fl. oz. of pre-meal water 3 times/d ($n=13$; "water"), 2) hypocaloric diet with no additional water ($n=10$; "nonwater"). Assessments at baseline and week 4 included weight, hydration (urinary specific gravity; USG), and the AX-Continuous Performance Task (CPT), a measure of inhibitory control and attention. Univariate ANCOVAs with experimental condition as a fixed factor, pre-test as a covariate, and post-test performance as the dependent variable were used to examine the outcome of the intervention on cognition.

RESULTS: Weight loss was 4.7% (± 0.7) and 4.3% (± 0.2) of baseline bodyweight for water and non-water groups, respectively, with no group difference. Intervention compliance evaluated at week two demonstrated lower USG in the water group (1.009 ± 0.002) than the nonwater group (1.015 ± 0.002), ($p=0.067$). Furthermore, at week 4, the nonwater group was 7% faster ($p=0.046$) and 4% less accurate ($p=0.076$) than the water group on the final block of the CPT after controlling for baseline performance. These results suggest a speed-accuracy tradeoff, such that individuals who were randomized to drink additional water while consuming a hypocaloric diet performed more slowly but more accurately on the later stages of the attention task. **CONCLUSIONS:** Among older, overweight adults undergoing weight loss, increasing water consumption may reduce cognitive fatigue during an attention task such that more hydrated individuals may favor accuracy over speed, relative to less hydrated individuals.

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3547 Board #235 June 1 9:30 AM - 11:00 AM
Effectiveness Of 12-week Exercise Training On Body Composition And Lipid Metabolism Of Non-alcoholic Fatty Liver Disease

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(No relevant relationships reported)

Exercise training is often prescribed to treat non-alcoholic fatty liver disease (NAFLD). However, body-weight training, as a simple and convenient exercise method, the effectiveness on NAFLD is still unclear.

PURPOSE: To determine the effects of 12-week individualized body-weight training combined with aerobic training on body composition, blood lipid and liver function of NAFLD. **METHODS:** Thirty participants (male: 10, female: 10, age 45.82 ± 7.55 years) who were clinically diagnosed as NAFLD were randomized allocated to the experimental group (EG) with a trained program that 3 times per week over 12 weeks (30 min body-weight training, 30 min walking exercise at 40 - 60% heart rate reserve) or a control group (CG) with health education. Body composition, blood lipid and liver function were measured at baseline and after intervention.

RESULTS: At 12th weeks there were significant changes within group in body weight (-4.61 ± 1.87 kg, $p<0.01$), body mass index (-1.57 ± 0.78 kg/cm², $p<0.01$), waist circumference (-5.20 ± 2.81 cm, $p<0.01$), hip circumference (-5.07 ± 2.28 cm, $p<0.01$), body fat percent ($-1.86 \pm 1.62\%$, $p<0.01$), body fat mass (-1.69 ± 0.87 kg, $p<0.01$) and visceral fat (-1 ± 0.78 kg, $p<0.01$) in EG. There was no significant change in body composition of CG ($p>0.05$), all these changes were significant different between EG and CG ($p<0.05$). EG resulted in a significant increase in triglyceride (-0.56 ± 0.91 mmol/L, $p<0.05$), low-density lipoprotein cholesterol (-0.33 ± 0.53

mmol/L, $p < 0.05$), while total cholesterol and high-density lipoprotein cholesterol did not change significantly after exercise. Exercise training decreased Alanine aminotransferase (43.87 ± 31.34 to 23.53 ± 12.78 u/L, $p < 0.0001$) and Aspartate aminotransferase (33.87 ± 15.67 to 22.40 ± 6.32 u/L, $p < 0.0001$), which were significantly different from CG. **CONCLUSIONS:** Participates in regular combination exercise of body-weight exercise and aerobic exercise have marked beneficial effects on body composition, blood lipid and liver function on NAFLD.

3548 Board #236 June 1 9:30 AM - 11:00 AM

Post-Meal Walking Vs. Pre-Meal Vinegar Ingestion: Strategies to Reduce Postprandial Hyperglycemia

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Postprandial hyperglycemia is a risk factor for future CVD events. Lifestyle interventions to blunt postprandial glucose are needed to reduce diabetic and CVD risk. Apple cider vinegar, a "functional food", has been shown to attenuate the rise in glucose following a meal. Aerobic exercise may also reduce blood glucose (BG) levels when performed before or following a high-glycemic meal. **Purpose:** This study aimed to compare the effectiveness of post-meal vinegar ingestion and pre-meal walking in reducing postprandial hyperglycemia in elderly individuals. We also investigated whether this population will self-select walking speeds sufficient to reduce postprandial glucose spikes. **Methods:** Participants ($n=12$) reported for testing following a 3 hour fast. Baseline BG was measured upon arrival, after which participants completed one of three conditions in a randomized, crossover order: (1) Consumption of standard meal followed by 2 hours of sitting, (2) Consumption of standard meal with apple cider vinegar (.3g/kg BW) or (3) Consumption of a standard meal followed by 15 minutes of self-paced walking. BG was measured by finger stick at 30, 60, 90, and 120 minutes following meal consumption. The meal was designed to be high glycemic-index (GI) and included a bagel, butter, and orange juice. Total energy content of the meal was 470kcal (79g CHO [28gsugar], 12g FAT, 1g PRO). **Results:** The control trial confirmed BG rose significantly following the meal at 30 (167.8 ± 6.1 mg/dl vs. 91.8 ± 2.4 mg/dl; $p < .005$) and 60 minutes (172.8 ± 11.8 mg/dl vs. 91.8 ± 2.4 mg/dl; $p = .024$). There was no difference in BG area under the curve (AUC) at any time point following vinegar or walking interventions vs. control. However, following vinegar and walking, the absolute increase in BG at 30 minutes following the meal was significantly reduced vs. control ($\Delta 30$ BG in control 76.1 ± 7.0 mg/dl vs. vinegar 46.8 ± 9.2 mg/dl vs. walking 44.3 ± 7.5 mg/dl; $p < .05$). Speed was found to be correlated with BG AUC, such that an increase in walking speed was associated with a greater reduction in 2-hour glucose AUC ($R = .590$). **Conclusions:** Lifestyle interventions such as walking and vinegar ingestion may effectively lower postprandial glucose spikes. For elderly individuals these represent alternative therapies to aid in glucose management and improve metabolic health.

3549 Board #237 June 1 9:30 AM - 11:00 AM

Effects Of Different Exercise On Autophagy & Inflammation In Visceral Adipose Tissue Of Obese

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(No relevant relationships reported)

PURPOSE: to examine the impact of exercise on autophagy and inflammation response in visceral adipose tissue in obesity in order to explore the relationship between them in adipose tissue after exercise. **METHODS:** 42 obese mice were randomly divided into four groups as follows: high fat diet (HC, $n=9$), normal diet (NC, $n=9$), normal diet combined with endurance exercise intervention (NE, $n=12$), and normal diet combined with resistance exercise intervention (NR, $n=12$). NE and NR conducted treadmill and ladder climbing exercise respectively for 8 weeks. Then to detect the gene and protein expression of autophagy, inflammation, ER stress and antioxidant markers using RT-PCR and WB, in addition, TEM and IHC were used to observe the autophagosome in visceral adipose tissue. **RESULTS:** BW, Lee's index and BFI were significantly decreased in all three intervention groups, and there is a great decreasing in the two exercise group, but no difference between them. Atg5, Becn1 expression and LC3II/I were decreased significantly in NE and NR group compared with HC, meanwhile p62 expression were significantly increased. When compared with NC group, p62 expression were significantly increased in NE and not happened in NR group. Becn1 mRNA expression increased and p62 protein expression decreased significantly in NR group when compared with NE group. IL-1 β was decreased significantly in NC, NE and NR group compared with HC. In addition, IL-6 and IL-10 protein expression increased significantly both in NE and NR group. When compared with NC group, IL-6 and

IL-10 protein expression increased and IL-1 β was decreased significantly both in NE and NR group except IL-6 protein expression in NR group. IL-6 increased and IL-10 decreased significantly in NR group when compared with NE group. Finally we found that IL-10 showed a negative correlation with almost every autophagy markers used in this study.

CONCLUSIONS: The effectiveness of 8wks different exercise intervention had no difference in fat reduction. The autophagic activity of visceral adipose tissue was inhibited after exercise, especially after aerobic exercise. Autophagy and inflammation enjoy the same trend before and after exercise in visceral adipose tissue in obesity, and the IL-10 is the most sensitive factor in reflecting the relationship between autophagy and inflammation.

3550 Board #238 June 1 9:30 AM - 11:00 AM

"Living High-training Low" Improves Hepatic Steatosis In Obese Mice

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(No relevant relationships reported)

"Living high-training low" (LHTL) is effective for weight loss in nutritional obese individuals. But whether the LHTL improves hepatic steatosis is unknown.

PURPOSE: To explore the effect of LHTL on serum lipids and hepatic steatosis in obese mice.

METHODS: High-fat diet induced obese mice (male C57BL/6J) were randomly divided into obesity (OB, $n=9$) and "Living high-training low" group (LHTL, $n=9$), both of which were fed a high-fat diet that fat provides 60% calories (Research Diets). Mice in OB group were kept quiet, while mice in LHTL group conducted hypoxia exposure (Mixing nitrogen and air, PO₂ 14.7%, from 08:30 to 16:30, 8 h/d, 6 d/w) and exercise training (starting at 20:00, treadmill slope is zero, 14 m/min, 840 m/d, 6 d/w) intervention for 4 weeks. Animals were euthanized after the intervention. Body weight (BW), fat mass (FM), body fat percentage (BFP), liver index, serum High/low density lipoprotein cholesterol (HDL/LDL-C), Triglyceride (TG), Alanine aminotransferase (ALT), Free fatty acids (FFA), liver FFA and Histological staining (HE & Oil red O) were measured.

RESULTS: LHTL 1) reduced BW (38.41 ± 0.74 vs. 44.21 ± 0.74 g, $p < 0.01$), FM (2.06 ± 0.09 vs. 2.45 ± 0.14 g, $p < 0.05$) significantly, while BFP (5.76 ± 0.30 vs. $6.49 \pm 0.29\%$, $p > 0.05$), serum HDL-C (0.72 ± 0.01 vs. 0.72 ± 0.01 μ g/ μ l, $p > 0.05$), LDL-C (0.66 ± 0.02 vs. 0.68 ± 0.01 μ g/ μ l, $p > 0.05$), TG (0.20 ± 0.02 vs. 0.20 ± 0.03 pmol/L, $p > 0.05$) and FFA (722.59 ± 40.74 vs. 606.06 ± 15.97 μ mol/L, $p > 0.05$) levels showed no significant difference between the two groups; 2) reduced liver index (3.58 ± 0.12 vs. $4.45 \pm 0.19\%$, $p < 0.01$), serum ALT (5.06 ± 0.12 vs. 6.28 ± 0.31 U/L, $p < 0.01$) and liver fat content significantly while liver FFA (0.11 ± 0.01 vs. 0.13 ± 0.01 μ mol/L, $p = 0.131$) only showed a downward trend.

CONCLUSIONS: "Living high-training low" is effective for weight loss and improves hepatic steatosis without attenuating circulating dyslipidemia. Supported by NSFC (Grant No. 81472148; 31671242).

No potential conflicts of interest relevant to this abstract were reported.

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3551 Board #239 June 1 9:30 AM - 11:00 AM

Effects Of Nutritional Status On Arterial Stiffness In The Subjects With Pre-sarcopenia

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(No relevant relationships reported)

Sarcopenia associated with arterial stiffness and poor nutrition intake. However, it is unclear whether the effects of nutritional status on arterial stiffness in the subjects with pre-sarcopenia.

PURPOSE: The purpose of this study was to investigate whether the effects of nutritional status on arterial stiffness in the subjects with pre-sarcopenia in Japanese men and women. **METHODS:** The participants included 56 Japanese adults (44-77 years). Men ($n=15$) and women ($n=41$) in whom skeletal muscle index (SMI; appendicular muscle mass/height²) was measured by dual-energy X-ray absorptiometry. Pre-sarcopenia was defined as the cut-off value of SMI based on Asian Working Group for Sarcopenia. We assessed nutritional status by Brief-type self-administered Diet History Questionnaire, and the subjects divided into high- and low- nutritional status based on the mean values of this study independent of gender.

RESULTS: Two-way ANCOVA with adjustment for age, gender and physical activity as a covariate indicated that total energy intake and sarcopenia interacted to produce a significant effect on the brachial-ankle pulse wave velocity (baPWV) in Japanese adults ($P < 0.05$). The baPWV was significantly higher in the subject with coexisting sarcopenia and low-energy intake than that with non-sarcopenia regardless of total energy intake. **CONCLUSION:** Low-energy intake effects on arterial stiffness in the subjects with pre-sarcopenia even adjustment of age and physical activity involved. Future prospective studies are needed to assess the effects of nutritional status on

arterial stiffness in sarcopenia. Supported by Grant-in-Aid for Scientific Research from the Ministry of Education, Culture, Sports, Science and Technology of Japan (#24300239).

3552 Board #240 June 1 9:30 AM - 11:00 AM
Effects of Novel Compression Exercise Technology on Glycohemoglobin Levels and Weight in Type II Diabetics

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Reported Relationships: C. Torres: Salary; Vaspar Systems.

The most potent lifestyle intervention for treatment of Type II Diabetes (T2D) is consistent exercise. However, for many patients with the condition, other comorbidities such as osteoarthritis, hypertension, and high body mass indexes prevent them from being able to exercise intensively and consistently enough to experience optimal metabolic benefits. Recent research has supported the use of compression exercise in physically limited populations and demonstrated physiologic responses at lower intensities (10-20% one repetition maximum vs. 70% for hypertrophic response in conventional resistance exercise). The combination of compression technology with core cooling further lowers the exertional requirements and has been used in cardiopulmonary rehabilitation populations to provide a safe and reliable exercise intervention. Compression exercise has also been shown to significantly increase muscle hypertrophy, with a greater growth in type II fibers (higher expressers of GLUT4). Therefore, this technology could directly address basal metabolism through increasing muscle protein turnover, increasing glucose storage in skeletal muscle mass, and improving glycemic control. This capacity to attenuate the insulin response combined with the accessibility of the platform suggests a clinical implication for diabetes management.

PURPOSE: To establish safe use of cooled compressive exercise in Type II Diabetics and to examine the effect of 6 months of training on biometabolic markers, especially Glycohemoglobin levels and weight.

METHODS: Thirty Type II Diabetics agreed to 3 training sessions a week for 6 months. Biometabolic markers via blood draw were analyzed at 0, 3, and 6 months.

RESULTS: Midpoint data from 16 participants at 0 and 3 months were analyzed with a two-tailed T-test, revealing significant differences in Glycohemoglobin and weight. There was an 8% average decrease in Glycohemoglobin levels (8.5 ± 2.2 vs. 7.8 ± 1.8 mg/dl, $p = 0.002$) and an average weight loss of 3.6 lbs (211 ± 50 vs. 208 ± 48 lbs, $p = 0.032$).

CONCLUSION: The preliminary results of this study suggest exercise with compression and cooling contributes to a reduction in biometabolic markers of diabetes. This intervention has promise in contributing to effective management of T2D with a low physical burden.

3553 Board #241 June 1 9:30 AM - 11:00 AM
High-fat Diet-induced Obesity Induces Peripheral Neuropathy During Impaired Cutaneous Wound Healing

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(No relevant relationships reported)

Type-II diabetes is a societal epidemic that is associated with obesity and metabolic disease often resulting from poor diet and reduced physical activity. Two major complications associated with type-II diabetes are peripheral neuropathy which leads to a loss of sensation and chronic pain as well as poor wound healing, which can progress to ulceration and ultimately amputation. Since clinical trials for the treatment of these chronic conditions have only fostered limited success we examined the possibility that the nervous system and wound repair are linked. The **PURPOSE** of this study was to investigate the potential that the peripheral nervous system is a necessary regulator for normal wound repair and that diabetes-induced neuropathy is in part, causative of impaired wound healing. **METHODS:** We administered a 6 mm skin punch biopsy wound to high-fat diet (HFD, 10 weeks of feeding with 60% of energy from fat content, $n=9$) and control (10% of energy via fat content, $n=9$) fed mice. **RESULTS:** A diabetic phenotype was confirmed in HFD mice as evidenced by elevated body weight (Control mean weight=32.4g, HFD mean weight=40.7g) and impaired glucose tolerance ($p < 0.05$) in response to an intraperitoneal glucose tolerance test. Following skin injury, HFD mice demonstrated an impaired wound healing rate as evidenced by a larger wound diameter and area ($p < 0.05$) at days 2-9 while hematoxylin, and eosin staining of tissue-cross sections revealed larger wound widths and a poorly formed dermis in HFD mice in comparison to controls at day 9. Immunohistochemical analysis demonstrated that poor wound healing was coincident with a reduction of S100 β cutaneous Schwann cells within and around the healing dermis. Ongoing analysis includes the examination of additional markers of cutaneous neuropathy using immunohistochemistry to quantify total nerve axons (UCHL-1+ cells), growing/regenerating axons (Gap43+ cells) and markers of activated/

dedifferentiated Schwann cells (p75NTR+;Sox2+ cells) as well as testing the efficacy of Schwann cell transplantation to rescue HDF-induced neuropathy and wound healing deficits. **CONCLUSION:** Collectively, these experiments will give insight into the mechanisms underpinning two major complications associated with type-II diabetes that could be further explored to develop novel therapeutics.

3554 Board #242 June 1 9:30 AM - 11:00 AM
Home Cooked Meals With Whole, Plant Foods and the Protection Against Central Adiposity

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(No relevant relationships reported)

It is well-established that central adiposity (CA) is associated with the risk of chronic disease. Diets high in processed foods and low in whole, fibrous plant foods, are often cited as risk factors for the development of CA and its adverse metabolic sequelae. Much of the processed foods consumed consist of pre-prepared foods and foods eaten outside of the home.

PURPOSE: To examine whether the consumption of processed, ready-to-eat (PRE) or restaurant meals that lack whole, plant-based foods was positively associated with CA in male and female adults. **METHODS:** A total of 2,703 adults (1,521 females and 1,182 males), from a HealthSnap wellness assessment platform used in physicians' offices across the country, self-reported their frequency of consuming PRE foods or restaurant meals versus whole, plant foods. CA was based upon a waist-to-hip ratio of ≥ 0.95 and ≥ 0.85 for males and females, respectively. To identify the association between PRE and CA, a chi-squared analysis (χ^2) was performed across quintiles of PRE by CA, and a relative risk (RR) was calculated. **RESULTS:** A significant association between PRE and CA (χ^2 [4, $n = 2703$] = 48.27, $p < 0.001$) was observed. These associations remained significant regardless of gender. The RR for CA among patients in the top 20%, Q_5 , was compared to the lowest 20%, Q_1 , for PRE. The RR of a patient having CA in Q_5 for PRE was 225% greater than Q_1 (RR: 2.25, 95% CI: 1.69-2.99, $p < 0.001$). **CONCLUSION:** A strong positive association exists between dietary consumption of PRE and CA. This supports the consumption of more home-cooked meals with whole, plant foods over PRE in the clinical setting to protect against CA and its adverse health consequences.

3555 Board #243 June 1 9:30 AM - 11:00 AM
Role Of Aerobic Exercise On Cardiac Autonomic Modulation And Adipokines In Polycystic Ovary Syndrome

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(No relevant relationships reported)

Women with Polycystic Ovary Syndrome (PCOS) present substantial weight gain that may increase the risk of developing cardiovascular diseases. Hormonal, metabolic and cardiac autonomic changes also occur and increase the risk of these diseases. However, despite advances, the effects of aerobic exercises on the different aspects of this syndrome are still unknown, especially when the body fat percentage is considered. **PURPOSE:** To investigate the effects of aerobic exercise on hormonal and metabolic aspects and cardiac autonomic modulation in women with PCOS with different percentages of body fat. **METHODS:** Women with PCOS ($N=60$) and without PCOS (control, $N=60$), between the ages of 18 and 39 years, were divided into three groups, according to their body fat percentage (22-27%, 27-32% and 32-37%). The participants were submitted to assessment of the following parameters before and after the aerobic physical training (16 weeks); body composition, fasting glucose and insulin, androgens, leptin, adiponectin, tumor necrosis factor- α (TNF- α), interleukin-6 (IL-6), and the analysis of heart rate variability (HRV). **RESULTS:** Women with PCOS had increased serum levels of androgens, insulin (insulin resistance), leptin, TNF- α and IL-6 associated with reduced serum levels of adiponectin. Autonomic assessment revealed that these women also exhibited an impaired autonomic modulation characterized by reduced HRV, but mainly in high-frequency oscillations (HF=0.2-0.5Hz), corresponding to vagal modulation. These findings were directly associated with the body fat percentage; however, according to some parameters evaluated (insulin, TNF- α , IL-6 and HRV), PCOS seems to play a key role. In turn, the aerobic physical training was effective in improving almost all the parameters evaluated, except the serum levels of androgens and TNF- α . **CONCLUSIONS:** The results showed that PCOS has been found to be associated with significant endocrine/metabolic disturbances and cardiovascular autonomic dysfunction, which are exacerbated by overweight. Aerobic physical training proved to be an effective treatment for most parameters evaluated and should be prescribed as an adjunct treatment for PCOS, the same way it has been used to treat chronic degenerative diseases.

Supported by CNPq (457216) and FAPESP (07561-0) Grants

3556 Board #244 June 1 9:30 AM - 11:00 AM

Aerobic Exercise Reduced Body Weight through Midbrain-striatal Dopaminergic Plasticity in Obese MiceWei Chen, Juan Li, Yuxiu He, Yakai Niu. *Hebei Normal University, Shijiazhuang, China.*

(No relevant relationships reported)

PURPOSE: Previous research indicates that midbrain-striatal dopaminergic disruption is associated with obesity and involved in feeding behavior and voluntary physical activity. Since the action of exercise on midbrain-striatal dopamine, it may be an effective strategy to improve physical inactivity and overeating induced by food reward dysfunction in obesity. We therefore explored the mechanisms.

METHODS: Male C57BL/6 mice were randomly divided into control group (C, n=12), exercise group (CE, n=12) fed a normal diet (13% fat), and an additional group (H, n=40) fed a high fat diet (51% fat). Obese mice in H were further divided into obesity group (O, n=12) and obesity + exercise group (OE, n=12). The CE and OE mice underwent treadmill exercise (5-13 m/min, about 58%-75% VO₂max, 50 min/d, 5 d/wk for 8 wks). The food preference test and open-field test were used to assess food reward, and voluntary physical activity. Tyrosine hydroxylase (TH)⁺ neurons were detected by immunohistochemistry, and the expression of TH protein in midbrain-striatum were measured by western blot.

RESULTS: Body weight of OE was 15.2% lower than that of O ($P < 0.01$). Sucrose preference, physical activity level and time were decreased by 25.8%, 46.77% and 37.56% in O compare to C ($P < 0.05$, $P < 0.01$, $P < 0.01$), but were 18.2%, 37.28% and 26.35% higher, respectively, in OE than O ($P < 0.05$). TH⁺ cells in substantia nigra pars compacta (SNc) and ventral tegmental area (VTA) decreased by 15.41% and 18.45%, respectively, in O compare to C ($P < 0.05$), but increased by 12.62% and 15.53% in OE compare to O ($P < 0.05$). TH⁺ fibers in dorsal striatum nucleus accumbens were 16.36% and 17.48% lower in O than C ($P < 0.05$), but was 12.54% and 14.13% higher in OE vs. O ($P < 0.05$). In addition, the expression of TH protein in midbrain and striatum decreased by 18.46% ($P < 0.05$) and 16.35% ($P < 0.05$) in O compared with C, but increased by 12.23% and 11.58% in OE compare to O ($P < 0.05$).

CONCLUSIONS: The aerobic exercise inhibits body weight gain, improves food reward and voluntary physical activity in obese mice. The exercise-induced midbrain-striatal dopaminergic plasticity may be one of the important mechanisms for this adaptation.

3557 Board #245 June 1 9:30 AM - 11:00 AM

Effect Of Physical Training In Leptin-deficient Ob/ob Mice: Oxidative Stress Evaluation In Prefrontal CortexMatheus Santos de Sousa Fernandes, Sr.¹, Lucas Lucena¹, Diorginis José S. Ferreira², Anderson Pedroza³, Severina Andrade-Silva³, Glauber Braz³, José Stefano Tadeu, PhD¹, Fabiana Sant'anna Evangelista, PhD¹, Claudia Pinto Marques Souza de Oliveira, PhD, MD¹, Claudia J. Lagrancha³. ¹University of São Paulo, São Paulo, Brazil. ²Federal University of São Francisco Valley, Petrolina, Brazil. ³Federal University of Pernambuco, Vitória de Santo Antão, Brazil.

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(No relevant relationships reported)

PURPOSE: The overweight/obesity affects brain function from cellular to structural levels, and due to the mitochondria importance, several studies have focused upon its involvement in the obesity and brain function. On rodents, previous data have already identified impairments of the prefrontal cortex triggered by obesity and its association with the oxidative stress. As the effect of moderate exercise training in the amelioration of the oxidative balance on prefrontal cortex was not examined in leptin-deficient ob/ob mice, this study assesses the effect of moderate physical exercise on oxidative stress parameters in the prefrontal cortex of leptin-deficient ob/ob mice. **METHODS:** Male ob/ob mice (Jackson Laboratories, Bar Harbor, ME, USA) with nine-weeks-old (32 g) were assigned into groups sedentary (S) and trained (T), housed in temperature and humidity controlled rooms, and kept on a 12 h light/dark cycle with food and water ad libitum. The physical training was performed at 60% of the maximal running capacity, 5 times/week, for 8 weeks. Forty-eight hours after last training, the animals were sacrificed and the prefrontal cortex quickly collected for oxidative balance analysis.

RESULTS: We did not observe differences in the lipid ($p=0.3285$) and protein oxidation ($p=0.3208$) in leptin-deficient ob/ob exercised mice, with concomitant unchanging in the superoxide dismutase activity ($p=0.2366$) and catalase ($p=0.7068$). However, we observed that the physical training significantly increased glutathione-S-transferase activity (S: 0.93 ± 0.3 vs. T: 3.63 ± 0.8 U/mg prot; $p=0.04$). Moreover, the physical training increased the non-enzymatic antioxidant defense (GSH= S: 5.1 ± 0.3 vs. T: 6.4 ± 0.6 μ M/mg prot, $p=0.04$; -SH levels= S: 0.016 ± 0.003 vs. T: 0.031 ± 0.001 mM/mg prot, $p=0.02$). Additionally, we evaluated the AMPK and PGC1 α gene expression, and we observed that AMPK wasn't modified after 8 weeks of physical training ($p=0.86$), however, PGC1 α expression increased significantly (S: 1.00 ± 0.2 vs. T: 1.98 ± 0.20 ddCt; $p=0.013$). **CONCLUSIONS:** We suggest that physical

exercise can minimize the detrimental effect of the obesity-induced oxidative stress in prefrontal cortex by activates an important transcriptor factor and possibly stimulates mitochondrial biogenesis.

G-42 Free Communication/Poster - Cancer

Saturday, June 1, 2019, 7:30 AM - 11:00 AM

Room: CC-Hall WA2

3558 Board #246 June 1 9:30 AM - 11:00 AM

Severity of Fatigue is Associated with Cardiorespiratory Fitness in Cancer SurvivorsRosie Twomey¹, Mary E. Medysky², John Temesi³, S. Nicole Culos-Reed¹, Guillaume Y. Millet⁴. ¹University of Calgary, Calgary, AB, Canada. ²Oregon Health & Science University, Portland, OR. ³Northumbria University, Newcastle upon Tyne, United Kingdom. ⁴Univ Lyon, UJM-Saint Etienne, Saint-Etienne, France.

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(No relevant relationships reported)

Cancer-related fatigue (CRF) is defined as a distressing, persistent, subjective sense of physical, emotional, and/or cognitive tiredness or exhaustion related to cancer or cancer treatment that is not proportional to recent activity and interferes with usual functioning. It has previously been suggested that CRF is associated with cardiorespiratory deconditioning. However, there is a lack of data to support this hypothesis. **PURPOSE:** To investigate: (i) peak oxygen uptake (VO_{2peak}) in fatigued vs. non-fatigued cancer survivors; and (ii) the relationship between VO_{2peak} and CRF severity. **METHODS:** Participants ($n=86$) were recruited via a cancer-registry mail-out and from local cancer centres. Participants were allocated into two groups using the Functional Assessment of Chronic Illness Therapy-Fatigue (FACIT-F) scale and a previously established cut-off (score of ≤ 34 and >34 for fatigued and non-fatigued, respectively). Participants categorized as fatigued ($n=48$ [25 female]; mean \pm SD age 55 ± 9 years; FACIT-F 27 ± 6) and non-fatigued ($n=38$ [21 female]; age 57 ± 11 years; FACIT-F 44 ± 5) performed an incremental exercise test to volitional exhaustion on a cycle ergometer. Data were compared to reference standards based on sex and age. Differences between groups were compared using an independent samples t -test. The association between FACIT-F score and VO_{2peak} was examined using linear regression. **RESULTS:** In comparison to reference standards, 23% of the fatigued group and 5% of the non-fatigued group were below the 50th percentile for VO_{2peak}. VO_{2peak} was significantly lower in the fatigued vs. non-fatigued group (25.7 ± 6.0 vs. 30.4 ± 5.9 mL.kg⁻¹.min⁻¹; $t_{(84)}=3.9$; $p<0.001$; $d=0.8$). There was a significant association between FACIT-F score and VO_{2peak} ($r=0.36$; $p=0.001$). The variance in VO_{2peak} explained 13% of the variance in FACIT-F score. **CONCLUSIONS:** Cardiorespiratory fitness was associated with the severity of CRF. In cancer survivors with CRF of a clinically-relevant severity, VO_{2peak} was lower in comparison to cancer survivors categorised as non-fatigued. Although CRF is complex and multifactorial, an improvement in cardiorespiratory fitness may explain some of the improvement in CRF severity with aerobic exercise interventions.

3559 Board #247 June 1 9:30 AM - 11:00 AM

Comparing Modified Treadmill Protocols for Cancer Survivors: A Pilot StudyDaniel Y.K. Shackelford, Jessica M. Brown, Edwin R. Rodriguez, Richard K. Thomas, Jessica J. Ruffert, Anne E. Smith, Kieran J. DeGroot. *Carroll University, Waukesha, WI.*

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(No relevant relationships reported)

INTRO: The University of Northern Colorado Cancer Rehabilitation Institute (UNCCRI) treadmill protocol has been validated to accurately predict peak oxygen consumption (VO_{2peak}) in the cancer population. It is unknown if the Modified Bruce and Balke-Ware treadmill protocols are an accurate means to assess VO_{2peak} in cancer survivors. **PURPOSE:** Determine whether the Modified Bruce and Balke-Ware treadmill protocols yield similar VO_{2peak} values and are as feasible as the UNCCRI protocol in the cancer population. **METHODS:** Eight cancer survivors participated in the study, one of which dropped out. All participants performed three VO_{2peak} treadmill tests using the following protocols: UNCCRI, Modified Bruce, and Balke-Ware. One protocol was performed per week in a randomized order. VO_{2peak} values were obtained via gas analysis using a research-grade CosMed metabolic cart. A Kruskal-Wallis test was used to determine differences in VO_{2peak} between all three protocols. **RESULTS:** VO_{2peak} values (mL.kg⁻¹.min⁻¹) did not significantly differ between the UNCCRI (27.1 ± 5.8), Modified Bruce (27.3 ± 5.5), or Balke-Ware treadmill protocols (28.8 ± 5.8) ($p=0.42$). **CONCLUSION:** The findings from this limited data set suggest that the Modified Bruce and Balke-Ware may be suitable in

determining VO₂peak in cancer survivors. However, these are not cancer-specific protocols and may be difficult to perform in patients suffering from severe muscular impairments, cachexia, balance issues, peripheral neuropathy, and/or cancer-related fatigue. The Modified Bruce has large and abrupt single-stage increases in speed and grade and the Balke-Ware has a faster, consistent speed of 3.5 mph. Attempting either of these two protocols with the aforementioned side effects may cause early test termination due to non-cardiovascular reasons, be a barrier to testing, and result in an inaccurate VO₂peak. The UNCCRI protocol accounts for cancer side effects by using a more gradual increase in speed and grade, resulting in validated and accurate values. Nevertheless, valid VO₂peaks may be achieved from the Modified Bruce and Balke-Ware if the participant is not suffering from any severe side effects and is fully able to exert themselves during testing, as occurred in this pilot study. Further data collection is needed to expand upon these findings.

3560 Board #248 June 1 9:30 AM - 11:00 AM
Exercise as Supportive Care Has Selective Benefits for Chemotherapy Tolerance and Weight Gain

Amy A. Kirkham¹, Kelcey A. Bland², Karen A. Gelmon³, Donald C. McKenzie⁴, Kristin L. Campbell, FACSM⁴.
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PURPOSE: To determine whether chemotherapy tolerance and side effects differ among women with breast cancer who do and do not participate in an exercise program.

METHODS: Women with early stage breast cancer who were offered supervised exercise programming as supportive care during adjuvant chemotherapy (n=73) were compared to a randomly selected, retrospective, usual care group (n=87). Exercise programming included supervised moderate-intensity aerobic and whole-body resistance training 3x/week plus home-based aerobic training 2x/week. Clinical data were extracted from medical records in a standardized manner for both groups. Weight gain was defined as ≥0.5 kg increase in body weight from chemotherapy records. Complete blood counts were extracted to determine prevalence of anemia and neutropenia.

RESULTS: The groups were matched on age, body mass index, medical history, diagnosis, and treatment characteristics. The relative dose intensity and risk of a dose reduction of any chemotherapy type did not differ between groups. Neuropathy was the most common reason for a dose reduction and the prevalence did not differ between groups. Dose reductions due to neutropenia or fatigue were significantly less common, while dose reductions due to mucositis were more common in the exercise group (all p<0.04). The severity, frequency, and risk of experiencing neutropenia and anemia did not differ between groups. Most (95%) patients experienced anemia, while one-third experienced neutropenia for at least 1 treatment cycle. There were some agent-specific effects of exercise including 1) a relative risk reduction of a doxorubicin dose reduction (relative risk, RR=0.40, 95% CI=0.17-0.94, p=0.04), but not for docetaxel or paclitaxel; and 2) risk reduction of weight gain with receipt of docetaxel and cyclophosphamide (RR=0.61, 95% CI = 0.37-1.00, p=0.05) but not with receipt of doxorubicin and cyclophosphamide.

CONCLUSIONS: Women who participated in a supportive care exercise program did not experience greater overall tolerance for chemotherapy treatment. However, exercise may have some selective effects on tolerance for doxorubicin chemotherapy, weight gain with docetaxel chemotherapy, and dose reductions due to neutropenia and fatigue.

3561 Board #249 June 1 9:30 AM - 11:00 AM
Adherence And Attendance During Versus After Chemotherapy In Exercise Influence On Taxane Side Effects

Kendra Zadravec¹, Kelcey A. Bland², Amy A. Kirkham³, Josh Bovard¹, Tamara Shenkier⁴, David Zucker⁵, Margot K. Davis¹, Donald C. McKenzie¹, Karen A. Gelmon⁴, Kristin L. Campbell¹. ¹University of British Columbia, Vancouver, BC, Canada. ²Australian Catholic University, Melbourne, Australia. ³University of Alberta, Edmonton, AB, Canada. ⁴British Columbia Cancer Agency, Vancouver, BC, Canada. ⁵Seattle Cancer Institute, Seattle, WA.
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 (No relevant relationships reported)

Exercise throughout cancer treatment can positively affect clinical and patient-reported outcomes. However, adverse side effects (e.g. fatigue) may reduce exercise adherence

during chemotherapy. To potentially further improve patient prognosis, developing strategies to maximize exercise participation across the cancer treatment trajectory is warranted. **Purpose:** To compare adherence and attendance to a supervised multimodal exercise intervention completed during chemotherapy for breast cancer to the same intervention completed after chemotherapy. **Methods:** Women with stage I-III breast cancer were randomized to: 1) immediate exercise during chemotherapy (IE); or 2) delayed exercise after chemotherapy (DE). The exercise intervention matched the length of each participant's chemotherapy regime (8-12 wks) and included 3x/wk supervised aerobic (50-75% HRR, 30-35 min), resistance (1-2 sets, 10-12 reps, 50-65% estimated 1-RM), and balance training. Mean attendance and adherence to aerobic (i.e. intensity/duration) and resistance (i.e. sets/reps) exercise were calculated. Exercise trainers recorded reasons for missed sessions. **Results:** 26 women enrolled and attended ≥1 session (IE: n=12, DE: n=14). Attendance did not differ between groups (IE=79±24%, DE=81±21%, p=0.82). No group differences were found for adherence to aerobic duration (IE=94±12%, DE=98±2%, p=0.28) or intensity (IE=78±30%, DE=82±17%, p=0.64), or resistance training (IE=73±35%, DE=90±9%, p=0.13). Among IE participants, top reasons for missed sessions were treatment-related symptoms (38%) (i.e. fatigue) and non-treatment related illness (17%) (i.e. cold/flu). Missed sessions for the DE group were most often due to non-treatment-related injury (43%) and travel (23%). **Conclusion:** Adherence to an identical supervised exercise intervention did not vary based on whether it was completed during or after chemotherapy. Barriers to attendance differed by group, thus strategies to maximize exercise participation during chemotherapy should be unique to the time of intervention delivery. Although feasibility does not appear to vary by timing relative to treatment, further analysis is required to determine if the timepoint of exercise delivery has differing effects on physical and psychological benefits.

3562 Board #250 June 1 9:30 AM - 11:00 AM
Changes of Total and Tumor Specific Cell Free Dna During an Exhaustive Cycling Exercise Test

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 (No relevant relationships reported)

PURPOSE: Circulating, cell free DNA (cfDNA) is known to directly accumulate in a load-dependent fashion in various aerobic and anaerobic exercise sessions within minutes. Furthermore, increases of cfDNA at baseline have been reported for different patient groups with cancer to depend on malignancy and tumor progression. Typically, such analysis did not differentiate between cfDNA and circulating tumor derived levels of DNA (ctDNA). Here we investigated for the first time, whether exercise to voluntary exhaustion induces increases in cfDNA and ctDNA in patients with advanced stage cancer.

METHODS: In a pilot study, individuals with solid tumors of diverse entities and an age matched control group (n = 5) were subjected to a step-wise incremental cycling spiroergometry until exhaustion. Blood samples were taken before, directly after, and 90 minutes after the end of the test. Total cfDNA was quantified directly from the blood plasma using a qPCR targeting repetitive Line-1 elements and ctDNA was measured following silica-based total DNA purification and enrichment from plasma and subsequent specific quantification using a nested qPCR assay targeting the seven most frequent oncogenic KRAS sequences in comparison to wild-type sequence. Additionally, DNase activity reduction was measured with a commercial ELISA kit.

RESULTS: We quantified total cfDNA in all blood samples and detected and quantified ctDNA concentrations in all three samples of one cancer patient with metastatic colon cancer. Total cfDNA concentrations increased 1.7-fold (95% CI 1.28-2.22-fold; p<0.01) in all tumor patients during exercise, but to a significantly lesser extent (p=0.003) than in the healthy control group (3.7-fold; CI 2.23-6.15-fold, p<0.01). The decrease of cfDNA concentrations during the recovery period was significantly lower in tumor patients than in the healthy control (1.8-fold vs 5.5-fold decrease, p=0.001), independent of the DNase activity. Tumor DNA increased only slightly, causing a relative decrease in the ctDNA during exercise.

CONCLUSIONS: cfDNA kinetics seem to be less dynamic in tumor patients, especially the depletion of cfDNA from the plasma seems to be impaired. This effect does not seem to be a result of circulating DNA originating from the Tumor.

3563 Board #251 June 1 9:30 AM - 11:00 AM

Cardiac Rehabilitation Improves Fitness In Patients With Subclinical Markers Of Cardiotoxicity While Receiving ChemotherapyDennis J. Kerrigan, FACSM, Madhulata Reddy, Eleanor Walker, Bernard Cook, Randa Loutfi, James McCord, Jodi Baxter, Steven J. Keteyian, FACSM. *Henry Ford Heart and Vascular Institute, Detroit, MI.*

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(No relevant relationships reported)

Cardiotoxicity is the leading non-cancer related cause of morbidity and mortality in cancer survivors. Cardiac rehabilitation (CR) improves function and reduces morbidity and mortality in patients with heart failure, but little is known about its ability to ameliorate or attenuate the known cardiotoxic effects of chemotherapy agents. **PURPOSE:** Determine if participation in CR improves fitness and quality of life (QOL) in patients undergoing treatment with either Doxorubicin or Trastuzumab who exhibit markers of subclinical cardiotoxicity. **METHODS:** 20 female patients with breast cancer and evidence of subclinical cardiotoxicity (i.e. >10% decrease in global longitudinal strain (GLS) or a cardiac troponin > 20 ng·L⁻¹) were randomized to 10 weeks of CR or usual care (UC). Exercise training was performed at a cardiac rehabilitation facility and included 2-3 days per week of interval training on a treadmill or cycle at 70-90% of heart rate reserve for 40 minutes. **RESULTS:** Cardiorespiratory fitness, as measured by peak oxygen uptake (VO₂), significantly improved with CR and decreased in the UC group (between group change, 0.009; Table). No changes were observed between or within groups with respect to QOL or high sensitivity troponin. GLS, improved overtime in both groups, but no differences were observed between groups. **CONCLUSIONS:** This pilot study suggests the use of CR may be a viable option to attenuate the reduction in fitness that occurs in patients undergoing cardiotoxic chemotherapy. While trends were observed for improvements in both predictors of cardiotoxicity (GLS and troponin) with CR, these changes were not significant when compared to UC. The long-term effects of exercise on these predictors and left ventricular function warrants further investigation.

	Exercise Baseline	Exercise post test	Control baseline	Control post test	P value
Peak VO ₂ (mL·kg ⁻¹ ·min ⁻¹)	17.5 ± 4.8	19.2 ± 5.9*	16.7 ± 1.5	15.7 ± 1.4	0.009
High sensitivity troponin (ng·L ⁻¹)	24.9 ± 43.8	13.9 ± 14.9	15.6 ± 25.3	27.1 ± 60.8	0.211
FACT-G score	82.6 ± 11.6	86.2 ± 14.4	72.4 ± 11.7	79.6 ± 13.6	0.556
Relative global longitudinal strain (%)	-14.7 ± 13.7	3.3 ± 9.0*	-20.7 ± 6.0	12.3 ± 10.7*	0.091
Myoglobin (ng·mL ⁻¹)	17.9 ± 5.7	21.5 ± 5.7	21.9 ± 11.4	31.2 ± 14.1*	0.134

3564 Board #252 June 1 9:30 AM - 11:00 AM

Exercise Prescription Based on a Six Minute Walk Test in Childhood Acute Lymphoblastic Leukemia SurvivorsGabrielle E. Duhamel¹, Maxime Caru¹, Valérie Lemay¹, Simon Drouin², Nathalie Alos², Laurence Bertout², Maja Krajcinovic², Caroline Laverdière², Marie-Josée Raboisson², Daniel Sinnett², Gregoir Andelfinger², Daniel Curnier¹. ¹University of Montreal, Montreal, QC, Canada. ²Sainte-Justine University Hospital Research Center, Montreal, QC, Canada.

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(No relevant relationships reported)

PURPOSE: Advance in cancer treatment induced drastic improvements in survival rate of Acute Lymphoblastic Leukemia (ALL) for pediatric patients. These medical advancements came at the cost of cardiac dysfunction. Regular physical activity (PA) has been known to have a preventive effect on these health issues. Previous studies have shown that survivors are less active than their peers and below the recommended PA guidelines. The aim of this study is to evaluate the intensity measured from the Six Minute Walk Test (6MWT) comparatively to maximal exercise test and verified if it is compatible with standard recommendations.

METHODS: We tested 177 ALL survivors. We used a 6MWT and a cardiopulmonary exercise test (VO_{2max}). Classification of risk level factors was based on treatment dosage, age at diagnosis, sex, prognostic risk group, time from the end of the treatment (Standard Risk (SR) and High Risk (HR)). Participants were divided in two groups according to their median cardiorespiratory fitness level (<84.3% vs ≥84.3%)

RESULTS: Mean survivors age was 22.27±6.30. The survivors included had 44.6% SR and 55.4% HR factors. The mean VO_{2max} measured was significantly lower than the one predicted; 85.8%±16.5. The heart rate measured at the end of the walk represents a mean of 75.8% of the maximal predicted. The mean intensity measured at the end of the walk test was 60.4%±17.9 of the VO_{2max}. There is no significant difference between low and high cardiorespiratory fitness level of relative exercise intensity during the 6MWT (p=0.609). We observe a trending difference in relative exercise intensity during the 6MWT depending on risk factors (SR=63.3%±17.0 vs HR=58.1%±18.4; p=0.051).

CONCLUSIONS: Although the physical cardiorespiratory fitness of survivors is lower, our results demonstrate that with a self-pace exercise (i.e. 6MWT) participants reached similar level as those of a healthy population. Their physical fitness level does not impact the relative intensity levels measured during the 6MWT. Criteria link to the disease (ALL risk prognostic: SR and HR) needs to be considered while prescribing PA to this population. Survivors have greater chances of overcoming their disease than in past history, but specific and increased knowledge about physical activity is needed to prevent late-effects related to the treatments.

3565 Board #253 June 1 9:30 AM - 11:00 AM

Comparison of Body Composition Quantification Methods in Prostate Cancer Patients Undergoing Androgen Deprivation TherapyZachary L. Chaplow¹, Brian C. Focht, FACSM¹, Alexander R. Lucas², Elizabeth Grainger¹, Christina Simpson¹, Ciaran M. Fairman³, Jennifer M. Thomas-Ahner¹, Jessica Bowman¹, Victoria R. DeScenza¹, Kathryn Dispennette¹, Marcy Haynam¹, Steven K. Clinton¹. ¹The Ohio State University, Columbus, OH. ²Virginia Commonwealth University, Richmond, VA. ³Edith Cowan University, Perth, Australia.

(No relevant relationships reported)

Androgen deprivation therapy (ADT) results in adverse effects on body composition (BC) and places prostate cancer (PCa) patients at increased risk for sarcopenic obesity. Accurate BC assessment across the treatment continuum is an important aspect of integrating successful supportive care strategies. Dual-energy x-ray absorptiometry (DEXA) and air displacement plethysmography (ADP) are valid methods and have exhibited excellent reliability in various populations. Evaluation of the relationship between methods when used to detect BC changes in PCa patients across an active treatment timeline would inform future trials of their respective clinical relevance. **PURPOSE:** The purpose of the single-blind, randomized controlled Individualized Diet and Exercise Adherence-Pilot (IDEA-P) trial is to evaluate the preliminary efficacy of an exercise and dietary intervention, implementing a group-mediated cognitive behavioral approach, relative to standard of care treatment among PCa patients undergoing ADT. In the current study, we evaluated the reliability and absolute agreement of estimates of percent body fat (%BF), fat mass (FM) and fat-free mass (FFM) between DEXA and ADP in PCa patients to establish efficacy for detecting change in BC during treatment. **METHODS:** Change in BC estimates (baseline to 3-month) from a total of 30 PCa patients (M age = 66) on ADT were analyzed by DEXA and ADP. Degree of interrater reliability between methods was evaluated using mean-rating (k = 2), absolute-agreement, 2-way mixed-effects model intraclass correlation coefficients (ICC) and 95% confidence intervals. Potential bias between DEXA and ADP was examined using Bland-Altman plot analysis. **RESULTS:** A high degree of reliability and agreement was found for measurements of %BF and FM change between methods with average measure ICC = 0.865 (95% CI = 0.719, 0.936; p < .001) and 0.904 (95% CI = 0.800, 0.954; p < .001), respectively. Bland-Altman plots of change in %BF, FM and FFM revealed no evidence for proportional bias between DEXA and ADP. **CONCLUSIONS:** Findings from this study suggest DEXA and ADP measure change in BC with similar sensitivity across time. These results support the clinical application of DEXA and ADP as valid and reliable methods of BC quantification for PCa patients undergoing ADT. Supported by NIH/NCI R03 CA16296901

3566 Board #254 June 1 9:30 AM - 11:00 AM

Delivering Exercise Medicine To Pancreatic Cancer Patients: Is It Feasible, Safe And Efficacious?Nicolas H. Hart¹, Dennis R. Taaffe, FACSM¹, Robert U. Newton¹, Nigel A. Spry², Daniel A. Galvão, FACSM¹. ¹Edith Cowan University, Perth, Western Australia, Australia. ²Genesis Care, Perth, Western Australia, Australia. (Sponsor: Dennis Taaffe, FACSM)

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(No relevant relationships reported)

Pancreatic cancer is an aggressive adenocarcinoma affecting men and women, with very poor patient prognoses. Alarming, the 5-year survival rate is only 8.7%, despite the provision of intensive treatment regimens involving surgery, chemotherapy, radiotherapy or combination therapy, all of which significantly impact function and

quality of life. Exercise has been shown to be feasible, safe and effective in other cancer populations to mitigate treatment-related side-effects, improve quality of life and minimise dose limitation. Exercise may therefore have clinical utility within pancreatic cancer.

Purpose: To establish the safety and feasibility of a supervised exercise program for patients with histologically confirmed adenocarcinoma of the pancreas.

Methods: This non-blinded, single cohort feasibility study provided patients with a 3-month supervised exercise program consisting of resistance and aerobic exercise two days per week. Upper and lower-body muscle strength, physical function (6MWT, 400m Walk Test), and body composition (DEXA) were obtained at baseline, 12 and 24 weeks.

Results: Thirty nine patients (M=23, F=16) were referred with approximately 56% of referrals leading to enrolments (n=22; M=11, F=11). Patients who declined to participate reported feeling too unwell (41%), unable to travel easily (23%), not interested (17%), lost to follow-up (17%), and in one case, the patient deceased during the screening period (2%). Twenty two patients aged 60.9 ± 12.8 years attended baseline testing and commenced exercise, however, a 50% withdrawal rate was observed during the intervention consisting of 8 females (73%) and 3 males (27%). Increased appendicular lean mass at baseline was significantly associated with patient completion, using gender and age as covariates ($F = 4.609$; $p = 0.046$). For those who exercised, improvements ($p < 0.05$) were observed at 12 weeks and maintained at 24 weeks for 6MWT, 400m Walk Test, 1RM Seated Row and 1RM Leg Press. Diastolic BP was also significantly reduced following training ($p = 0.012$).

Conclusion: Exercise programs are safe for pancreatic cancer patients. Appendicular skeletal muscle (ASM) appears critical to facilitate program completion. Focusing on increasing ASM could be a priority for this patient population. RCT's are required to confirm these results.

G-43 Free Communication/Poster - Clinical Exercise Physiology - Other

Saturday, June 1, 2019, 7:30 AM - 11:00 AM
Room: CC-Hall WA2

3567 Board #255 June 1 9:30 AM - 11:00 AM

The Intersection Of Cognitive Performance, Physical Function, Aging, And Multiple Sclerosis: A Cross-sectional Comparative Study

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(No relevant relationships reported)

PURPOSE: Older adults with MS have worse physical and cognitive function than older adults without MS and young and middle-aged adults with MS. To date, there is no evidence regarding the associations, or coupling, of cognitive and physical function outcomes in older adults with MS. The purpose of this study was to examine the associations between physical (i.e., walking speed and endurance and functional mobility) and cognitive (i.e., information processing speed and verbal memory) functions in older adults with multiple sclerosis (MS) and healthy controls.

METHODS: 40 older adults with MS and 40 demographically-matched controls undertook measures of physical and cognitive function. Bivariate linear relationships were examined with Pearson correlations in the overall sample and subsamples of older adults with MS and healthy controls. Linear regression analyses were further used to examine the independent associations between demographic characteristics and physical and cognitive function variables in the subsamples.

RESULTS: Cognitive function (i.e., information processing speed) was significantly correlated with all physical function variables in the overall sample, and these correlations were driven by the subsample of older adults with MS. The linear regression analyses further indicated that information processing speed and years of education consistently explained variance in all physical function variables, beyond the influence of demographic variables, in older adults with MS.

CONCLUSIONS: Information processing speed and physical function are strongly correlated in older adults with MS. Future research should examine underlying neurobehavioral mechanisms associated with cognitive and physical function and behavioral strategies for jointly improving these functions in older adults with MS.

3568 Board #256

June 1 9:30 AM - 11:00 AM

Influence of Acute Aerobic Exercise on 24-hour Ambulatory Central Blood Pressure

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(No relevant relationships reported)

Ambulatory central blood pressure (cABP) assessed for 24-hours is a relatively new measurement that may be predictor of cardiovascular disease (CVD). Acute bouts of exercise lower peripheral blood pressure; however, it is currently unknown if an acute bout of vigorous exercise reduces 24-hour cABP. **PURPOSE:** To examine the response of cABP over 24 hours after an acute bout of aerobic exercise. **Methods:** Apparently healthy adults (N=10; 6 males; age 25.9 ± 1.8 years; body mass index 25.4 ± 0.6 kg/m²; $\dot{V}O_{2max}$ 46.1 ± 2.7 ml/kg/min) completed two trials in a randomized order. Trials consisted of a progressive maximal treadmill exercise test to assess $\dot{V}O_{2max}$ or a non-exercise control. During each trial, participants wore an ambulatory BP (ABP) monitor to record brachial and central BP variables over 24 hours. Hemodynamic variables between trials were analyzed as mean for 24 hours and by time of day; Daytime (0800-2200 hours), and Nighttime (2200- 0800 hours). Dependent t-test were used to compare 24-hour averages between control and exercise. A 2-way ANOVA with repeated measures was performed to examine time of day differences between trials. **Results:** Over the course of 24 hours, average brachial systolic BP (bSBP) (119.6 ± 2.2 vs. 122.0 ± 2.5 mmHg) central systolic BP (cSBP) (108.1 ± 2.2 vs. 111.2 ± 2.4 mmHg), and mean arterial pressure (MAP) (86.9 ± 1.5 vs. 89.4 ± 1.9 mmHg) were lower ($p < 0.05$) after exercise compared to control. A main effect for time ($p < 0.05$) indicated that bSBP, bDBP, brachial pulse pressure, MAP, cSBP, and cDBP, were lower during nighttime compared to day time, independent of exercise. **Conclusion:** A single, vigorous bout of aerobic exercise lowers ambulatory central hemodynamics for at least 24 hours. These novel findings provide insight into the regulatory effects of exercise on blood pressure.

3569 Board #257

June 1 9:30 AM - 11:00 AM

Leucocyte Telomere Length, Inflammation and Oxidative Stress in Master Athletes: The Interplay

Herbert G. Simões, Samuel S. Aguiar, Lysleine A. Deus, Caio V. Souza, Rodrigo VP Neves, Lucas P. Barbosa, Patrick A. Santos, Érica C c c Rosa, Rosângela V. Andrade, Thiago S. Rosa. *Catholic University Of Brasilia, Brasília, Brazil.* Email: hgsimoes@gmail.com

(No relevant relationships reported)

Leucocyte telomere length, chronic inflammation and oxidative stress play a self-feeding loop that may be cause and consequence of several age-related diseases. However, the interplay of markers of biological aging, oxidative stress and inflammation were not investigated in master athletes who follow an anti-aging lifestyle. **PURPOSE:** To analyze the leucocyte telomere length (LTL), inflammatory markers and redox profile of master athletes and compare to young and age-matched untrained controls. **METHODS:** Subjects (n=45) were 23 middle-aged master athletes (MA, 51.95 ± 8.87 yrs.), 11 young controls (YC, 21.81 ± 3.97 yrs.) and 11 middle-aged untrained controls (MU, 45.40 ± 10.33 yrs.). Relative LTL was determined with qPCR analyses (T/S). Markers of inflammatory, oxidative and anti-oxidant status were assessed in plasma using commercial kits. A one-way ANOVA and Pearson's moment correlation enabled for comparisons and correlations. **RESULTS:** The LTL (T/S) of YC (1.26 ± 1.01) differ significantly from MU (0.48 ± 0.52) ($p < 0.05$) but did not differ from MA (0.99 ± 0.67). MA and YC demonstrated a higher CAT, SOD activity, CAT/TBARS and SOD/TBARS ratios than MU, and the % body fat of MA was also lower than MU ($p < 0.05$). The levels of inflammatory cytokines TNF, soluble TNF receptor (sTNF), IL6 and sIL6 were lower in the YC in comparison to MU and MA. Moreover, MA presented lower levels of sTNF, IL6 and sIL6 and higher IL10 and IL10/IL6 ratio compared to MU. Negative associations were found between body fat and antioxidant enzymes (CAT: $r = -0.448$ and SOD: $r = -0.413$) and IL10 ($r = -0.585$) and positively correlated with pro-inflammatory cytokines (TNF: $r = 0.278$; sTNF: $r = 0.709$; IL6: $r = 0.720$; sIL6: $r = 0.430$) ($p < 0.05$). Further, CAT and SOD were negatively associated with inflammatory parameters (sTNF, IL6 and sIL6), while the LTL was negatively associated with inflammatory markers and positively associated with anti-inflammatory variables ($p < 0.05$). **CONCLUSIONS:** Middle-aged master athletes presented lower markers of oxidative stress and inflammation, with improved antioxidant defense and longer LTL. Once inflammatory and oxidative status were negatively associated to adiposity and LTL, the biological aging of MA is attenuated possibly due to a low adiposity, a better redox balance and reduced inflammatory markers.

3570 Board #258 June 1 9:30 AM - 11:00 AM
Short-term Detraining Effects On Cardiorespiratory Fitness And Body Composition In Trained Older Adults

Inês R. Correia, Sofia L. Freitas, Júlia M. Lopes, João P. Magalhães, Diana A. Santos, Luís B. Sardinha. *Faculdade de Motricidade Humana, Universidade de Lisboa, Lisbon, Portugal.*

(No relevant relationships reported)

An interruption in the training routine may have deleterious effects on cardiorespiratory fitness (CRF) and body composition. Particularly the decline that can occur in the phase-angle (PhA), derived from the tangent value of the ratio of reactance versus electric resistance from bio-impedance analysis (BIA), may be of concern, as it is a predictive marker for cellular integrity, sarcopenia, muscular function, and frailty in older adults.

PURPOSE: To determine the effects of 2-week detraining period on CRF and body composition (including PhA) in older trained adults.

METHODS: A total of 11 older adults (4 females) aged ≥ 65 years were assessed at baseline and follow-up for CRF and body composition in the early morning in fasting condition. Fat-free mass (%FFM), fat mass (%FM), android fat mass (%AFM), and gynoid fat mass (%GFM) were estimated with dual-energy X-ray absorptiometry (DXA) and PhA was assessed with BIA. CRF was evaluated with a breath-by-breath gas analyser system (Quark RMR, Cosmed) with a modified Bruce protocol. During the 15-day detraining period, participants were instructed to refrain from structured and supervised exercise sessions. One - way repeated measures ANOVA were performed and all analyses were adjusted for sex.

RESULTS: The interruption of structured and supervised exercise sessions for 15-days resulted in declines in PhA (5.5%; p -value=0.037). No differences were found for weight ($p=0.662$), body mass index ($p=0.631$), %FM ($p=0.953$), %FFM ($p=0.455$), %AFM ($p=0.138$), %GFM ($p=0.300$), and CRF ($p=0.618$).

CONCLUSIONS: A short-term detraining period of 2-weeks resulted in detrimental changes in PhA, suggesting a decline in the integrity of body cells, but no changes in the remaining body composition outcomes or CRF. These results highlight the importance of maintaining structured exercise sessions in older adults in order to preserve body cell integrity.

3571 Board #259 June 1 9:30 AM - 11:00 AM
The Effects of Aerobic Exercise on Heart Rate Variability in People Living with HIV

Norberto Quiles¹, Alex Evangelista², Alexis Ortiz, FACSM³.
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(No relevant relationships reported)

People living with HIV (PLWH) often present with lower heart rate variability (HRV) than healthy counterparts. This is problematic because lower HRV has been associated with cardiovascular morbidity and mortality. Aerobic exercise has been shown to improve HRV in the general population and in those with chronic diseases but its effectiveness in PLWH is unknown. **PURPOSE:** To evaluate the effects of 8-week aerobic exercise in PLWH on anti-retroviral therapy. **METHODS:** Twenty-six participants were randomly assigned to either a control group (no exercise) or an aerobic exercise group. Twenty-three participants completed the study. Resting HRV was measured for 5 minutes through an electrocardiogram. Measures included high frequency power (HF), low frequency/high frequency ratio (LF/HF ratio), low frequency power (LF), very low frequency power (VLF), standard deviation of normal-to-normal (NN) intervals (SDNN), and the square root of the mean squared differences of successive intervals (RMSSD). Estimated $\dot{V}O_{2peak}$ was assessed through a 6-minute walk test (6-MWT) on a treadmill. Body fat percentage (BF%) was measured through air displacement plethysmography. The training group performed aerobic exercise 3 times per week (2 lab-based sessions and 1 home-based session per week) at 65%-75% of the heart rate max. Exercise duration was 30 minutes per session during the 1st week increasing to 45 minutes for weeks 2 to 8.

RESULTS: Participants were 48.4 years old with a CD4 T-cell count of 681.9 cells/ μ L. There were no significant differences between groups in any of the HRV indices. However, SDNN (a marker of overall autonomic function) increased significantly in the exercise group (Pre: 46.97 ± 32.70 ms vs Post: 59.49 ± 37.20 ms, $p=0.036$). There was a moderate correlation between SDNN and $\dot{V}O_{2peak}$ ($r=.53$; $p=0.01$). There were no significant differences in $\dot{V}O_{2peak}$ or BF% between groups. **CONCLUSIONS:** While differences in HRV were not observed between groups, our data suggests that overall autonomic function can improve with aerobic exercise and these changes are associated with higher levels of $\dot{V}O_{2peak}$. These results advocate the importance of improvements in HRV as greater levels of HRV are associated to lower risk of CVD and mortality.

3572 Board #260 June 1 9:30 AM - 11:00 AM
Associations Between Cardiorespiratory Fitness and Brain-derived Neurotrophic Factor In Serum and Platelets-poor Plasma

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(No relevant relationships reported)

Emerging evidence suggest that brain-derived neurotrophic factor (BDNF) could mediate some of the beneficial effects of physical activity observed in neurodegenerative and metabolic disease. Observational studies report that cardiorespiratory fitness (CRF) is associated with circulating BDNF levels, but the direction of the association is inconsistent among studies. Accordingly, it appears that CRF is mostly positively associated with BDNF in plasma and negatively associated with BDNF in serum. **PURPOSE:** To investigate the associations between CRF and BDNF measured in serum and platelet-poor plasma, respectively.

METHODS: This cross-sectional study was conducted using data from a subgroup of 81 participants (mean age: 14.3 (1.4), 51% males) included in the 2015 follow-up of the population-based CHAMPS Study-DK. Blood samples were drawn in resting horizontal position from the antecubital vein after an overnight fast (≥ 8 hours). BDNF was analyzed in serum and platelets-poor plasma. CRF was assessed using a field-based running test (the Andersen test). Linear regressions adjusted for potential known confounders (age, sex, Tanner stage and BMI) were conducted in the total sample and stratified by sex.

RESULTS: No significant associations were found between CRF and BDNF measured in serum (std. $\beta = -.02$, CI: $-.21$; $.18$) or platelet-poor plasma (std. $\beta = -.09$, CI: $-.28$; $.09$). Likewise, when stratified by sex, no associations were observed between CRF and BDNF in males (serum, std. $\beta = -.17$, CI: $-.42$; $.08$ or plasma std. $\beta = -.10$, CI: $-.35$; $.15$) or females (serum, std. $\beta = .18$, CI: $-.21$; $.57$ or plasma, std. $\beta = -.10$, CI: $-.40$; $.19$).

CONCLUSIONS: Opposite to some studies in the field, results from this study suggest no association between CRF and BDNF measured in either serum or platelet-poor plasma or in males or females. However, the measured level of BDNF may be highly modified by several unmeasured factors such as physical activity prior to blood drawing or pre-analytical handling of the blood samples (e.g. storage time and centrifugation strategy), making it problematic to use BDNF concentrations obtained from a single blood sample as a measure of general circulating levels of BDNF. Funding: The study was funded by the Tryg Foundation (104982).

3573 Board #261 June 1 9:30 AM - 11:00 AM
Effect of Resistance Training Session on Intraocular Pressure in Patients with Primary Open Angle Glaucoma

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(No relevant relationships reported)

Chronically elevated intraocular pressure (IOP) scores are considered as main risk factor for the development of primary open angle glaucoma (POAG). It is known that aerobic and resistance training (RT) can promote reductions of IOP in individuals without diagnosis of the disease. However, there is still a need to understand the IOP behavior during RT in individuals with POAG. **PURPOSE:** To evaluate the IOP behavior in individuals with POAG during and after a RT session (RTS). **METHODS:** Six sedentary woman (64 ± 8.2 y), with POAG, were submitted to RTS. After two familiarization sessions and seven days prior to RTS, participants were submitted to a maximum strength predictive test (1RM) in each of the exercises that comprised RTS (leg-press; chest press machine; leg curl machine; rowing machine; calf machine; abduction machine; adduction machine; seated crunch machine and side lateral raise). Then, they performed the RTS composed of the nine exercises tested, 3 sets until the concentric muscle failure with 60% 1RM and rest interval of 60sec among sets. IOP and lactacidemia (LAC) were measured at the pre-RTS (M1), after the fourth exercise (M2), immediately after the last exercise (M3) and after 5min of the RTS end (M4). The LAC was measured by blood lactate analyzer, while the IOP was measured by an ophthalmologist by Perkins tonometer. One-way ANOVA with Bonferroni's post-hoc was utilized to compare differences among the RTS moments; Pearson's correlation test was used to verify possible correlations between IOP and LAC and; Effect Size was calculated by using Cohen d. **RESULTS:** There was a significant reduction in IOP at all moments evaluated in relation to M1 (M1: 13 ± 2.1 mmHg; M2: 8.33 ± 2.6

mmHg, ES=1.97; M3: 6.83±1.7 mmHg, ES=3.22; M4: 7.33±3.8 mmHg, ES=1.8, $p < 0.01$). LAC showed a significant increase in all moments evaluated in relation to M1 (M1: 2.60±1.3mmol/dL; M2: 10.88±5.8mmol/dL, ES=1.9; M3: 11.25±5.1mmol/dL, ES=2.3; M4: 8.45±4.3 mmol/dL, ES=1.8, $p < 0.01$). Significant negative correlation between LAC and IOP was observed ($r = -0.79$, $p < 0.05$). **CONCLUSION:** A single RTS was able to reduce IOP in POAG patients. RT protocols that promote significant increases in lactacidemia are able to promote important reductions in IOP. RT should be understood as a relevant non-pharmacological resource in the control of POAG.

3574 Board #262 June 1 9:30 AM - 11:00 AM
Hippocampal Growth Factor and Myokine Cathepsin B Response to Aerobic and Resistance Training in 3xTg-AD Mice

Gabriel Pena. *Florida Atlantic University, Boca Raton, FL.*
 (Sponsor: Michael Whitehurst, FACS)M
 (No relevant relationships reported)

Hippocampal Growth Factor and Myokine Cathepsin B Response to Aerobic and Resistance Training in 3xTg-AD Mice

Gabriel S. Pena, Hector G. Paez, Trevor K. Johnson, Jessica L. Halle, Joseph P. Carzoli, Nishant P. Visavadiya, Michael C. Zourdos, Michael A. Whitehurst FACS, Andy V. Khamoui
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 Alzheimer's disease (AD) is a progressive neurodegenerative disease and the most prevalent form of dementia among the elderly today. Aerobic training (AT) has been shown to support brain health in AD through mechanisms involving neurotrophins including BDNF and IGF-1. Unlike AT, the role of resistance training (RT) in AD is not well-established, yet RT may modulate brain health through skeletal muscle-derived myokines. **PURPOSE:** This study examined the effects of AT and RT on hippocampal BDNF and IGF-1 signaling, β -amyloid expression, and myokine cathepsin B in the triple transgenic (3xTg-AD) model of AD. **METHODS:** 3xTg-AD mice were assigned to sedentary (Tg), aerobic-trained (Tg+AT, 9 wks treadmill running), or resistance-trained (Tg+RT, 9 wks weighted ladder climbing) ($n = 10$ /group). RotaRod latency and grip strength were assessed pre- and post-training. Hippocampus and skeletal muscle were collected after training and analyzed by high-resolution respirometry, ELISA, and immunoblotting. **RESULTS:** Tg+RT showed greater grip strength than Tg and Tg+AT at post-training (+13% vs. both groups, $p < 0.01$). Only Tg+AT improved RotaRod peak latency after training (+88%, $p < 0.01$). Hippocampal IGF-1 concentration was ~15% greater in Tg+AT and Tg+RT compared to Tg ($p < 0.05$), however, downstream signals p-IGF-1R, p-Akt, p-MAPK, and p-GSK3 β were not altered. Myokine cathepsin B, hippocampal p-CREB and BDNF, and hippocampal mitochondrial respiration were not affected by AT or RT. β -amyloid was ~30% lower in Tg+RT compared to Tg ($p < 0.05$). **CONCLUSION:** This data suggests that resistance training may ameliorate β -amyloid load in the hippocampus concurrent with increased concentrations of IGF-1. Both types of training offered distinct benefits, either by improvement of whole body physical function, or by modifying signals in the hippocampus. Therefore, inclusion of both training modalities may address central defects, as well as peripheral comorbidities in AD.

3575 Board #263 June 1 9:30 AM - 11:00 AM
Comparison of Work-induced Fatigue Responses Between One Versus Three 12-hour Shifts in Nurses

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 (No relevant relationships reported)

Fatigue-related impairments in the nursing workforce contribute to a multitude of health, safety, and economic consequences at the individual, organizational and societal levels. Long and compressed work schedules are commonly worked in the healthcare industry, but more research is needed to understand the cumulative effects of multiple work shifts on performance-based fatigue responses in nurses. **PURPOSE:** To examine the effects of a single nursing work shift compared to three successive (one every 24-hours) 12-hour shifts on performance-based fatigue responses in nurses and aides. **METHODS:** Twenty-six fulltime hospital working nurses and aides (age = 36.1 ± 13.3 years) reported to the lab for testing before, immediately after a single 12 hour shift, and after working three 12-hour shifts in a 72-hour period. Outcome measures included vigilance-based reaction time and muscle function assessments (lower and upper body maximal strength, rate of torque development and vertical jump performance). **RESULTS:** All performance variables except hand grip strength showed a significant ($P < 0.05$) decline following the three work shifts. The psychomotor vigilance reaction time variable significantly declined from the end of shift one to the end of the three shifts (8% more impaired following shift 3 versus shift 1), indicating an accumulation of fatigue with increasing number of shifts worked. Muscle function variables responded early in the shift cycle, showing a significant decline following shift one ($P < 0.05$ for all but hand grip) and remained reduced but did not further decline by the end of the third shift (performance reductions ranged from 6 – 18% from baseline to post shift three). **CONCLUSION:** This study used objective measures to substantiate that

fatigue impairments occur from working a single 12-hour shift and in several instances, increases further with increased number of successive work shifts. Nurse personnel and administrators should view work schedules involving multiple successive shifts with caution. Fatigue management strategies may reduce consequences from fatigue-related mishaps, and this study reports several variables – namely lower body strength and power and psychomotor vigilance reaction time – that appear to be sensitive for identifying and tracking fatigue in a full time working nurse population.

3576 Board #264 June 1 9:30 AM - 11:00 AM
The Effectiveness Of Simulation-based Learning In Preparing Exercise Physiology Students For Emerging Clinical Practice Domains

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PURPOSE: Given the pivotal role exercise plays in the prevention and management of chronic diseases, developing practice-ready clinical exercise physiology (EP) students to program and prescribe exercise-based interventions across these conditions is critical. In emerging clinical domains, the lack of practicum opportunities makes it challenging to provide students with the vital opportunity to translate theory into practice. This study reports on the impact a simulation-based learning experience (SBLE) had on EP student's confidence and perception of knowledge in the clinical domain of palliative care. **METHODS:** 12 EP students completed a palliative care interprofessional SBLE alongside students from Dietetics ($n = 50$), Pharmacy ($n = 44$) and Social Work ($n = 7$). The SBLE comprised modules on what is palliative care, effective communication for grief, and spiritual and cultural considerations in palliative care. Experienced and accredited practitioners across the range of health disciplines facilitated the SBLE which included pre-reading, briefing, simulation using simulated patients, and debriefing components. Interprofessional simulated patient interactions included initial consultations, education and treatment planning, and a multidisciplinary case conference. A post-simulation questionnaire explored the effectiveness of the SBLE in developing palliative care graduate capabilities. **RESULTS:** 100% of students ranked their confidence in caring for people with a life-limiting illness as moderate or higher (mean 7.6/10), while 91.7% of students ranked their knowledge and preparedness as moderate or higher (mean 7.5). 75% of students reported having one or no experience, in the past twelve months, caring for a person who has died due to a life-limiting illness in either a clinical placement, employment or personal capacity. Qualitative responses supported the quantitative data with students appreciating the opportunity of being exposed to the clinical domain in a safe and supportive environment that bridged the gap between theory and a real world setting. **CONCLUSIONS:** The positive impact on student confidence and perceived knowledge highlights the influence of SBLE in palliative care, suggesting a broader utility for this mode of learning in other emerging clinical domains for EP students.

3577 Board #265 June 1 9:30 AM - 11:00 AM
Relationship Between Changes in Gait Speed & Resistance Training

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 (No relevant relationships reported)

Self-selected gait speed (SGS) is an important indicator of current health. Maximal gait speed (MGS) is an important functional outcome to assess how people can function in their environment. With insufficient MGS individuals may lack the ability to adapt to sudden changes or dangerous situations. Muscular strength is related to both self-selected and maximal gait speed, however there is little known about the relationship between changes in lower extremity strength training and changes in both SGS and MGS. **PURPOSE:** To examine the effect of lower body strength training on changes in SGS and MGS. **METHODS:** Eleven individuals (10 male, 72±8 years, BMI 36±7) with dysmobility, (SGS below 1.0 m/s), or use of an assistive device were recruited. SGS and MGS were measured at baseline and after a 12-week multimodal exercise intervention that included walking, balance, and lower extremity resistance training. Strength progressions, defined as the resistance used in the leg press during weekly exercise sessions, were recorded. After 12 weeks participants were categorized as either responders (>100% increase in leg press) or non-responders (<100% increase in leg press). The relationship between strength change, SGS, and MGS was examined with a Pearson product correlation. An independent t-test was used to compare speed changes in responders and non-responders. Significance was set at $p < 0.05$. **RESULTS:** Changes in MGS (Pre = 1.10±0.21 m/s, Post = 1.14±0.28 m/s) were significantly positively correlated with leg press change (Pre = 166±51 psi, Post = 313±121 psi, $r = 0.81$, $p < 0.01$). There was no significant relationship between SGS change (Pre = 0.89±0.19 m/s, Post = 0.98±0.15 m/s) and leg press strength change. Responders ($n = 5$) improved MGS by 16.5% (Pre = 1.06±0.18 m/s, Post = 1.24±0.30 m/s, $p < 0.01$) while non-responders ($n = 6$) showed reduced MGS by 7.6% (Pre =

1.14±0.24 m/s, Post = 1.05±0.27 m/s). Responsiveness had no effect on the change in SGS. **CONCLUSIONS:** MGS improved in those who made the largest progress in lower extremity strength. Encouraging the use of an aggressively progressed strength program may help a geriatric population to greater improve a functional outcome such as MGS.

3578 Board #266 June 1 9:30 AM - 11:00 AM
Telephone Intervention Is An Effective Follow-up To Stabilize %body Fat and Markers Of Inflammation After Primary Intervention

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Reductions in %body fat and markers of obesity-related disorders have been reported following obesity treatments; however, this short-term success is regressed after the termination of treatments. **PURPOSE:** The purpose of this study was to evaluate whether telephone follow-up intervention is effective in preventing long-term regression of %body fat and inflammation after primary intervention in obese children. **METHODS:** 56 obese children (aged 10-14yrs) completed this study (19 PITI: primary intervention and telephone follow-up intervention, 18 PI: primary intervention only, and 19 CON: no intervention). Anthropometric data and blood samples were obtained before (PRE), after 8weeks of primary intervention (POST), and 10month telephone follow-up intervention (1YEAR) to measure levels of %body fat, tumor necrosis factor-alpha (TNF- α), C-reactive protein (CRP), and adiponectin. **RESULTS:** 8weeks of primary intervention in PITI and PI significantly reduced %body fat (PITI:29.2±1.1%→25.8±1.3, Mean±SE, P=.003; PI:28.9±1.0→26.1±1.4, P=.008), TNF- α (PITI:4.18±40pg/mL→3.24±.62, P=.02; PI:4.05±.38→3.19±.56, P=.016), and CRP (PITI:2.95±.33mg/L→2.31±.47, P=.035; PI:2.87±.36→2.28±.49, P=.031) and elevated levels of adiponectin (PITI:6.68±.69µg/mL→8.55±.85, P=.019; PI:6.48±.60→8.18±.85, P=.024), while CON showed an increase in %body fat (29.3±1.0%→30.7±1.1, P=.028) with no differences in inflammatory cytokines. Results of 10month follow-up measurement (1YEAR) were reverted back to PRE for the PI (1YEAR value and P value for PRE vs. 1YEAR; %body fat: 28.3±1.2, P=.89; TNF- α : 4.14±.51, P=.60; CRP: 2.66±.55, P=.75; adiponectin: 6.98±.79, P=.47) whereas those in PITI at 1YEAR remained statistically significant to PRE (1YEAR value and P value for PRE vs. 1YEAR; %body fat: 27.1±1.3, P=.016; TNF- α : 3.68±.52, P=.035; CRP: 2.48±.47, P=.043; adiponectin: 8.03±.80, P=.038). **CONCLUSIONS:** Results of this study confirm that levels of inflammation are correlated to changes in %body fat, indicating that fat loss is effective in preventing and managing obesity-associated disorders. It is suggested that a telephone intervention is an effective follow-up tool for stabilizing reductions in %body fat, and levels of inflammation obtained from an intensive primary intervention in obese children.

3579 Board #267 June 1 9:30 AM - 11:00 AM
Sports Injury Management Program in Pima Community College Offers Study Abroad Opportunities for International Students

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PURPOSE: Sports injury management program is a growing academic discipline. Pima Community College, Tucson, Arizona offers study abroad sports science program. The program attracts the students who are interested in pursuing athletic training, personal training, exercise sciences, and sports coaching as a career. **METHODS:** Pima Community College Sports Injury Management (SIM) program offers an athletic training student internship. Students interns are expected to fulfill requirements including taking classes at the college and professional development activities in the US. Qualified student applicants were evaluated on the quality of their athletic training experiences, academic performance, and professional attitudes. To be enrolled in the program, the students went through an application process such as writing a letter of interest, resume, and references, then had a face-to-face interview experiencing a formal job-hunting process with SIM staff. **RESULTS:** All selected applicant international students were from Japan (18 years and older). They were assigned to work with SIM staff who provide athletic training services to their 16 intercollegiate athletic teams. The interns took classes on SIM (i.e., learning principles and techniques of preventing, recognizing, treating and rehabilitating sports related injuries, recognition of common sports injury, gaining skills of taping/wrapping technique, and an event preparation and risk managements). They also independently continued their academic development in health, physical education, recreations, coaching, dance, or fitness. Some students completed their prerequisite classes to transfer to four-year college/university and/or to apply for an entry level of master's

degree program for athletic training. **CONCLUSION:** Pima Community College SIM interns were not only preparing to become an athletic trainer (e.g., completion of an accredited athletic trainer degree program, hands-on experiences, etc.), but they also gained cultural awareness and valuable life-changing experiences by receiving opportunities such as volunteer work in a local community.

G-43b Free Communication/Poster - Late-Breaking Abstracts

Saturday, June 1, 2019, 7:30 AM - 11:00 AM
 Room: CC-Hall WA2

3580 Board #268 June 1 9:30 AM - 11:00 AM
A Comparison of Attitude Toward Physical Education Class, Physical Activity Level, and Aerobic Fitness between Hong Kong and Shanghai Adolescents

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 (No relationships reported)

Studies revealed that participation in Physical Education (PE) classes could increase the chance to be more physically active and influence aerobic fitness among youth (Chen, 2014; Fairclough & Stratton, 2004). Meanwhile, it is noted that weekly amount of PE classes in Shanghai and Hong Kong is largely different (Shanghai: 5 times per week, 40 mins per session; Hong Kong: 80-120 mins per week). Due to the difference in PE class volume, we hypothesized that attitude toward PE class, physical activity (PA) level and aerobic fitness of adolescents may be different between these two cities. **PURPOSE:** to compare the attitude toward PE class, PA and fitness between adolescents in Hong Kong and Shanghai. **METHODS:** A total of 2,059 adolescents (12-15 yrs old) randomly recruited from middle-schools of Hong Kong and Shanghai completed questionnaire surveys on attitudes toward PE (like, okay, or dislike), self-reported weekly moderate to vigorous PA (MVPA) (IPAQ), and field test on aerobic fitness (15m PACER). **RESULTS:** Chi-square test showed Hong Kong adolescents "like" PE (54.8%) more than that of Shanghai counterparts (39.5%) ($p<0.001$), whereas Hong Kong adolescents "dislike" PE (5.3%) much less than the Shanghai adolescents (21.5%) ($p<0.001$). After adjusting for age and gender, ANCOVA revealed that MVPA of Hong Kong adolescents was considerably higher (369.8±10.8) than that of Shanghai counterparts (302.0±8.4) ($p<0.001$). There was no difference ($p>0.05$) in aerobic fitness between adolescents from the two cities. **CONCLUSIONS:** The present study demonstrated that Shanghai adolescents, though receiving much higher volume of PE classes than Hong Kong adolescents, do not have better attitudes toward PE class nor higher MVPA level than the Hong Kong counterparts. Other factors other than the PE volume, such as PE curriculum and contents, teaching styles or leaderships, may be more important to affect attitude toward PE, PA and fitness levels.

3581 Board #269 Jun. 1 9:30 AM - 11:00 AM
Effects Of A Loaded Roach March On Isometric Muscle Strength Measured With A Novel HHD Fixation System

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 (No relationships reported)

PURPOSE: Understanding the effect that field exercises have on soldier muscular strength is an area of interest for the US Army. Reliably quantifying muscle strength in this context has been limited by availability of portable assessment equipment. The widely used hand-held dynamometer (HHD) presents a challenge when assessing strong muscle groups of healthy soldiers accurately. We devised a portable, field-ready HHD fixation solution to assist researchers in the evaluation of lower body and core isometric maximal muscle contractions. Reliability of the fixation system (patent pending) was assessed prior to implementation at a large-scale data collection during a military field exercise. The purpose of the current investigation was to identify strength changes in select muscle groups prior to and immediately following a loaded road march.

METHODS: 39 soldiers (36M, 3F) performed 4 maximal isometric contraction types, including lumbar extension, lumbar flexion, hip flexion, and knee extension. 3 trials of each contraction type were recorded during a pre-mission baseline, and 2 trials were recorded immediately following a 6-mi road march executed with an average load of 50% body weight. Measurements were recorded using the system developed, which provided repeatable subject stabilization, muscle group isolation, and HHD fixation.

The maximum force recorded from each muscle group during a session was used for analysis. A paired sample t-test was conducted to compare pre and post road march strength measures.

RESULTS: No significant change in lumbar extension strength was identified between the pre and post conditions. Significant decreases in strength performance were observed in the hip flexion (8.3%; $p=.003$), knee extension (7.8%; $p=.032$), and lumbar flexion (9.9%; $p=.009$) measurements between the pre and post conditions.

CONCLUSION: While lumbar extension strength did not change following the road march, the decreases identified for hip flexion, knee extension, and lumbar flexion followed the hypothesized trend. This study provides novel insight into the effects of field activities on soldier muscle strength that were not quantifiable prior to the portable HDD fixation system, and presents a range of new opportunities to understand the impact of military exercises on strength.

3582 Board #270 Jun. 1 9:30 AM - 11:00 AM
Effects of High-Intensity Interval Training on Fitness during Initial Military Training

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(No relationships reported)

Effects of High-Intensity Interval Training on Fitness during Initial Military Training

Author Block John R. Borman¹, Brittany R. Hotelling², Kevin A. Bigelman¹, Dan A. Jaffe¹, Jesse L. Germain¹, Richard B. Westrick², Nicholas H. Gist¹. ¹*United States Military Academy, West Point, NY.* ²*United States Army Research Institute of Environmental Medicine, Natick, MA.* **ABSTRACT**

High-Intensity Interval Training (HIIT) may confer rapid aerobic and anaerobic physiological adaptations. While several studies have compared HIIT and Moderate-Intensity Continuous Training (MICT), none have compared the United States Army's doctrinal interval training work-to-rest ratios to examine its effects on aerobic capacity, anaerobic power and physical performance. We hypothesize that HIIT will improve aerobic and anaerobic fitness as well as MICT.

PURPOSE: To investigate the effects of a 9-week low volume HIIT intervention on selected laboratory and field-based assessments {maximal oxygen uptake ($\text{VO}_{2\text{max}}$); Running Anaerobic Sprint Test (RAST) performance} compared to MICT protocol in Initial Military Training Soldiers.

METHODS: 30 college-aged males at the United States Military Academy Preparatory School participated in an 11-week (1 week of pre-testing, 9 weeks of exercise training, 1 week of post-testing) research study examining the effects of HIIT on components of aerobic and anaerobic endurance, anaerobic power and performance time.

RESULTS: After training, HIIT experienced a 4.3% increase in peak power as measured by RAST performance. MICT had a statistically significant decrease in $\text{VO}_{2\text{max}}$. Both groups had a non-significant increase in average power.

CONCLUSIONS: Using the United States Army's interval training work-to-rest ratios, the HIIT protocol was more effective for improving peak power and maintaining both anaerobic and aerobic endurance when compared to MICT protocol. The MICT protocol enabled the maintenance of peak power but decreased overall aerobic endurance. **DISCLAIMER:** The views expressed in this abstract are those of the authors and do not reflect the official policy of the Department of Army, Department of Defense, or the U.S. Government. Supported by the U.S. Army Medical Research and Materiel Command.

3583 Board #271 Jun. 1 9:30 AM - 11:00 AM
Individual Muscle Hypertrophy and Strength Responses to Traditional Resistance Training vs Drop Set System

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(No relationships reported)

Abstract category: Fitness Assessment, Exercise Training, and Performance of Athletes and Healthy People - 102 Exercise Training Interventions in Healthy People
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 To maximize, or to prevent the stagnation of gains in muscle strength and mass, coaches have used resistance training (RT) systems. It has been showed that traditional RT (TRAD) and drop-set systems (DS) result in similar gains in muscle hypertrophy and strength. However, a large variability has been reported for muscle strength and hypertrophy outcomes even when subjects perform RT programs. **PURPOSE:** The aim of this study was to compare the individual muscle mass and strength gains to TRAD vs DS in well trained young men. **METHODS:** We used a within-subjects design in which 14 participants had one leg randomly assigned to TRAD (3-5 sets

of 6-12 repetitions at 75% 1RM) and the other to DS [3-5 sets of ~50-75% 1RM to muscle failure]). Participants had one leg fixed in the TRAD while the contralateral leg performed either DS to allow for total training volume (TTV) equalization.

Muscle cross-sectional area (CSA) and one repetition maximum (1RM) were assessed at baseline and after 12-wks of RT. For group analyses, the accumulated TTV and changes in muscle CSA and 1-RM values were compared between TRAD and DS using paired *t*-tests. For individual analyses, if an individual that showed a difference in the response (for CSA or 1RM increases) from TRAD or DS (or vice-versa) within 2 typical errors (CSA typical error [TE] = 2.20%, 1RM TE = 2.62%), no difference in the response between RT schemes was considered. **RESULTS:** No significant differences in TTV ($P > 0.05$) were detected between protocols TRAD and DS. Muscle CSA and 1RM values increased significantly and similarly for TRAD and DS ($P < 0.0001$). This study highlights that some individuals showed greater muscle strength gains following TRAD (35.7% of individuals), and other show similar responses between TRAD and DS (64.3% of individuals). For muscle CSA, individuals showed similar responses to TRAD and DS. **CONCLUSION:** Despite the analysis groups show similar gains in strength and muscle hypertrophy, some individuals show greater strength gains for TRAD compared to the DS.

3584 Board #272 Jun. 1 9:30 AM - 11:00 AM
Wearable Positive End-Expiratory Pressure Valve Increases Aerobic Capacity and Performance

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Reported Relationships: S.F. Crouse: Other (please describe); Member, Board of Directors, PEEP Performance LLC.

PURPOSE: We report testing results of wearing a positive end-expiratory pressure (PEEP) valve mouthpiece during exercise on $\text{VO}_{2\text{max}}$ and cycling time to exhaustion.

METHODS: 4 women & 5 men (Age 31 ± 2 yrs, Ht 172.2 ± 3.8 cm, WT 72.1 ± 3.7 kg) were assigned at random on two separate occasions (time of day controlled, at least 48 hr between each test) to wear our PEEP mouthpiece or a Battle Oxygen Mouthguard® during cycle ergometer (Corival®) testing to maximal voluntary exhaustion (3 min unloaded warmup, then 150W for 2 min x 30W/2 min stages thereafter until exhaustion); VO_2 was measured continuously (MGC Ultima®), and heart rate (HR, bpm) and blood pressure (BP, mmHg) were recorded at the end of each stage. There followed approximately one week later a timed endurance ride to exhaustion with the assigned mouthpiece at a power (W) equivalent to each subject's ventilatory threshold (VT) measured during the VO_2 test. **RESULTS:** Table (all $p < 0.05$, paired *t*-test). Notably, time to exhaustion at VT was 13% greater with PEEP, but this did not reach statistical significance. Ratings of perceived exertion recorded during exercise did not differ between mouthpiece conditions.

Variable	$\text{VO}_{2\text{max}}$ ($\text{ml} \cdot \text{kg}^{-1} \cdot \text{min}^{-1}$)	$\text{VO}_{2\text{max}}$ Test Time to Exhaustion (sec)	Max Systolic Blood Pressure (mmHg)
Condition			
Control	42.44 ± 2.33	495.3 ± 72.8	193 ± 6
PEEP	45.18 ± 2.41	521.8 ± 73.4	186 ± 5
Change from Control	+6.7%	+5.8%	-3.6%

CONCLUSION: The wearable PEEP-valve mouthpiece significantly improves cycling maximal aerobic capacity, reduces peak exercise systolic blood pressure, and may improve cycling performance. The PEEP mouthpiece technology appears to confer a benefit to cyclists performing high intensity exercise.

3585 Board #273 Jun. 1 9:30 AM - 11:00 AM
Muscle, Blood and Performance Responses to Ice Hockey Match-play in Elite Male Players

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Competitive ice hockey is a high-intensity intermittent sport with an activity pattern characterized by short fast-paced bouts of skating repeated continuously over the course of the game interspersed by passive recovery intervals. However, no previous studies have yet examined the physiological response and degree of fatigue during an elite game. **PURPOSE:** To examine muscle, blood and performance responses to match-play in elite male ice hockey players in relation to physiologically mediated

fatigue. **METHODS:** Thirty players from the Danish U20 national team participated and completed one experimental game. The game was modified so each period consisted of 8 shifts of 1 minute duration pr. player separated by 2 minutes of recovery resulting in a total playing time of 24 min for each participant. During the game each player was monitored continuously using heart rate monitors and a local positioning system assessing the activity pattern. Muscle biopsies were taken before and after the game ($n=7$) as well as instantly following shifts during the game ($n=6$). Blood sampling was performed before the game and at the end of each period. In addition, players performed a repeated sprint test consisting of three maximal 30 m sprints interspersed by 25 s recovery before the game and following each period. **RESULTS:** Players covered on average 6015 ± 199 m reaching peak speeds of 29 ± 2 km/h including 109 ± 14 intense accelerating or decelerating actions and 2701 ± 251 m high-intensity-sprint skating resulting in an average and peak heart rate of 143 ± 9 and 182 ± 8 beats pr. min, respectively. Muscle lactate rose from 6.9 ± 3 before the game to 38 ± 20 and 20 ± 12 mmol/kg d.w during the first and third period, while blood lactate increased from 0.8 ± 0.3 at baseline to 4.7 ± 3 and 4.9 ± 3 mM following the first and third period ($p < 0.05$). Muscle glycogen decreased from 400 ± 22 to 188 ± 43 mmol/kg d. w. over the course of the game ($p < 0.05$). Compared to pre-game values mean sprint time declined following the first ($p < 0.05$) and third ($p < 0.01$), but not after the second period. **CONCLUSIONS:** Ice hockey is a high-intense team sport with a large anaerobic contribution resulting in significant glycogen utilization and fatigue development especially at the end of the game. The latter finding may at least partly be explained by lowered muscle glycogen levels.

3586 Board #274 Jun. 1 9:30 AM - 11:00 AM

Effect of Bicycle Crank Length on Maximal Oxygen Consumption and Ventilatory Threshold in Trained Cyclists

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Many potential benefits of altering bicycle crank length (CL) have been proposed from reducing injury to increasing aerodynamics and consequently, performance. Submaximal cycling bouts are often used to simulate various riding efforts to determine how CL can impact race performance in various cycling disciplines. These studies either used a set wattage for all participants or an intensity relative to $\dot{V}O_{2\max}$ or Ventilatory Threshold (VT) based on a Cardiopulmonary Exercise Test (CPET) performed on one CL. However, it is unknown whether CL impacts $\dot{V}O_{2\max}$ and/or VT, thus altering the prescribed submaximal intensity when CL is changed. This is crucial prior to future work in the area and for interpreting previous studies. **PURPOSE:** The purpose of this study was to determine the influence of crank length on $\dot{V}O_{2\max}$ and VT in trained cyclists and multisport athletes. **METHODS:** After a familiarization session, 10 subjects performed three separate trials using different crank lengths (162.5, 172.5 and 182.5 mm) in randomized, counter-balanced order. The trials consisted of a maximal CPET to determine $\dot{V}O_{2\max}$ and VT, a supra-maximal effort to verify $\dot{V}O_{2\max}$, and two 10-min submaximal efforts at a low intensity (70% of VT) and a high intensity (95% of VT). Individual repeated measures analysis of variance (ANOVAs) were used to compare differences in $\dot{V}O_{2\max}$ and VT across the three crank lengths. To achieve a power of 80% with a difference of 3 mL/kg/min and a standard deviation of 1.5, nine subjects were required. **RESULTS:** $\dot{V}O_{2\max}$ and $\dot{V}O_2$ at VT values were not significantly different across the three crank lengths (162.5, 172.5 and 182.5 mm) 4.35, 4.39 and 4.36 L/min, $p=0.65$ and 3.08, 3.04 and 3.08 L/min, $p=0.64$, respectively. **CONCLUSION:** Mean differences in the $\dot{V}O_{2\max}$ and VT values between crank lengths were not statistically significant; however, several individual differences were of clinical relevance (5/10 subjects for $\dot{V}O_{2\max}$ and 6/10 for VT differed by ~ 3 mL/kg/min or more between at least two CLs). Factors including explosive power capacity, preferred cadence, leg length, body composition, and submaximal cycling economy could influence these individual differences and warrant further evaluation.

3587 Board #275 Jun. 1 9:30 AM - 11:00 AM

The Effects of Experiential Learning on Exercise Physiology Self-Efficacy

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Purpose: This mixed methods, experiential learning research project incorporated multiple teaching methodologies to assess improvements in knowledge and self-efficacy in exercise physiology (EXPH) human performance testing. **Methods:** Six undergraduate EXPH students completed a pre-intervention quiz which assessed knowledge of blood lactate production and lactate threshold. Participants received

a lecture on lactate production and lactate threshold from an expert in the field of human performance and discussed peer-reviewed research readings. Supervised training and practice were held prior to conducting lactate threshold testing on the varsity women's rowing team. Following, participants met to review physiological concepts, data collection procedures, discuss research readings, and reflect on the service component of the project. At the end of the project, participants completed the same lactate threshold quiz as well as an anonymous, online, 15-question self-efficacy and satisfaction survey with answer choices on a 7-point Likert scale. A focus group discussion moderated by trained researchers captured participants' perceptions of the experiential service learning project. Data were content analyzed to identify common themes using independent data reviewers and a tiebreaker when necessary. **Results:** All participants agreed or strongly agreed that participation in this project would allow them to make a difference in [their] community, enable them to interact with relevant professionals in ways that are meaningful and effective, and apply [their] knowledge in ways that solve real-life problems. All students strongly agreed they would recommend this experience to their friends. Compared with a pre-assessment, participants scored 10% higher on the lactate knowledge quiz at the end of the experiential learning project. Students reported improved self-efficacy, knowledge, communication, and confidence in exercise physiology related content as well as professional skills. **Conclusion:** An experiential learning project incorporating multiple teaching methodologies successfully improved knowledge, self-efficacy, and professional skills in human performance testing.

3588 Board #276 Jun. 1 9:30 AM - 11:00 AM

Left Ventricular Function and Cardiac Biomarker Release -The Influence of Exercise Intensity, Duration and Mode: A Systematic Review and Meta-Analysis

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Prolonged strenuous endurance exercise is associated with altered cardiac physiology that often manifests as both transient cardiac dysfunction and detectable cardiac troponin (cTn) in peripheral circulation. The extent of a possible relationship between cTn release and cardiac function is unclear as many studies do not report significant correlations. The influence of exercise intensity, mode and duration on EICF and cTn release is also unknown due to large methodological variation.

Purpose: We performed a systematic review, meta-analysis and meta-regression of studies that sought to determine the relationship between cTn and left ventricular (LV) function. The second objective was to determine how study-level and exercise factors influenced the variation in the body of literature.

Methods: A systematic search of Pubmed Central, Science Direct, SPORTDISCUS, and MEDLINE databases for original research articles published between 1997-2018 involving >30mins of continuous exercise, measuring cTn event rates, LV ejection fraction and E/A ratio. Random-effects meta-analyses and meta-regressions with four *a priori* determined covariates (age, exercise heart rate [HR], duration, mass) were performed.

Results: Pooled cTn event rates were evident in 45.6% of participants (95% CI = 33.6 – 58.2%); however, the overall effect was non-significant ($P > 0.05$). There were significant ($P < 0.05$) reductions in E/A ratio: -0.38 (SMD = -1.2 , 95% CI $[-1.4, -1.0]$), and LVEF: 2.02% (SMD = -0.38 , 95% CI $[-0.7, -0.1]$) pre to post-exercise. Exercise HR predicted cTn release and E/A ratio. Participant age was negatively associated with cTn release. There was a significant negative association between E/A ratio and cTn event rate ($P < 0.05$).

Conclusions: High levels of statistical heterogeneity and methodological variability exist in the majority of EICF studies. Exercise intensity and age are the most powerful determinants of cTn release. E/A ratio is influenced by exercise HR and cTn release, implying exercise bouts at high intensities are enough to elicit cTn release and reduce E/A ratio. Future EICF studies should reduce heterogeneity by use of echocardiographic techniques such as myocardial speckle tracking, maintaining participant hydration, serial follow-up measures to assess symptom progression or recovery.

3589 Board #277 Jun. 1 9:30 AM - 11:00 AM

Independent and Combined Effects of Arterial Angulations and Shear Stress on Vascular Function

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Excessive sedentary time is a significant health risk, independent of daily physical activity or exercise. In particular, long periods of prolonged sitting is associated with an increased risk of cardiovascular disease. Prolonged sitting reduces flow-mediated

dilation (FMD), which is a key indicator of vascular health. Recent evidence suggests that the seated position strains the arteries through angulations that create turbulent blood flow, thereby reducing FMD. However, when blood flow in the arteries is slightly increased (via local heating), vascular function improves even when seated. However, the combined effects of removing arterial angulations (i.e., standing) and increasing shear stress (i.e., local heating) on reducing sitting-induced vascular dysfunction have yet to be investigated. **PURPOSE:** This project aims to determine if arterial angulations (through sitting or standing), shear stress (through local heating), or a combination of these factors affect vascular function. **METHODS:** 13 individuals (n = 4 male; n = 9 female) participated in a randomized crossover design study. Participants completed two experimental trials (one sitting and one standing). At the beginning of each experimental trial, participants laid supine for at least 20-minutes prior to baseline measurements of FMD at the superficial femoral artery (SFA). Participants then moved into a sitting or standing position. One leg was then passively heated through a water-perfused pant leg in order to increase shear rate. Participants maintained this position for 2-h. Participants then returned to a supine position and post measures of FMD were obtained. **RESULTS:** Overall, sitting led to approximately a 1.2% decline in FMD. Standing appeared to confer the greatest benefit independent of heating ($p = .025$). By the end of standing, participants FMD was 2.88% ($p = .037$) greater than after 2-h of sitting. However, there was no significant effect of local heating (0.75 ± 1.90 , $p = .594$) and no interaction between heating and body position (-0.17 ± 2.70 , $p = .879$). **CONCLUSION:** Standing was superior to sitting with regards to FMD while local heating had a non-significant effect. However, future studies need to examine modifiers such as biological sex.

3590 Board #278 Jun. 1 9:30 AM - 11:00 AM
Association Of Mid-pregnancy And Current Exercise With Arterial Stiffness 6 Months-3 Years After Delivery In Women

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PURPOSE: Regular exercise is associated with lower cardiovascular disease (CVD) risk. Pregnancy influences longer-term CVD risk for women, regardless of their previous prenatal risk level. Our purpose was to assess whether prenatal and/or current physical exercise levels were associated with arterial stiffness in women 6 months-3 years after a singleton delivery.

METHODS: We performed gold-standard measurement of central arterial stiffness (aortic pulse wave velocity; PWV) in 19 women (mean age=34±1 yrs; mean BMI=27.0±2 kg/m²; 15 white/3 black/1 Asian). Participants were asked to recall leisure-time exercise performed during mid-pregnancy, as well as current exercise habits, and reported both using a validated survey (Godin Leisure-time Exercise Questionnaire). We used linear regression to determine associations of mid-pregnancy and current exercise with PWV, adjusted for age.

RESULTS: Average exercise units were 39±6 (mid-pregnancy) and 43±7 (current). Mean systolic and diastolic blood pressures were 111±3 and 70±2 mmHg, respectively; mean PWV was 6.4±0.3 m/s. Mid-pregnancy exercise score ($b = -0.02 \pm 0.01$, $p = 0.051$), but not current exercise score ($b = -0.01 \pm 0.01$, $p = 0.24$), was associated with PWV after adjustment for age.

CONCLUSIONS: Mid-pregnancy exercise levels were significantly associated with PWV 6 months-3 years after delivery. The findings suggest that exercise during pregnancy may be important for influencing longer-term maternal vascular function.

3591 Board #279 Jun. 1 9:30 AM - 11:00 AM
The Impact of Blood Flow Restrictive Exercise on Endothelial Function

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Research has shown low intensity resistance training done with blood flow restriction (BFR) to be an effective means at increasing skeletal muscle strength. However, research is lacking examining the effects of BFR exercise on brachial artery endothelial function, which is closely linked to coronary artery endothelial function and thus predisposition to developing atherosclerosis. Given the important role of blood flow (i.e., shear stress) on maintaining endothelial function, BFR exercise may have negative consequences on vascular health. **PURPOSE:** The purpose of this study was to examine the effects of blood flow restriction training on endothelial function in healthy men. **METHODS:** Subjects were 9 healthy males, 23.9±1.2 years, 27.7±1.2 kg/m² who regularly participated in resistance training exercises at least 2 times per week. Subjects performed 3 sets of bicep curls at 30% of their 1 repetition maximum to failure with a blood pressure cuff at 80% arterial occlusion pressure. Endothelial function was assessed by percent flow mediated dilation (%FMD) performed before,

immediately after, and one hour post an acute bout of BFR exercise. **RESULTS:** %FMD was unaltered immediately (9.57 ± 2.33) and 1 hr post (9.43 ± 3.05) BFR exercise compared to baseline (9.62 ± 1.63) ($p > 0.05$). **CONCLUSION:** An acute bout of BFR exercise does not alter endothelial function in healthy males. Future studies are aimed at determining if females display a similar response when controlling for the impact of the menstrual cycle on vascular function.

3592 Board #280 Jun. 1 9:30 AM - 11:00 AM
The Effects of Simultaneous Upper and Lower Body Cycling on Cardiorespiratory Responses.

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Some forms of physical activity require greater amounts of upper body activity combined with lower body activity. Arm ergometry has been shown to elicit larger increases in blood pressure and heart rate when compared to lower body ergometry. Arm ergometry, in workloads up to 125 W, has been shown to illicit greater increases in VO₂ due to extra stabilization of the torso and mechanical efficiency. The effects of a combined lower and upper body ergometry simultaneously, with identical workloads, on the cardiorespiratory system has not yet been studied. Previous studies have evaluated cardiorespiratory responses to elliptical ergometry, which utilizes both upper and lower body extremities. However, an elliptical does not allow for precise regulation and measurement of work performed by both upper and lower body.

PURPOSE: The aim of this study was to examine the effects graded upper body ergometry, lower body ergometry, and combined upper and lower body ergometry on oxygen consumption, heart rate, minute ventilation, respiratory exchange ratio, and blood pressure. **METHODS:** Eight males, ages 18-28y, participated in three trials over seven days. Subjects were divided into two groups. Session one included one trial of graded leg ergometry and one trial of graded arm ergometry. The two groups completed each of these trials in a counterbalanced fashion with 20min rest between trials. Session two included a trial of graded leg ergometry combined with graded arm ergometry, performed simultaneously, at identical workloads. Each trial began with a warmup at 0kp and maintained a 60rpm cadence. Workload for each trial increased by 0.5kp every 2 min peaking at 95W. **RESULTS:** Combined body ergometry produced significantly ($p < .001$) greater peak oxygen consumption (36.14 ± 4.95 ml/kg/min) compared lower body ergometry (19.41 ± 3.88 ml/kg/min) and upper body ergometry (21.58 ± 7.08 ml/kg/min). Combined elicited a significantly higher peak blood pressure ($p < .005$) and heart rate ($p < .005$), respectively ($180 \text{ mmHg} \pm 10$) (168 ± 16 BPM), than lower body (156 ± 13 mmHg) (126 ± 12 BPM), but not upper body.

CONCLUSIONS: These data could be helpful in considering cardiorespiratory stress in healthy and clinical populations from manual tasks involving both upper and lower body extremities.

3593 Board #281 Jun. 1 9:30 AM - 11:00 AM
Bone Density and Cross-Sectional Area are Inversely Related in the Young Adult Distal Tibia

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Bone is posited to develop and adapt to loads by satisfying the competing demands for achieving sufficient stiffness and minimizing mass. This compromise has been demonstrated at the midshaft of the tibia by an inverse relationship between cross-sectional area and thickness of the cortical shell. The requirement for minimizing mass is likely greater at the distal tibia where inertial properties cause bone mass to be more metabolically expensive. Whether there is a similar tradeoff between bone size and the amount of bone tissue at the distal tibia remains to be determined. **PURPOSE:** Determine whether cross-sectional area of bone is inversely related to bone density at the distal tibia. **METHODS:** Six hundred seventy-three (476M, 197F) Army trainees (20.4 ± 3.4 yrs; 1.71 ± 0.09 m; 72.5 ± 13.3 kg) underwent high resolution peripheral quantitative computed tomography (HR-pQCT, XtremeCT2, Scanco Medical AG) scans of their non-dominant distal tibias at 4% of bone length from the distal growth plate, at the start of their initial military training. Generalized linear models adjusted for sex were used to test the significance and directionality of relationships between total cross-sectional area (CSA) normalized to body mass and total volumetric bone mineral density (vBMD). **RESULTS:** Normalized CSA was significantly and inversely related to vBMD ($p < 0.001$) where a one-unit increase in normalized CSA (mm²/kg) resulted in a 5.856 mg HA/cm³ reduction in vBMD. Specifically, the lowest compared to the highest quartile of normalized CSA had 13% higher vBMD, per unit body mass. **CONCLUSION:** These findings support the hypothesis that bone in the distal tibial

metaphysis develops in a manner which balances the need to be adequately stiff against that of minimizing the mass of a metabolically costly tissue through maintaining lower bone density relative to larger bone size.

3594 Board #282 Jun. 1 9:30 AM - 11:00 AM
Dynamic Changes Of Doppler Signal During Tendon Scraping

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Midsubstance Achilles tendinosis and patellar tendinosis are degenerative lesions that impede athletic performance and activities of daily living. Tendon scraping (TS) is a minimally invasive procedure to accelerate pain relief by disrupting neovascularity and reinnervation hypothesized as responsible for pain. The original description uses color Doppler (CD) to identify the region with increased blood flow but does not comment on how CD changes during TS. Others propose that TS is complete when Doppler flow is absent. Our observation is that CD is absent after a small volume injection of local anesthesia, before scraping is begun.

PURPOSE: This case series reports changes in CD during TS to better inform technical understanding of this procedure.

METHODS: Six patients (male=4, female=2) with 5 cases of Achilles and 1 case of patellar tendinosis presented to the Sports Medicine Clinic. Ultrasound identified diseased tendon, and all patients had increased CD prior to the procedure. A 25-gauge 1.5-inch needle was advanced from lateral to medial to the tendon-fat pad interface. Doppler was left on during anesthetic administration. Once local anesthesia was administered, a stab incision was made with an 11 blade scalpel. A 14-gauge 2-inch needle was then advanced under ultrasound guidance in identical fashion. The bevel was turned to make contact with the tendon surface. The fat pad was separated by pulling it away from the tendon in an anterior-posterior direction and then semi-circular, cranial-caudal sweeps were made to complete fat pad separation until the needle moved with unrestricted motion.

RESULTS: In all six patients, CD was absent after injecting 1-3 mL of lidocaine. Though only 1 needle pass was made, CD was completely absent throughout the length of the tendon. No complications occurred.

CONCLUSION: The most important finding of this work is that CD is absent after a small injection of local anesthetic, demonstrating that CD cannot be used to determine TS completion. CD is still a useful pre-procedure guide to identify the tendon region needing treatment, but it cannot be used as a marker of effective scraping / devascularization. A superior marker of procedure completion is freedom of needle motion demonstrating tendon separation from adjacent fat pad.

3595 Board #283 Jun. 1 9:30 AM - 11:00 AM
Mesenchymal Stem Cells Injection As A Therapy In A Rat Model Of Collagenase-induced Tendinopathy

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Tendinopathy represents 30 to 50% of sports-related injuries. Yet, a significant proportion of patients do not respond to the first-line conservative management with progressive loading and strengthening exercises program. Recently, Mesenchymal Stem Cells (MSC) have emerged as a potential regenerative treatment in tendinopathy. **Purpose:** The aim of the present study is to determine whether the injection of MSC and/or Celastrol-conditioned MSC promote histopathological healing in a rodent Achilles tendinopathy model.

Methods: Eighteen Sprague-Dawley rats (36 Achilles tendons) were injected with collagenase type 1A (25 international units) in each Achilles tendons under echographic guidance. After one week, rats were randomly and equally assigned to receive a repeat injection, also under echographic guidance, with either: 1) 60 µL of Phosphate-Buffered Saline (PBS: vehicle); 2) 2.4M MSC derived from rat bone marrow aspirate or; 3) 2.4M MSC conditioned with celastrol, a HSP90 inhibitor and antioxidant. The outcome measurements were histopathological changes assessed after Hematoxylin Eosin Saffron, Bleu Alcian and Factor VIII staining of Achilles tendons. Each item of the semi-quantitative modified Bonar score (tenocytes morphology, cellularity, vascularity, abundance of mucin in fundamental substance and collagen organization) was assessed by a blinded experienced pathologist at 4 weeks (4 rats/8 tendons per group) and at 12 weeks (2 rats/4 tendons per group).

Results: There were no statistically significant differences between groups, both at 4 weeks and 12 weeks ($\alpha > 0.05$). However, at 12 weeks, there was a trend towards

more improvement and better Modified Bonar Scores in the tendons treated with MSC (0.48 ± 0.46) and conditioned-MSC (1.51 ± 0.81) compared to tendons injected with vehicle (2.26 ± 1.90).

Conclusion: No difference was found in Modified Bonar Scores in tendon specimens injected with PB-saline compared to MSC and celastrol-conditioned MSC at 4 weeks. The number of rats per group that was observed until 12 weeks for pathologic analysis was insufficient to draw any conclusion. Nevertheless, these results underline that we need to host rats for a longer period for pathologic analysis. We are currently expanding this experiment with a larger number of rats to be assessed at 12 weeks.

3596 Board #284 Jun. 1 9:30 AM - 11:00 AM
Modeling Elbow Valgus Torque From Throwing Distance With 54,701 Collegiate Baseball Throws

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Reported Relationships: B. Hansen: Salary; Motus Global. Receipt of Intellectual Property Rights/Patent Holder; Motus Global.

The scalability and usability of inertial measurement units (IMU's) allows for biomechanical research to be conducted on datasets that are orders of magnitude larger than traditional motion-capture equipment allows for. From a clinical rehabilitation perspective, there is a large need to better understand the effects of throwing distance on elbow valgus torque in a real-world setting.

PURPOSE: To develop a framework for the prediction of elbow valgus torque at specific long-toss distances in college baseball players. **METHODS:** 30 players from a NCAA baseball team were fitted with a motusTHROW sensor and sleeve (Rockville Centre, NY, USA) that measures peak elbow valgus torque. The sensor was worn during all training in 2018, resulting in a total of 238,611 anonymized throws captured. Of this, 54,701 throws were tagged with a long-toss distance (30-300 ft). A 3rd order polynomial regression and one-way ANOVA were performed to test for differences in elbow torque between throwing distances with Tukey post-hoc tests used to for p-value calculation. **RESULTS:** A strong relationship was found between the throwing distance and elbow torque from the 3rd order polynomial (torque = $1.18 \times 10^{-7}x^3 - 8.90 \times 10^{-5}x^2 + 2.41 \times 10^{-2}x + 0.55$, $p < 0.001$). The ANOVA showed all but 7 of 35 distance relationships had statistically significant differences: 80-90 ft, 210-240/270/300 ft, 240-270/300 ft, and 270-300 ft ($p < 0.001$).

CONCLUSION: There was a strong cubic relationship between throwing distance and elbow torque. The cubic regression formula allows for clinicians to estimate peak valgus torque in the throwing arm from distance alone. This relationship can be used to better design return-to-throw programs.

3597 Board #285 Jun. 1 9:30 AM - 11:00 AM
Does Sharing Wearable Physical Activity Monitor Data with Others Lead to Longer User Engagement?

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The use of wearable physical activity (PA) monitors has increased rapidly over recent years and these devices are becoming more widely used in behavior change interventions. However, high rates of disengagement have been reported, with up to 70% stopping device use within 3 months. This trend is concerning, as these devices are unlikely to impact habitual PA behavior if they are not worn for a sustained length of time. Understanding which factors contribute to long-term engagement can support more effective use of this technology. **PURPOSE:** To assess whether the sharing of data from physical activity monitors (PAMs) via social media or directly with others (e.g. doctor, personal trainer/coach, friends/family) are related to sustained device engagement in a longitudinal survey study. **METHODS:** Current PAM users ($n=418$; mean age: 36.3 ± 12.6 ; 78% female) from across the United States were recruited online and completed a baseline web-based survey in 2015/2016. Participants were followed-up again in 2017. How respondents shared their device data (on social media, privately with family/friends, with their doctor, with coach/personal trainer [yes/no response items]) was queried. Sustained PAM engagement was defined as those who continued PAM use at follow-up. **RESULTS:** The median follow-up time was 15.5 (± 3.7) months. Approximately, 11.5%, 55.7%, 9.1%, and 4.3% reported sharing their data via social media, with family/friends, with a doctor, or with a coach/personal trainer, respectively. At follow-up, 72.5% of participants were still using their PAM. Sharing data from the PAM publicly on social media (e.g. Facebook, Twitter) was significantly associated with long-term PAM engagement (OR: 4.45; 95% CI: 1.51-13.15, $p=0.007$). Sharing of PAM data privately with family/friends (OR: 1.21; 95% CI: 0.76-1.92, $p=0.418$), with a doctor (OR: 1.38; 95% CI: 0.57-3.34, $p=0.477$), or with a coach/personal trainer (OR: 0.91; 95% CI 0.28-3.00, $p=0.881$) were not significantly associated with sustained PAM use. **CONCLUSION:** Sharing PAM data on social media was associated with sustained device use of over median follow-up

of 1.3 years. The extent to which PAM users share their data should be considered when using this technology as a behavior change tool. Encouraging users to share data publicly may lead to longer device engagement.

3598 Board #286 Jun. 1 9:30 AM - 11:00 AM
Does Post-diagnosis Physical Activity Prolong the Duration of Active Surveillance in Men With Prostate Cancer?

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PURPOSE: In this retrospective cohort study, we examined the effect of post-diagnosis physical activity on active surveillance (AS) termination in men with low-risk prostate cancer.

METHODS: 630 participants on AS were included in the analysis. Post-diagnosis physical activity was measured using the Godin Leisure-Time Exercise Questionnaire and expressed in metabolic equivalent-minutes per week (MET-min/wk). Four physical activity categories were created to classify participants throughout the study: inactive (<210 MET-min/wk), insufficiently active (210-500 MET-min/wk), active/meeting physical activity guidelines (500-1000 MET-min/wk), or highly active (>1000 MET-min/wk). Using Cox regression models, we evaluated the relationship between post-diagnosis physical activity and risk of terminating AS, adjusting for age, prostate-specific antigen (PSA) and number of positive cores most proximal to AS initiation. **RESULTS:** Of the 630 participants, 198 underwent active treatment and 432 were censored. The earliest and latest events of AS termination, indicated by active treatment initiation occurred at 5 and 116 months, respectively. In this cohort, post-diagnosis physical activity was not significantly associated with time to AS termination. PSA (HR, 1.11; 95% CI, 1.03 to 1.20) and the number of positive cores (HR, 1.34; 95% CI, 1.12 to 1.61) most proximal to AS initiation were associated with a significantly increased risk of initiating active treatment. **CONCLUSIONS:** The findings of this study suggest that termination of AS and initiation of active treatment is not influenced by post-diagnosis, self-reported physical activity status.

3599 Board #287 Jun. 1 9:30 AM - 11:00 AM
Assessing Safety, Ease of Use, and Productivity While Using Treadmill Desks: A Pilot and Feasibility Study

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BACKGROUND: Sedentary behavior is associated with a variety of health complications. Long bouts of sitting is becoming a recognized risk of workplace environments.

OBJECTIVE: The purpose of this study was to evaluate the safety, ease of use, and productivity associated with using treadmill desks (TD) during the work day.

METHODS: Sedentary office workers (n=14; 86% female, 40±12 yrs) took part in a within-person, 4-week randomized crossover study comparing group usage of a TD to a usual desk condition. During the TD condition, participants were asked to use the treadmill for a minimum of 30 minutes each workday. In-person study visits were conducted at baseline and during the final week of each condition, and electronic surveys were administered via an email link. Treadmill use and physical activity bouts were tracked with logs and the activPAL accelerometer worn on the thigh. **RESULTS:** During the TD period, participants spent an average of 33±25 minutes at an Active Station (Hopkins, Minn.) TD each day; the range of the walking bout durations, when the TD was used, was 15-120 minutes. All participants reported feeling safe while using the TD. 12 people reported it was 'easy' to use, with one person reporting it was 'somewhat easy'. Productivity results were mixed; 4 reported they were somewhat or much more productive, 4 were neutral, and 5 reported they were somewhat less productive. All participants endorsed a desire to continue using the treadmill desks.

CONCLUSIONS: Results suggest that, over the short term, treadmill desks are safe and easy to use and appear to have mixed effects on productivity. Further research should include full-scale long-term efficacy trials of treadmill desks that include measures of productivity, adherence, and cardiometabolic health outcomes.

3600 Board #288 Jun. 1 9:30 AM - 11:00 AM

Dearborn SHINES For Healthy Kids: Understanding Physical Activity Among Arab American Students in Physical Education and the Impact of SPARK

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 (No relationships reported)

Background/Purpose: Arab Americans account for almost 3.7 million people in the United States (Arab American Institute, 2014). However, limited health data is available on youth populations. Additionally, very few interventions have been designed to increase the physical activity levels of Arab American youth. Therefore, the purpose of this study is twofold: evaluate Arab American children's physical activity (PA) levels during physical education (PE) class and understand how the implementation of SPARK can influence the PA of Arab American youth in the PE context.

Methods: System for Observing Fitness Instruction Time (SOFIT) was used to assess activity levels, lesson context, and teacher involvement during PE class. A total of 66 PE classes in one urban, primarily Arab American, district, were observed in grades 3-8, involving 18 PE teachers. Data collection took place over two time points, with one professional development of the SPARK PE curriculum occurring in-between. Data were downloaded from the iSOFIT app and analyzed using SPSS (v25).

Results: MANCOVA's were run to better understand the effect grade level has on physical activity minutes, lesson context, and teacher involvement while controlling for teacher, total lesson minutes, and type of activity. In general results showed that students were not meeting suggested PA guidelines during PE class $M_{MVPA3rdgrade}=18.6$ min, $M_{MVPA4thgrade}=14.1$ min, $M_{MVPA5thgrade}=13.4$ min, $M_{MVPA6thgrade}=12.3$ min, $M_{MVPA7thgrade}=18.7$ min, $M_{MVPA8thgrade}=15.3$ min. Overall, grade did not have a significant effect on level of PA ($p=.08$). MVPA did not increase between T1 and T2 ($p>.05$), but there were significant changes across timepoints in lesson context ($p<.01$) and teacher involvement ($p<.01$).

Conclusions: The results show that youth were not meeting recommended amounts of daily PA during PE class at either timepoint. A one-time SPARK professional development did not significantly change student behavior as measured by MVPA, but did show improvements in teacher knowledge as measured by lesson context and teacher involvement. Implications for using SOFIT data gathered to inform the ongoing SPARK and Dearborn SHINES intervention and importance of prolonged professional development to transition from increases in knowledge to behavior change will be discussed.

3601 Board #289 Jun. 1 9:30 AM - 11:00 AM
Do Activity Monitors Correctly Classify Driving Time as Sedentary?

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 (No relationships reported)

PURPOSE: Driving is a common sedentary activity for many individuals. Previous studies suggest that accelerometers may misclassify driving as a more active behavior due to vehicle vibrations not related to human movement. Therefore, the purpose of this study is to examine how accurately accelerometer processing methods classify driving-specific sedentary time.

METHODS: Participants (n=26, mean age=30.5yrs, 16 female, 20 male) wore an ActiGraph wGT3X-BT (AG) on the right hip, an AG on the non-dominant wrist, and an activPAL (AP) accelerometer on the thigh. They were directly observed for two 2-hour sessions using a GoPro Hero 5 to establish the criterion measure of driving time. We used published methods to classify accelerometer data as sedentary, light, and moderate to vigorous physical activity (MVPA). For the AG-hip, we used the Sojourn-3x (S3x), Freedson, Sasaki, and Crouter methods. The AG-wrist was classified using a random forest (RF) and linear model (lm), and the AP used a proprietary algorithm. We isolated the directly observed driving time and determined whether each of the methods categorized the driving time as sedentary, light or MVPA.

RESULTS: Nine of the twenty-six participants drove during the observed time, resulting in 24 separate driving bouts with a mean bout length of 8.5 minutes, totaling 3.4 hours of sedentary driving time. For the AG-hip, the Crouter method produced the lowest classification accuracy with 26.5% correctly classified as sedentary, 68.4% classified as light and 7.0% as MVPA. In contrast, using the Sojourn-3X method, 70.2% of driving time was correctly classified as sedentary, 26.9% was classified as light and 2.9% as MVPA. For the wrist, using a random forest method resulted in 44.5% correct classification, while the accuracy of a linear model was 30.2%. The AP classified 100% of the driving time as sedentary.

CONCLUSIONS: Existing algorithms to estimate sedentary time for hip- and wrist-worn accelerometers do not accurately classify driving time, while the thigh-worn AP

is highly accurate. Since the average American spends 46 min/day in the car, there is a need to develop new methods that correctly classify driving time for hip- and wrist-worn devices.

3602 Board #290 Jun. 1 9:30 AM - 11:00 AM
Comparing Estimates Of Sedentary, Light And Moderate-vigorous Physical Activity Between Activity Monitors

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Accelerometers are widely used in research, but studies use different monitors, attachment sites, and/or data processing methods, making it difficult to compare results across studies.

PURPOSE: Therefore, the purpose of our study is to compare data collected at the hip, wrist, and thigh to determine if estimates of sedentary time (ST), light physical activity (LPA) and moderate-vigorous physical activity (MVPA) are comparable over a 7-day wearing period.

METHODS: Participants wore an ActiGraph (AG) on the hip and non-dominant wrist, and activPal on the thigh 24 hours/day for 7-days. Intensity was categorized using the following methods: AG-Hip 3x, Freedson, Sasaki, Matthews, and Crouter; AG-wrist random forest (RF), linear model (LM) and GGIR; and activPal software. Across the different methods, we compared mean estimates and Pearson correlations for ST, LPA and MVPA.

RESULTS: Average ST ranged from 461 min/day (Hip-Crouter) to 610 min/day (Hip-Freedson), the lowest correlation was between Hip-3x and Wrist-GGIR ($R = 0.14$) and the highest was between Hip-Freedson and Hip-Sasaki ($R = 0.94$). Average LPA ranged from 201 min/day (Hip-Matthews) to 338 min/day (Hip-Sasaki), the lowest correlation was between Hip-3x and Wrist-LM ($R = 0.46$) and the highest was between Hip-Freedson and Hip-Matthews ($R = 0.94$). Average time in MVPA ranged from 53 min/day (Hip-Freedson) to 186 min/day (Wrist-LM), the lowest correlation was between Wrist-LM and Wrist-GGIR ($R = 0.30$) and the highest was between Hip-3x and Hip-Matthews ($R = 0.93$).

CONCLUSIONS: Estimates of ST, LPA and MVPA are heterogeneous across different processing methods and attachment sites, particularly when comparing hip and wrist attachment sites. There is a need to identify which procedures will result in equivalent methods to facilitate data pooling and ensure coherent public health translation of prospective cohorts that are using accelerometers.

3603 Board #291 Jun. 1 9:30 AM - 11:00 AM
High-active Mice Have Elevated Clearance Rate Of Bcaas Compared To Low-active Mice

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Physical activity (PA) is associated with a diminished prevalence of hypokinetic related diseases and its worldwide economic burden on health care cost. For several decades, branched-chain amino acids (BCAAs; leucine [LEU], isoleucine [ILE], valine [VAL]) have been studied for muscle wasting disorders. However, little is known about the metabolic interactions between BCAAs and regulation of PA levels.

PURPOSE: To assess BCAA metabolism by measuring plasma clearance rates in mice previously classified as either low-active (LA; C3H/HeJ) or high-active (HA; C57L/J).

METHODS: 12-week-old male LA ($n = 23$) mice (body weight: 25.8 ± 1.2 g; lean body mass: 21.0 ± 1.1 g; fat mass: 2.5 ± 0.5 g) and HA ($n = 20$) mice (27.5 ± 1.2 ; 22.5 ± 1.3 ; 2.5 ± 0.7) were used. Under anesthesia, a pulse of stable tracers (L-LEU[13C6], L-ILE [1-13C], and L-VAL [13C5]) was administered via the right jugular vein catheter. Subsequently, blood samples were taken (Time: 1, 3, 5, 7, 10, 15, 20, 25, 30, and 40 mins). Plasma enrichments and concentrations of LEU, ILE, and VAL were determined by LC-MS/MS. Whole-body production (WBP) was calculated from fitted area under the curve (AUC) as pulse/AUC, and clearance of stable tracers was calculated as WBP/plasma concentrations. Fitting and statistical analysis (unpaired student t-tests) were performed using GraphPad Prism 8 software. Data are expressed as mean \pm SE.

RESULTS: HA mice had significantly lower plasma concentrations for LEU (125.2 ± 4.8 vs 144.8 ± 6.4 $\mu\text{mol/L}$, $p = 0.02$), ILE (48.5 ± 1.9 vs 57.7 ± 2.3 $\mu\text{mol/L}$, $p < 0.01$) and VAL (156.8 ± 4.9 vs 187.9 ± 7.1 $\mu\text{mol/L}$, $p < 0.01$) and significantly higher WBP values for ILE (11.6 ± 0.6 vs 8.3 ± 1.1 nmol/g lbm/m, $p = 0.02$) and VAL (111.4 ± 5.4 vs 92.8 ± 2.8 nmol/g lbm/m, $p < 0.01$) compared to LA mice. No significant WBP differences were observed for LEU (75.5 ± 3.3 vs 72.7 ± 3.2 nmol/g lbm/m, $p = 0.56$). HA mice demonstrated higher percent clearance for LEU (40%), ILE (76%), and VAL (29%) compared to LA mice. **CONCLUSIONS:** The observed changes in plasma

concentration, WBP, and clearance of BCAAs suggest modified metabolic pathways of LEU, VAL, and ILE in HA mice, compared to LA mice. **FUNDING SOURCES:** Texas A&M Vice President of Research Office, TACSM Student Research Development Award, College of Education & Human Development Student Research Grant, and funds from the Omar Smith Endowment.

3604 Board #292 Jun. 1 9:30 AM - 11:00 AM
Ghrelin and PYY are Differentially Altered Following an Acute Bout of Aerobic vs Resistance Exercise

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PURPOSE: The purpose of our ongoing trial is to determine if aerobic exercise (AEx) and resistance exercise (REx) differentially influence acute energy intake and appetite regulation.

METHODS: Physically inactive adults with overweight/obesity ($n = 19$, 35 ± 1.7 yrs, BMI: 28.7 ± 1.1 kg/m²) completed 2 conditions; 1) AEx (treadmill walking at 65-70% of age-predicted maximum heart rate for 45 minutes) and 2) REx (1-set to failure of 12 resistance exercises). Each condition was initiated in the post-prandial state (35 minutes post breakfast). Appetite (visual analog scale [VAS] for hunger and satiety) and hormones (ghrelin and PYY) were measured every 30 minutes for 3 hours following consumption of the standardized breakfast meal. Post exercise food cravings (following 90 min VAS and blood draw via Food Cravings Inventory [FCI] questionnaire) and ad libitum energy intake at the lunch meal were also measured.

RESULTS: There was no difference in post-exercise ad libitum energy intake between conditions (AEx: 932 ± 75 kcal vs. REx: 910 ± 81 kcal). There were also no differences in post exercise food cravings, nor area under the curve (AUC) for hunger, satiety, ghrelin, and PYY. However immediately following exercise (90 minutes post breakfast), ghrelin (AEx: 784 ± 66 pg/mL vs. REx: 642 ± 41 pg/mL, $p = 0.08$) and PYY (AEx: 166 ± 12 pg/mL vs. REx: 124 ± 11 pg/mL, $p = 0.05$) were both higher in the AEx condition. Across conditions, higher scores on the FCI ($r = 0.49$, $p < 0.01$), increased hunger AUC ($r = 0.62$, $p < 0.001$), and decreased satiety AUC ($r = -0.43$, $p = 0.013$) were associated with increased ad libitum energy intake.

CONCLUSIONS: The data suggest that an acute bout of aerobic exercise appears to transiently increase both ghrelin and PYY, which are orexigenic and anorectic gut peptides, respectively, compared to resistance exercise. However, ad libitum energy intake was not different between conditions. Future work is needed to confirm these findings and uncover mechanisms by which exercise influences appetite indices and energy intake.

3605 Board #293 Jun. 1 9:30 AM - 11:00 AM
Can A Polyphenol Supplement Improve Sports Vision And Reaction Time? A Pilot Investigational Study

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PURPOSE: Polyphenol supplements have emerged as positive influencers in lipid and metabolic regulation related to cardiovascular disease risk. Limited research has assessed their value in neurological function and sports reaction measures. A highly concentrated extract of citrus bergamot polyphenols was tested because of extensive publications demonstrating benefits in oxidative stress and dyslipidemias, and therefore might improve visual components.

METHODS: Nineteen (19) volunteers, aged 50-74 years old, were studied. Fourteen (14) subjects consumed BergaMet Sport, a high concentration polyphenol compound, and five (5) controls consumed a placebo. Subjects were randomly assigned to either the placebo or intervention groups. Weight, body composition, visually directed balance, sports vision reaction time and a seven-test sports vision battery were measured at time 0 and at 30 and 60 days.

RESULTS: The mean age for the control group was 58, + or - 9.42 yrs for the and for the intervention group, 57.1 + or - 6.42 yrs. 52% were female and 48% were male. The subjects who received the intervention improved to statistically significant levels in all sports vision and balance measures compared to the placebo group. The key measures of time to balance task (5.76 second increase Placebo (PL) vs. 15.51 second decrease/improvement Intervention (INT)), reaction time test (73.6 point improvement PL vs. 492.5 point improvement INT) and the sports vision ranking composite of seven measures as a percentile to normative (.654 point improvement in percentile ranking for PL vs. 6.33 point improvement for INT), were all significant ($P < 0.05$), using paired student's t-tests.

CONCLUSIONS: In this pilot study, consumption of a high concentration polyphenol produced significant improvements in neurological function specifically related to visual components, balance and reaction time in this older age group in a relatively short time period. Further investigation in other age groups attempting to regain and maintain function in domains related to vision and reaction time is warranted in respect to polyphenol compounds.

3606 Board #294 Jun. 1 9:30 AM - 11:00 AM
Metabolic Flexibility is Impaired in Response to Acute Exercise in the Young Offspring of Mothers with Type 2 Diabetes

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Metabolic Flexibility is Impaired in Response to Acute Exercise in the Young Offspring of Mothers with Type 2 Diabetes.

Cullen Vincelle¹, Timothy Allerton², Brian Irving¹, Guillaume Spielmann¹, and Neil Johannsen¹

¹Louisiana State University, Baton Rouge, LA. ²Pennington Biomedical Research Center, Baton Rouge, LA. Healthy adults with a family history (first degree relative) of T2D demonstrate impairments in metabolic flexibility (MF), which is considered to be a factor in the development of T2D. Insulin sensitivity has been shown to improve in the first 48 hours in response to exercise. Whether, a single bout of high intensity interval exercise (HIIE) improves MF in men and women with a family history of T2D remains to be resolved. **PURPOSE:** The purpose of this study was to assess MF in a group of young, seemingly healthy adults with a positive family history of maternal T2D (FH+) and those without a family history of T2D (FH-) in response to a single bout of HIIE and 1 hour (1H) and 48 hours (48H) after exercise. **METHODS:** Seventeen participants (n=9 FH+ 2M/6F) consumed a liquid mixed meal with 3-hour post-prandial resting metabolic assessments (RMR) taken at baseline (BL, no prior exercise), and at 1H and 48H after a bout of HIIE (10 x 60s @90% watt max). **RESULTS:** Δ RER AUC for FH+ vs. FH- groups differed at BL, but not significantly ($p=0.08$); however, at the 1H visit the Δ RER AUC for the FH+ group (4.3 ± 1.6) was lower when compared to FH- group (6.5 ± 1.9 ; $p=0.02$). The suppression of FatOx (reduction at 60 minutes post-meal) was attenuated during the 1H visit in the FH- participants (-0.018 ± 0.01 g/min), but not in FH+ participants (0.007 ± 0.01 g/min; $p=0.03$). Δ RER AUC was increased at 48H in FH+ participants. **DISCUSSION:** Our results suggest that young adults with a maternal family history of T2D demonstrate impaired MF in response to a mixed meal tolerance test 1H post-HIIE. However, MF was improved to the level of FH- participants at 48H.

3607 Board #295 Jun. 1 9:30 AM - 11:00 AM
Relationship Of Leptin, Body Composition And Resting Metabolic Rate In Chinese Overweight And Obese Adults

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PURPOSE: Resting metabolic rate (RMR) and substrate utilization are important factors in maintaining energy balance and leptin is postulated to be involved in the regulation of body weight. However, in overweight and obese individuals, excess fat mass has a significant impact on metabolic function both directly through altered metabolic rate and substrate oxidation, and indirectly, through chronic changes in hormonal concentrations. This study determined the relationship of body composition and leptin with RMR and substrate utilization (carbohydrate, fat and protein oxidation rates) in Chinese overweight and obese adults.

METHODS: The subjects were 33 women (age = 44.0 ± 12.1 years; BMI = 27.9 ± 3.2 kg/m²; percent body fat (%fat) = $38.7 \pm 4.0\%$) and 34 men (age = 30.0 ± 9.7 years; BMI = 27.4 ± 1.7 kg/m²; percent body fat (%fat) = $27.5 \pm 4.3\%$). RMR and substrate utilization were measured by indirect calorimetry (Metamax 3B® Metabolic Measurement system, German) and body composition by the bioelectrical impedance method. Serum leptin levels were determined by radioimmunoassay.

RESULTS: In men and women, RMR significantly correlated with Skeletal Muscle Mass (Men: $R=0.556$, $p=0.001$; Women: $R=0.493$, $p=0.004$), but both not significantly correlated with leptin (both $p>0.05$). In stepwise multiple regression analysis, SMM was the main predictor of RMR, explaining 42.5% and 28.5% of the variance of RMR in men and women respectively. In women, but not men, leptin significantly correlated

with RER ($R=-0.581$, $p=0.029$) and carbohydrate, fat, and protein oxidation rates respectively ($R=-0.558$, 0.689 , 0.690 ; all $p<0.01$). Furthermore, in stepwise multiple regression analysis, leptin explaining 33.7% of the variance of RER in women.

CONCLUSIONS: Skeletal Muscle Mass is a significant predictor of RMR in Chinese overweight and obese adults, evaluation of body composition may be an effective and efficient way to evaluate metabolic status. Serum leptin concentrations in female subjects showed a negative association with respiratory quotient and carbohydrate oxidation rate and positive association with fat and protein oxidation rates. We suggest that sex-specific evaluations are also necessary. **Acknowledgements:** This work was supported by National science and technology program of China (Grants No.2013FY114700)

3608 Board #296 Jun. 1 9:30 AM - 11:00 AM
Exercise, Estradiol, And Specific Estrogen Receptor Activation For The Prevention Of Type 2 Diabetes

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Postmenopausal women have an increased risk for type 2 diabetes (T2D), and hormone replacement therapy (HRT) decreases this risk. However, HRT increases the risk of breast cancer and stroke, and thus, the US Preventive Services Task Force does not recommend HRT to prevent or manage T2D. Moreover, exercise is an effective means to prevent and treat T2D. **PURPOSE:** To compare exercise treatment with drug-induced estrogen receptor (ER) activation in ovariectomized (OVX) rats fed a high-fat diet (HFD). **METHODS:** OVX female rats were fed a HFD for 10 weeks. One group of rats ran on a treadmill for 25 minutes/day at 40 cm/s for 5 days/week (Ex), while the other rats were treated with estradiol (E₂: 1.4 µg/day), the specific ERα activator PPT (18 µg/day), or the specific ERβ activator DPN (18 µg/day) (n=8/group). Throughout the study, weekly food intake was determined by weighing the amount of food given and the amount of food remaining at the end of the week, and voluntary cage activity was measured using Optmo-M4 cage monitors. At the end of the study dual energy X-ray absorptiometry (DXA) determined the body composition. Normally distributed data were analyzed using a one-way ANOVA and an LSD post-hoc test. Non-normally distributed data were analyzed using Kruskal-Wallis testing. **RESULTS:** At the end of the study, the Ex and E₂ groups gained 125 ± 5 g and 125 ± 9 g of body weight, which was significantly less than the PPT and DPN groups (165 ± 12 g and 160 ± 8 g, respectively; $p<0.05$). Although the Ex and E₂ groups gained the same amount of total body weight, the Ex group had a significantly lower abdominal fat % compared to the E₂ group ($30 \pm 1\%$ vs. $37 \pm 2\%$; $p<0.001$), and the abdominal fat % of the E₂ group was the same as the PPT and DPN groups ($39 \pm 3\%$ and $38 \pm 2\%$, respectively). Although the food intake (kcal/day) did not differ between the groups, the voluntary cage activity of the E₂ group (498 ± 27 counts/hr) was significantly greater ($p<0.05$) than the Ex, PPT, and DPN groups (387 ± 34 , 397 ± 27 , and 370 ± 27 counts/hr, respectively). **CONCLUSION:** The prescribed exercise in the Ex group contributed to a lower body weight and lower % abdominal fat, and the voluntary cage activity in the estradiol group contributed to a lower body weight, but not lower % abdominal fat, which is the greatest risk factor for T2D. Supported by NIH Grant P20GM103443 and NSF Grant IIA-1355423.

3609 Board #297 Jun. 1 9:30 AM - 11:00 AM
The Effect Of Gestational Physical Activity On The Psychological Health Of Their Offspring

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PURPOSE: Gestational physical activity (GPA) has been associated with improved fetal outcomes. The purpose of this study was to examine whether exercise during pregnancy contributes positively to the psychological health of their offspring.

METHODS: A survey was administered to 1509 children (ages 11-13) to identify psychological health factors such as mental stress, depression, and self-esteem using a modified Daily Hassles Questionnaire, Children's Depression Inventory, and Rosenberg's self-esteem, respectively. Mothers of the participants were retrospectively categorized into three groups based on GPA: non-exercisers (CON), low-intensity aerobic exercise (AE), and body-weight strength training (BWT).

RESULTS: After excluding questionnaires due to incomplete data sets, 855 surveys were analyzed. Our results indicated significantly lower levels of depression with concomitant increased self-esteem among children of exercising mothers compared

to CON (AE: $p < 0.05$ and $p < 0.01$; BWT: $p < 0.05$ and $p < 0.01$, respectively). However, there was no effect of exercise on offspring mental stress levels, nor were there any differences observed between AE and BWT for any psychological health factors. Mental stress was significantly correlated with depression ($r = 0.640$, $p < 0.01$) and self-esteem ($r = -0.534$, $p < 0.001$). In addition, depression was negatively correlated with self-esteem ($r = -0.689$, $p < 0.01$).

CONCLUSIONS: GPA had a positive influence on the psychological health of their offspring. Interestingly, there were no differences between types of physical activity, which should be recognized to benefit the mental health of their children regardless of modality. Therefore, implementation of GPA should be accepted as part of the healthy gestational regimen along with prenatal vitamins and a healthy balanced diet.

3610 Board #298 Jun. 1 9:30 AM - 11:00 AM
Investigation of the Association of Depression and Cardiovascular Disease Risk in Retired Professional Football Players

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(No relationships reported)

Former professional football players have considerable cardiovascular disease risk. Studies have shown that psychosocial factors and depression are also strongly associated with CVD morbidity and mortality. **PURPOSE:** To better understand the association of cardiovascular disease and psychosocial factors such as depression in a population of retired NFL players. **METHODS:** Blood pressure, anthropometry, and laboratory blood analyses were collected from former NFL athletes ($n = 648$) between October 2016 and February 2018 during cardiovascular screenings held throughout the U.S. Questionnaires were used to collect demographic information, exercise frequency and Patient Health Questionnaire 2 (PHQ-2) scores. Means were analyzed via one-way ANOVA and associations between variables assessed using GLM. Chi-square analysis or t-test was used to assess differences between categorical variables, as appropriate. **RESULTS:** Variables of race ($p = 0.0007$), log of systolic blood pressure (SBP) ($\beta = -0.5258$, $p = 0.0404$), log of waist circumference ($\beta = -16.9366$, $p = 0.0218$), log of hip circumference ($\beta = 17.2927$, $p = 0.0196$) and waist to hip ratio ($\beta = 8.2430$, $p = 0.0171$) were significantly associated with positive screen for depression on the PHQ-2. Variables race ($p = 0.0002$), log of SBP ($\beta = -3.3818$, $p = 0.0009$), diastolic blood pressure (DBP) ($\beta = 0.0168$, $p = 0.0035$), log of waist circumference ($\beta = -46.3330$, $p = 0.0100$), log of hip circumference ($\beta = 46.5107$, $p = 0.0100$), and waist to hip ratio ($\beta = 22.3890$, $p = 0.0078$) were significantly associated with higher score on the little interest in doing things question of the PHQ-2. Variables race ($p = 0.0048$), log of SBP ($\beta = -2.2832$, $p = 0.0122$), and DBP ($\beta = 0.0141$, $p = 0.0059$) were significantly associated with higher score on the feeling depressed question of the PHQ-2. There were significant differences in prevalence between racial groups for positive screen for depression on the PHQ-2 ($p = 0.0006$). **CONCLUSIONS:** Factors reflecting body composition were found to be significantly associated with a positive screen for depression and depressive symptoms. Measures for abdominal obesity may be a better indicator for the association of body composition and depression in retired athletes. Accounting for racial differences in clinical practice may also help improve overall health outcomes.

3611 Board #299 Jun. 1 9:30 AM - 11:00 AM
Influence of Physical Stress on Interpretation of Ambiguous Social Cues

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Individuals with high stress jobs (e.g. law enforcement or military personnel) are often tasked with quickly interpreting ambiguous information in order to guide appropriate action. For example, certain social cues, such as (surprised) facial expressions, are ambiguous as they do not clearly signal whether an individual feels positive or negative, and could be interpreted as either safe or threatening. Previous work has demonstrated that acute emotional stress, which heightens arousal and negative affect, makes individuals more likely to interpret surprised facial expressions negatively. Likewise, exercise also influences affect and arousal, with the direction depending on exercise intensity. However, the influence of exercise intensity on valence bias, or tendency to interpret ambiguity as positive or negative, remains unexplored. **PURPOSE:** To examine shifts in valence bias of ambiguous social cues under moderate and high intensity exercise. **METHODS:** Forty-two healthy young adults (19 men, 23 women, ages 18-35) who engaged in regular exercise, completed 40 minutes of continuous steady-state cycling at moderate (65% Heart Rate Reserve, HRR) and high (85% HRR) intensities on two separate days. They completed measures of perceived exertion, affect and arousal 30 minutes into exercise, then rated a series of

ambiguous (surprised) faces as positive or negative. **RESULTS:** Heart rate, perceived exertion, negative affect and arousal were significantly higher under the high relative to moderate intensity condition (all p 's $< .05$). However, there was no significant difference in valence bias of surprised faces as a function of exercise intensity ($p > .1$). **CONCLUSIONS:** Understanding factors that influence interpretation of ambiguous social cues is important, as even slight shifts might alter if information is perceived as safe vs. threatening. This could have significant behavioral consequences for individuals operating in high-stakes environments. Results suggest that despite differences in participant's emotional state between moderate and high levels of physical stress, interpretation of ambiguous social cues remains unaffected. Supported by the U.S. Army Combat Capabilities Development Command Soldier Center (CCDC, Natick, Massachusetts, USA) under award number W911QY13C0012.

3612 Board #300 Jun. 1 9:30 AM - 11:00 AM
The Gut Microbiome Modulates Diet's Effect on the Regulation of Physical Activity

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(No relationships reported)

PURPOSE: We have observed chronic overfeeding via a high fat/high sugar diet decreases wheel running and substantially alters the microbiome in C57BL/6J mice. In this study, we tested the hypothesis that gut microbiota modulates the effect of nutrient intake on physical activity.

METHODS: 40 C57BL/6J male mice (5 wks of age) were individually housed, adjusted to a standard "chow" diet (CHOW) for a week, and then divided randomly into four groups: Group 1 (control group) received an *ad libitum* CHOW diet and water while Groups 2, 3, and 4 received an *ad libitum* high fat diet and a 20% fructose drinking water solution (HFHS) for a total of 12 weeks. Each group was given a running wheel for physical activity monitoring after three days on the new diet. After 12 weeks, Groups 2 and 3 were changed to a CHOW diet. Fresh fecal pellets from Group 1 (control group) were collected, homogenized in an anaerobic solution, and then 100 μ l was orally gavaged into Groups 2 and 4 one time a week for five weeks. Wheel running and body composition data were analyzed via repeated ANOVAs. The major bacterial phyla were quantified using qPCR.

RESULTS: By week 12, Groups 2, 3, and 4 (HFHS diet) ran significantly less distance, duration, and speed than Group 1 on a CHOW diet ($p < 0.05$). The HFHS animals ate significantly greater calories and had more body fat ($p < 0.05$) over the 12 weeks. With the diet alteration at week 13, Groups 1-3 (now all on CHOW) ran at a significantly higher speed than Group 4 (HFHS). Group 2 (CHOW plus transplant) had a significantly greater increase in wheel running compared to Group 3 (CHOW diet and a vehicle transplant). *Bacteroidetes* and *Firmicutes* were similar between Groups 1-3 within two weeks after the diet change regardless of the fecal transplant.

CONCLUSIONS: A HFHS diet increases body fat and decreases wheel running activity compared to a CHOW diet in C57BL/6J male mice. Recovery of wheel running and lowering body fat was accomplished within 2 weeks by switching from a HFHS diet to a CHOW diet. However, switching diets plus receiving a fecal transplant provided quicker results than diet alone. A fecal transplant without changing diet type did not recover activity levels.

3613 Board #301 Jun. 1 9:30 AM - 11:00 AM
The Association Between Player Age and Initial Helmet Contact Amongst American Football Players.

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(No relationships reported)

Recent research has demonstrated an association between repetitive head trauma and the incidence of chronic traumatic encephalopathy (CTE), particularly among professional American football players. It is believed that younger players are more susceptible to head injury yet the incidence in these younger age groups appears to be lower. We have shown that video review of game film is a reliable tool in quantifying the frequency and characteristics of head impacts in football games. **PURPOSE:** To study the association between player age and dangerous tackling techniques in all age groups of tackle football using video review of game film.

METHODS: 8 video reviewers were trained in a universal definition of a "hit" and 3 were chosen to individually review each game. Each reviewer classified each "hit" between a ball carrier and defender based on the level of helmet involvement from the two players. Initial Helmet Contact (IHC) hits were defined as hits between a

ball carrier and a defender that were initiated by at least one of the players' helmets. Regional or national championship level game-films from 2016 and later were obtained, from each age division, via open-source locations on the internet or a private subscriptions service for film review (NFHS Network, Indianapolis, IN). This study received IRB waiver of consent, an a priori power analysis was done to detect a 5% difference between age divisions, and data analyzed by assessing relative risk of each division as compared with the NFL and utilizing tests of trends.

RESULTS: A total of 37 games, 2,912 hits, were watched over 7 age groups. Nearly 1 in 6 (16% [95% CI 15-17]) hits involved IHC. 18.9% [95% CI 15.8-22.31] of hits were IHC at the NFL level. Most lower age levels demonstrated significantly lower relative risks of IHC (range 0.55-0.92) as compared with the NFL and there was a trend toward increasing risk of IHC with increasing age division of play ($p=0.09$). IHC was twice as common amongst defensive participants as offensive (RR 2.0, $p<0.01$).

CONCLUSIONS: IHC is relatively frequent amongst all levels of American tackle football. There is a higher rate amongst defensive participants and a trend toward an increased relative risk at higher age divisions. Further study is necessary to identify the relationship with quantitative forces of impact and potential cognitive sequelae.

3614 Board #302 Jun. 1 9:30 AM - 11:00 AM

Head Trauma Biomarkers In NCAA Men's Soccer Athletes Over The Course Of A Season

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(No relationships reported)

Repetitive subconcussive impacts to the head are commonplace in soccer. The ability to detect the extent of neurological injury due to these impacts over the course of a season is paramount. **PURPOSE:** The purpose of the current study was to examine alterations in blood biomarkers of head injury over the course of a soccer season.

METHODS: Sixteen National Collegiate Athletic Association (NCAA) male soccer athletes (20.1±1.3 years, 178.6±8.3 cm, 77.8±11.3 kg, 15.0±6.0 %BF) participated in weekly blood sampling throughout an 18-week season. Coaches provided player statistics following the season. Headers (HEAD) were defined as any impact of the players' head with the ball. Serum samples were stored at -80°C until analysis for Tau and Neurofilament Light polypeptide (NFL). We used R statistical language and the lme4 statistical package to perform a linear mixed effects analysis of the relationships of minutes played (MP) and HEAD with Tau and NFL. We included the intercept for subjects as a random effect, and time point (TP), MP, and HEAD (without the interaction term) as fixed effects. P-values for model comparisons were obtained by likelihood ratio tests of the full model with the effect in question against the model without the effect in question. Visual inspection of residual plots did not reveal any obvious heteroscedasticity or deviation from normality. **RESULTS:** NFL was significantly elevated in weeks 5 (7.3±2.8pg/mL; $p<0.001$), 14 (7.0±3.1pg/mL; $p=0.047$), and 15 (7.9±4.0pg/mL; $p<0.001$) compared to baseline (5.2±1.2 pg/mL). Tau did not change significantly over the course of the season. Neither adding MP ($\chi^2(1)=1.85$, $p=0.17$, $\Delta AIC=0.2$) nor adding HEAD ($\chi^2(1)=0.15$, $p=0.69$, $\Delta AIC=1.85$) as fixed effects improved the model fit for Tau, compared to the simpler model with TP. Similarly, the addition of MP did not improve model fit for NFL ($\chi^2(1)=1.50$, $p=0.22$, $\Delta AIC=0.5$). Conversely, including HEAD improved the model for NFL compared to the simpler model with TP ($\chi^2(1)=5.68$, $p=0.02$, $\Delta AIC=-3.7$). However, only a small negative effect of HEAD, -0.09 (95%CI=-0.16, -0.02), was detected. **CONCLUSION:** In our study, neither MP nor HEAD had a significant effect on Tau concentration over the course of an NCAA Men's soccer season. HEAD appeared to have a small negative effect on NFL concentrations across the season.

3615 Board #303 Jun. 1 9:30 AM - 11:00 AM

The Role of Endogenous Opioids in Cerebral Glucose Uptake Following Acute Exercise

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(No relationships reported)

Exercise has been linked to several opioid mediated phenomena including exercise mediated analgesia, euphoria "runner's high" and addiction. The role of the endogenous opioid system in these events have all been verified using the opioid receptor blocker naltrexone. Despite this, a full understanding on how the endogenous opioid system influences brain activity under acute exercise conditions is lacking. **PURPOSE:** To investigate the role of the endogenous opioid system on brain

glucose uptake following an acute bout of exercise with and without administration of naltrexone. **METHODS:** To assess cerebral glucose uptake mice were fasted overnight and scanned using positron emission tomography (PET) in one of four assigned conditions: control (CON), exercise (EX), naltrexone injection (NTX) or exercise + naltrexone injection (EX+NTX). Mice were delivered a dose of 18F-fluorodeoxyglucose (FDG) 1 hour prior to scanning. Mice that underwent exercise performed 50 minutes of forced swimming (FS) following a week of familiarization, which consisted of 5-25 minutes of FS. NTX was given via intraperitoneal injection (4 mg/kg) 15 minutes prior to exercise or FDG administration. Data was imaged using VivoQuant software and analyzed using PMOD software by a technician blinded to the experimental conditions. Data was calculated as average standardized uptake values (SUV) for 19 regions of interest (ROI) and made relative to the SUV of the whole brain. **RESULTS:** Exercise increased the SUV of glucose in the cerebellum ($EX=1.27 \pm 0.14$; $P<0.05$) relative to mice under CON (0.98 ± 0.07) or NTX (0.85 ± 0.03) conditions. The exercise mediated increase in activity in the cerebellum was abolished ($P<0.05$) with the addition of NTX (0.88 ± 0.10). The combination of EX+NTX increased the SUV of glucose in the hypothalamus region relative to all groups ($P<0.05$). **CONCLUSIONS:** The cerebellum is largely responsible for the regulation of voluntary muscular activity. Exercise appears to have a potent effect on brain activity specific to this region and may be at least partially mediated by endogenous opioids. Further, the endogenous opioid system may play a role in the attenuation of the hypothalamic-pituitary-adrenal system during exercise.

3616 Board #304 Jun. 1 9:30 AM - 11:00 AM

Diminished Cardiovascular Performance That Persists Up To 3 Days After Completion Of Repeated 6-hour Hyperoxic Resting Dives At 1.35 ATA Is Associated With Reduced Oxygen Consumption

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(No relationships reported)

Previous measures of cardiovascular endurance after repeated dives on air and 100% oxygen at 1.35 atmospheres absolute (ATA) have shown reductions in performance that persist up to 3 days post-dive for the hyperoxic group only. **PURPOSE:** Examine ventilatory parameters associated with changes in treadmill endurance immediately and 3 days after completing repeated air and oxygen resting dives. **METHODS:** 15 and 12 healthy male Navy divers completed 5 consecutive 6-hr dives with 18-hr surface intervals while breathing air and 100% oxygen, respectively, at 1.35 ATA (Air/Oxygen: 30±5/32±7 yrs; VO_{2max} : 52±7/53±5 ml/kg/min; mean±SD). Treadmill endurance time at 80-85% of VO_{2max} and associated physiological variables were tested a few days prior to the first dive (BL), 2 hours post-dive day 5 (PD) and 3-days post-dive (PD3) on day 8. Breath-by-breath (Innocor) minute ventilation (VE), end-tidal CO_2 ($F_{ET}CO_2$), oxygen consumption (VO_2), and respiratory quotient (R) were collected during the 80-85% VO_{2max} run at 10% grade until exhaustion. PD and PD3 were compared to BL (BL-PD and BL-PD3) using data from the first minute, mid-run, and last minute of the run. **RESULTS:** PD cardiovascular endurance significantly decreased for Air and Oxygen phases (Air: -34%; Oxygen: -36%; $p<0.05$), yet only the Oxygen phase remained reduced PD3 (Air: -11.9%; $p>0.05$; Oxygen: -31%; $p<0.05$). VE increased significantly during the run, but was not different between Air and Oxygen phases or across testing days. Although $F_{ET}CO_2$ decreased across run times and testing days for Air and Oxygen, values for the Oxygen group remained lower than Air throughout ($p<0.05$). PD VO_2 showed decline in both groups (Air/Oxygen: PD -7%; $p<0.05$). VO_2 for Air recovered by PD3, whereas Oxygen remained reduced (Air: +1%; Oxygen: -13%; $p<0.05$). PD R increased overall for both groups, yet Air returned to baseline while Oxygen remained elevated by PD3 (Air: PD: +4%; $p<0.05$; Oxygen: PD +7%, PD3 +4%; $p<0.05$). **CONCLUSIONS:** Treadmill endurance is reduced after long-duration diving and persists longer when exposed to hyperoxic diving conditions. Reduced VO_2 and elevated R has been reported in the literature to correlate with increased lactate production and a greater reliance on anaerobic energy systems making them likely causes of this decrease in aerobic performance.

3617 Board #305 Jun. 1 9:30 AM - 11:00 AM

The Combined Impact Of Altitude And Heat On Heat Shock Protein 70 And Hypoxia-inducible Factor-1 Alpha

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(No relationships reported)

There are areas in the world where elevated temperatures occur at relatively high altitudes. Exposure to heat or altitude typically induces an increase in intracellular heat shock protein 70 (iHSP70) and hypoxia-inducible factor-1 α (iHIF-1 α), which

have beneficial down-stream physiological effects. However, the responses to the combination of these environments are unclear. **Purpose:** To determine the impact of combined acute exposure to heat and altitude on iHSP70 and iHIF-1 α .

Methods: Using a randomized, cross-over study design, 10 men (mean \pm SD; age: 25 \pm 7 yr; weight: 88 \pm 13 kg; height: 180 \pm 6 cm; sea level (SL) VO_{2peak}: 42 \pm 5 ml·kg⁻¹·min⁻¹) were exposed to four environmental conditions separated by at least one week: (1) SL thermoneutral (SLTN; 250m, 20°C, 30-50% rh); (2) SL hot (SLH; 250m, 35°C, 30% rh); (3) altitude thermoneutral (ATN; 3000m, 20°C, 30-50% rh); and (4) altitude hot (AH; 3000m, 35°C, 30% rh). Blood samples were collected at SL (baseline, BL) prior to ~1.5 hour environmental equilibration period and again immediately Pre- and Post- 30 minute of steady state (SS) exercise (cycling, 50% of SL VO_{2peak}). iHSP70 and iHIF-1 α were measured from peripheral blood mononuclear cells. The percent change (% Δ) from BL to Pre- and PostSS was analyzed with 2 x 4 (% Δ BL to Pre- and PostSS x environment) RM ANOVA. **Results:** iHSP70: there was an effect of exercise (PreSS: 4.4 \pm 7.6% vs PostSS: 17.5 \pm 9.6%, $p < 0.05$), but no effect of environment ($p > 0.05$) or an exercise x environment interaction ($p > 0.05$). iHIF-1 α : there was no effect for exercise ($p > 0.05$), environment ($p > 0.05$), or an exercise x environment interaction ($p > 0.05$). **Conclusion:** Our results indicate that iHSP70 increased in response to SS exercise while iHIF1 α was unaltered in these testing conditions. The combination of heat and altitude did not result in an even greater protein expression when compared to exercise alone. However, it is plausible that a more severe environmental stress and/or higher exercise intensity (> 50% SL VO_{2peak}) would result in elevated cellular response compared to a single environment. Funded by USAMRMC; authors views not official US Army or DOD policy.

3618 Board #306 Jun. 1 9:30 AM - 11:00 AM
Effects Of Exercise On Stress-induced Attenuation Of Vaccination Responses In Mice

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Vaccination is one of the most successful public health interventions for preventing infectious diseases, although the immunosuppressive effects of chronic stress can reduce a vaccine's efficacy. Exercise improves vaccine responses, but the role in attenuating stress-induced effects is unknown. **Purpose:** We investigated the effects of forced/acute (eccentric exercise; ECC) and voluntary/long-term (wheel running; VWR) exercise on antibody and cell-mediated immune responses to vaccination in chronically stressed mice. **Methods:** Mice were randomized into Control (CON), S (Stress)-ECC, S-VWR, and S-SED (Sedentary) groups. Chronic restraint stress occurred 6-h/day, 5-days/week for three weeks. S-VWR mice were allowed access to a wheel for the entire experiment. One week post-stress, S-ECC mice ran on a treadmill for 17m/min, -20% grade, for 45 minutes and were then injected with 100 μ g of ovalbumin (OVA) and 200 μ g of alum adjuvant (intramuscularly), along with all other groups. Anti-OVA IgM and IgG was measured via ELISA. Three weeks post-stress, mice were injected with OVA into the ear to determine delayed-type hypersensitivity (DTH) response as a measure of cell-mediated immunity. **Results:** As expected, chronic restraint stress significantly reduced body weight and caused adrenal hypertrophy. Over the course of the experiment, S-ECC, and S-VWR groups had significantly elevated anti-OVA IgG compared to S-SED which had significantly lowered levels compared to CON ($p < 0.05$). No differences were observed with anti-OVA IgM nor DTH responses. **Conclusion:** Acute ECC and VWR alleviated chronic stress-induced reductions in anti-OVA IgG vaccination responses while neither type of exercise had an impact on anti-OVA IgM or cell-mediated immune responses. Future experiments need to address the mechanism of the exercise beneficial effects on IgG.

3619 Board #307 Jun. 1 9:30 AM - 11:00 AM
Body Composition Assessment in Athletes with Spinal Cord Injury

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PURPOSE: To determine which anthropometric equation used to estimate body composition in athletes with chronic spinal cord injury (SCI) has better concordance with Dual X-ray absorptiometry. **METHODS:** Seventeen male athletes with chronic SCI AIS A or B, participated from this study. Body composition was estimated using two anthropometric equations (Kerr Ross and Durnin Womersley). The evaluation was performed with the athlete in the supine/prone position and seating in their wheel chair. The same day a DEXA scan was performed. Shapiro Wilk test was used

and results were analyzed with student T test, Pearson correlation test and Bland & Altman method. **RESULTS:** The athletes were 30,9 year old (SD: 7,1), they trained 14,5 (SD 7,7) hours a week and averaged 5,4 years of experience in sports. They had 29,5% Fat Mass (FM) (SD: 7,3) and 48,6 (SD: 5,5) kilograms of Free Fat Mass (FFM) measured with DEXA scan. There was no difference between FM and FFM results determined by DEXA scan and those estimated by Kerr Ross Method ($p < 0,001$). There was a significant difference between DEXA scan results and estimations by Durnin Womersley equation ($p > 0,05$). No difference was found when comparing anthropometric results with the athlete in the supine/prone position and seating in their wheel chair. The correlation between FM and FFM measured with DEXA scan and the estimated By anthropometric equation where superior for Kerr Ross method ($r = 0,75$ and $r = 0,86$ respectively). The average difference between DEXA scan results and Kerr Ross method estimation for FM and FFM was: 0,84% (SD= 5,04) and -0,39 kilograms (SD= 3,49) respectively. **CONCLUSIONS:** When using anthropometric evaluation to estimate body composition in athletes with SCI, Kerr Ross method is superior to Durnin Womersley equation. But this method does not have acceptable agreement with DEXA scan for clinical purposes. Anthropometric evaluations are easily performable in the field and affordable, but more research is needed to determine the best method to estimate body composition in athletes with SCI.

3620 Board #308 Jun. 1 9:30 AM - 11:00 AM
Wearable Technology To Reduce Sedentary Behavior And CVD Risk In Older Adults: A Pilot Trial

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 (No relationships reported)

Older adults account for the vast majority of healthcare expenditures and deaths attributable to cardiovascular disease (CVD). Physical activity (i.e. exercise) is associated with decreased CVD risk, but recent large-scale trials suggest that exercise alone is insufficient to reduce CVD events in high-risk populations of older adults.

PURPOSE: This pilot randomized clinical trial evaluated the impact of combining structured exercise with an intervention designed to enhance non-exercise physical activity (EX + NEPA) compared to EX alone. **METHODS:** Participants aged ≥ 60 years ($n = 40$) with moderate to high risk of coronary heart disease (CHD) events were randomly assigned to either the EX + NEPA or EX groups and followed for 20 weeks. Both groups underwent a twice weekly, eight-week center-based exercise intervention with aerobic and resistance exercises. The EX + NEPA group also received a mobile activity tracking device along with behavioral monitoring and feedback throughout the study. Study outcomes evaluated at week 20 were: 1) physical activity patterns (steps/day and sedentary time), 2) blood pressure, and 3) circulating indices of cardiovascular risk (blood glucose and triglyceride levels). Linear mixed models estimating group differences were adjusted for age, sex, group, visit, and baseline level of the outcome. Data are presented as mean differences (EX + NEPA relative to EX) with 95% confidence intervals at week 20. **RESULTS:** Relative to EX, the change in steps/day at week 20 was 2,071 [61.07, 4081] for EX + NEPA. For sedentary time (minutes per day) the difference between groups was -31.21 [-168.18, 105.76]. The differences for systolic and diastolic blood pressure were -9.94 [-19.57, -0.31] and -1.77 [-6.89, 3.34] mm Hg, respectively. The difference was 0.70 [-15.90, 17.31] mg/dL for glucose and -5.53 [-58.63, 47.57] mg/dL for triglycerides. **CONCLUSIONS:** The addition of activity tracking technology appeared to positively influence daily activity patterns and directionally favored blood pressure and triglyceride levels. Wearable technology may impact daily habits of older adults and improve risk factors for CHD - although a fully-powered trial is needed to definitely test this hypothesis. Supported by AHA 16IRG27250237, NIA 2P30AG028740, NCMRR 1P2CHD086851, and the UAB Center for Exercise Medicine

3621 Board #309 Jun. 1 9:30 AM - 11:00 AM
Identifying Specific Elements Necessary for a Pediatric Cardiac Rehabilitation Program: An e-Delphi Study

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Encouraging children and adolescents with congenital heart disease (CHD) to participate in regular exercise is an essential component in helping them rise toward their full potential physically, socially, and emotionally. Identifying appropriate tools and resources that promote healthy and active lifestyles specifically for this population are currently lacking and must be developed. Cardiac rehabilitation programs are an effective modality with beneficial clinical outcomes for adult patients with coronary heart disease, however these programs are scarce for the CHD pediatric population and not well defined.

Purpose: The purpose of this study was to identify relevant content for the development and structure of a pediatric cardiac rehabilitation curriculum for young patients with CHD using a consensus approach.

Methods: A three-round e-Delphi study among CHD and pediatric exercise physiology (EP) experts was conducted. In the first round, experts provided opinions in a closed- and open-ended electronic questionnaire to identify specific elements necessary for inclusion in a Pediatric Cardiac Rehab Program. In the second round, experts were asked to re-rate the same items after feedback and summary data was provided from round one. In the third round, the same experts were asked to re-rate items that did not reach consensus from round two.

Results: 47 experts were contacted via e-mail to participate on the Delphi panel. 37 consented, 35 completed round one, 29 completed round two and 28 completed the final round. After the third round, consensus was reached in 55 of 60 (92%) questionnaire items. Experts identified specific elements across four domains: exercise training, education, outcome metrics and self-confidence to be included in a Pediatric Cardiac Rehab Curriculum.

Conclusion: This study established consensus toward the ideal program structure, exercise training principles, educational content, patient outcome measures and self-confidence promotion. By identifying the key components within each domain, there is potential to benchmark recommended standards and practice guidelines for the development of a Pediatric Cardiac Rehab curriculum to be used healthcare team members for optimizing the health and wellness of pediatric CHD patients.

3622 Board #310 Jun. 1 9:30 AM - 11:00 AM

Consequences Of Physical Inactivity In Older People: An Umbrella Review Of Meta-analyses

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Low physical activity (PA) levels are implicated in the aetiology of many non-communicable diseases. However research often fails to specifically focus on the impact of physical inactivity on the health of older adults, despite the fact that PA declines and health worsens with age.

PURPOSE: An umbrella review of the epidemiological evidence for the effects of physical inactivity on physical and mental health in older adults (≥60yrs) for the 2019 Copenhagen Consensus Statement on PA and Ageing.

METHODS: Systematic database search for meta-analyses (MA) of longitudinal observational studies. Titles and abstracts were reviewed independently by two researchers. Duplicates were removed and data from included MAs extracted, including relative risk (RR) for health outcomes, characteristics and risk of bias (AMSTAR Scale) of included reviews.

RESULTS: 4,434 citations identified. 17 full text MA were included. Key findings of high quality reviews (≥8/11 on AMSTAR scale): **All-cause mortality:** 34% RR reduction with highest vs lowest level of PA (≥70yrs, RR=0.66, 95% CI 0.50-0.88) (Samitz et al., 2011); **Healthy ageing** was significantly associated with PA (n=174,114, ≥65yrs, ES=1.14 95% CI 1.07-1.22) (Daskalopoulou et al., 2017); **Cognitive decline:** Moderate vs lowest level of PA=RR reduction ranged from 26% (OR=0.74, 95% CI 0.60-0.90) (Guure et al., 2017) to 35% (HR=0.65, 95% CI 0.57-0.75) (Sofi et al., 2011); **Dementia:** Highest vs lowest level of PA=14% RR reduction (n=40,384, RR=0.86, 95% CI 0.76-0.97) (Blondell et al., 2014); **Alzheimer's disease:** Highest vs lowest level of PA=35% RR reduction (n=23,345, 70-80yrs, RR=0.65, 95% CI 0.56-0.74) (Santos-Lozano et al., 2016); **Incident depression:** Highest vs lowest level of PA=17% RR reduction (adjusted OR=0.83, 95% CI 0.79-0.88) (Schuch et al., 2018); **Musculoskeletal health:** RR reduction in hip fracture=6% (n=96,966 women, RR=0.94, 95% CI 0.93-0.96) (Rong et al., 2016) and 29% RR reduction in total fractures for highest vs lowest level of PA (RR=0.71, 95% CI 0.63-0.80) (Qu, et al., 2014). Adverse risks were not reported.

CONCLUSION: PA confers contemporaneous and wide ranging health benefits in later life. These findings make a compelling case for further investment in preventive services that promote PA in older adults.

3623 Board #311 Jun. 1 9:30 AM - 11:00 AM

How Does Circadian Rhythmicity Relate to Neuropsychological and Neuroimaging Markers in Older People at Risk for Dementia?

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(No relationships reported)

Background: Changes in the circadian regulation of the sleep-wake cycle occur with ageing and may be linked to neurodegeneration. It is unclear the extent to which such changes are evident in mild cognitive impairment (MCI), and how they may relate to neuropsychological functioning, the integrity of key temporal lobe structures

and longitudinal decline. **Method:** 334 older individuals (mean age=66.1, sd=8.9) with subjective cognitive impairment (SCI) and MCI (mean MMSE=28.1, sd=1.4) received detailed neuropsychological assessment including Logical Memory, Rey Auditory Verbal Learning Test, Rey Figure and Boston Naming Test. They also received clinical and wrist-worn actigraphic assessment, and a subset of 60 individuals underwent neuroimaging. Circadian rhythm analysis was performed using non-parametric methods to obtain intradaily variability, interdaily stability, and activity during the least and most active 5-hours and 10-hours of the day, respectively. Cosinor methods were also used to derive amplitude, mean, and variability of the rest-activity rhythm. For the neuroimaging subset, cortical thickness of the entorhinal cortex and hippocampal volume were derived using Freesurfer. A subset of 90 individuals had 2-year longitudinal follow-up data from which memory decline scores were computed. **Results:** Compared to SCI, after controlling for age, participants with MCI showed significantly greater intradaily variability as well as lower amplitude of activity across the circadian period, and lower activity during the most active 10-hour period. Across both groups, circadian disruption was associated with poorer performance on tests of verbal memory ($p<0.05$), visuospatial memory ($p<0.001$) and confrontation naming ($p<0.001$). Lower activity amplitude was associated with reduced cortical thickness in the entorhinal cortex. For those with follow-up data, greater activity during the least active 5-hours of the day was associated with memory decline longitudinally ($p<0.05$). **Conclusion:** Disruptions to the rest-activity cycle relate to both memory and language decline cross-sectionally and memory decline longitudinally as well as to degeneration of key temporal brain regions. Alterations in this cycle may represent a preclinical or prognostic marker for dementia and may warrant intervention.

3624 Board #312 Jun. 1 9:30 AM - 11:00 AM

Exercise Intervention Reduces Circadian Clock Suppressor, CRY2, in Adults with Obesity

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(No relationships reported)

PURPOSE: Exercise improves skeletal muscle insulin sensitivity, and also resets physiological circadian clocks. CRY2, a circadian clock suppressor, reduces exercise capacity in mouse models. Whether exercise impacts CRY2 in humans is unknown. Thus, we tested the effects of 12 weeks of exercise training on circulating CRY2 concentrations in adults with obesity. Secondly, we assessed whether these changes were related to improvements in insulin sensitivity. **METHODS:** Thirteen adults (Age: 64.4 ± 13.7 , BMI: 35.9 ± 5.1) participated in 12 weeks of exercise training (5 day/wk, 60 min/session, 85% HRmax) combined with a eucaloric diet. Body composition (abdominal adiposity using computed tomography), insulin sensitivity (glucose disposal rate from euglycemic-hyperinsulinemic clamp), exercise capacity (VO_{2max}), and circulating CRY2 levels measured by ELISA were assessed before and after intervention. **RESULTS:** Body composition (BMI, abdominal adiposity), insulin sensitivity, and exercise capacity all improved (all $P > 0.05$). CRY2 levels decreased after intervention (Pre: 12.2 ± 2.1 ; Post: 10.1 ± 2.3 ng/mL; $P=0.001$). Baseline CRY2 inversely correlated with baseline fat-free mass ($r=-0.56$, $P=0.046$) and baseline insulin sensitivity ($r=-0.61$, $P=0.038$). **CONCLUSION:** We show for the first time that exercise training reduces circulating levels of CRY2, a circadian clock suppressor, in adults with obesity, which was accompanied by increased insulin sensitivity and improved body composition. Direct links between exercise-induced changes in circadian clock function and parallel systemic metabolic improvements are worthy of further investigation.

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The Effects Of Different Resistance Training Zones With Equalized Volumes On Muscular Adaptations

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PURPOSE: To investigate the effects of different resistance training (RT) zones with equalized volumes on muscular adaptations. **METHODS:** Thirty-one volunteers underwent 8 weeks of RT and were distributed in two groups: ten sets of three maximal

repetitions (10x3, n=14) and three sets of ten maximal repetitions (3x10, n=17). The biceps curl, squat and elbow extension exercise were performed twice a week. The maximum strength (one repetition maximum test-1RM) was tested before and after the study for these exercises. Muscle thickness (MT) was also measured (pre x post) for biceps brachii (BB), triceps brachii (TB) and vastus lateralis (VL). RESULTS: As showed in Table 1, a significant main effect ($p=0.001$) on time in 1RMbiceps curl, 1RMsquat and 1RMelbow extension was observed for both groups. There was no significant difference in time x group interaction for 1RMbiceps curl, 1RMsquat and 1RMelbow extension (all $p>0.05$). A significant main effect ($p=0.001$) in time was observed in MT for BB, TB and VL. There was no significant difference in time x group interaction for BB, TB and VL (all $p>0.05$). CONCLUSION: The present study suggests that, regardless of the number of sets and maximum repetition zone, the improvement of maximum strength in squatting, elbow flexion and extension, as well as biceps, triceps and vastus lateralis muscle thickness occurs similarly when volume of repetitions is equalized.

KEY WORDS: Resistance training; Muscular adaptations; Volume of training

Table 1. Muscle strength and muscle thickness measures after 8 weeks of training.

Parameters	Before	After	$\Delta\%$	Cohen	ANOVA 3x2	
				ES	time	time*group
					p value	p value
1RM_{biceps curl} (kg)						
3x10	29±10	38±11 ^a	30.3	0.86	0.001	0.414
10x3	29±15	38±17 ^a	33.2	0.60	0.001	
1RM_{squat} (kg)						
3x10	156±41	206±43 ^a	32.4	1.20	0.001	0.973
10x3	152±73	206±85 ^a	35.3	0.68	0.001	
1RM_{elbow extension} (kg)						
3x10	56±18	69±19 ^a	22.8	0.69	0.001	0.375
10x3	54±20	66±23 ^a	20.8	0.52	0.001	
BB (mm)						
3x10	34.6±6.9	39.3±6.8 ^a	13.7	0.69	0.001	0.226
10x3	34.9±6.5	39.4±6.7 ^a	13.0	0.69	0.001	
TB (mm)						
3x10	35.4±3.9	39.8±4.4 ^a	12.2	1.03	0.001	0.884
10x3	35.0±5.5	40.1±4.7 ^a	14.4	0.98	0.001	
VL (mm)						
3x10	40.7±5.5	45.2±6.3 ^a	11.2	0.77	0.001	0.775
10x3	40.9±4.7	45.7±4.9 ^a	11.8	1.01	0.001	

Values expressed in mean±SD of 3x10 group and 10x3 group One maximal repetition test (1RM). Muscle thickness (mm) of the biceps brachii and brachialis (BB), triceps brachii (TB) and vastus lateralis (VL). Effect size (ES). ^asignificant ($p<0.05$) differences to before.

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